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Introduction

The 6th *ICSD 2018 is* organized by the European Center of Sustainable Development, at the Roma Eventi- Fontana di Trevi, Piazza della Pilotta, 4 Rome, Italy from:

Wednesday 12 to Thursday 13 September, 2018

6th ICSD2018 will be an excellent opportunity to present your projects and discuss the latest results in the field of Sustainability Science. The general aim of the conference is to promote international collaboration in Sustainability Science and related disciplines.
The Conference theme is *Creating a unified foundation for the Sustainable Development: research, practice and education*. This theme emphasizes the strong foundation that is provided by using research to inform our everyday practices, policies, and research approaches. The 2017 Conference will once again provide a forum for the sharing of ideas, presentation of research findings, and discussion of professional issues relevant to Sustainability Science.
On behalf of the Scientific Program Committee, I have great pleasure in presenting this important event of the Scientific Community.

The Conference topics are distributed in the range of the following streams within the ICSD2018 program:

1. Economic Sustainability:
2. Environmental Sustainability:
3. Socio-Cultural Sustainability:

This Book is a collection of Selected papers presented in the 6th ICSD 2018, Rome, Italy.
All manuscripts went through a double blinded peer revieweing process by members of the ICSD2019 Steering Committee for rating of quality and presentation content.

Further details in accordance with the instructions of the ICSD2018 are provided on the Call for Papers page at: www.ecsdev.org

I would like to thank you for your scientific contribution to the Second International Conference on Sustainable Development and look forward to having the opportunity to showcase and disseminate your research.
Special thanks also to the organizing committee, and all the people that worked hard, to bring in light this considerable event

Yours sincerely

Professor Gian Paolo Caselli

Chair, 6th ICSD2018 Steering Committee

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1. The Energy Leviathan: or how U.S. Shales and Brazil Biodiesel Governance Systems Fail to Promote Decentralization, Accountability, Equality and Society Participation

Dr. Arnoldo de Lima, Dr. Fabiano Toni

ABSTRACT:
Energy resources and their different forms of regulation and management are critical to the sustainable development. Given this perspective, this paper explores and compares two different energy resources and their governance systems on Eagle Ford Shale at U.S. and the Gaucho Biodiesel Pole at Brazil. Despite its diametrical materialities, particular federalism structures, different political arenas, stakeholders, policies, rules and norms both systems presenting poorly performances to successfully deploy good governance on energy policy. Through the analyses, conducted using interviews with stakeholders, observation on public hearings, study of U.S./ Brazil Federalism and a compilation of secondary data we found patterns that reveals a significant asymmetric power relationships amongst stakeholders and institutions especially thru the dominance of industry's agenda over the communities self-regulatory autonomy and society participation.

Keywords: Energy, governance, shale, biodiesel, policy, participation

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1. Introduction: Biodiesel and Shales - between Good Governance and the Energy Leviathan

The transition from traditional forms of government to governance arrangements that overcome top-down 'big government' structures and widen society participation on policy-making is not a simple task (Jordan, *et al.*, 2005).The heterogeneity among institutions and the uneven distribution of power among stakeholders pose challenges to the enhancement of accountability and to the neutralization of mutual mistrust (Lemos & Agrawal, 2009).

The discourse of sustainable development is ubiquitous in the energy sector, yet, complex power relations may turn governance arrangements into threats rather than opportunities (Verdonk, *et al.*, 2007). As Nadaï *et al.* (2010 p.143) put it, "new energies bring new practices" - shifts in energy generation and in the control and use of resources do not necessarily lead to more transparency, accountability, and equity. Federalist systems are particularly complex, for private and public actors interact at multiple levels. Governance

analysis, therefore, needs to address the ways that the regulatory framework flows across the political structure and how policy guidelines define arenas in which actors contend and reap their gains and losses.

The degree of 1) decentralization, 2) participation, 3) accountability, and 4) transparency indicates paths towards democratic governance and well-designed policies (Scheberle, 2004; Ribot, 2007). In the opposite direction, arrangements that fail on those parameters have the potential to render spurious governance arrangements (Gerber & Kollman, 2004). In this paper we analyze how governance evolved along the four aforementioned axes in two emerging energy landscapes, the Eagle Ford Shale in the U.S. and the Gaucho Biodiesel Pole in Brazil.

Innovative resources such as biodiesel and shales increased their market share in the last decade, propelled as solutions to economic development, energy security and even as bridges to a clean energy transition (Lima & Toni, 2017). Both resources involve specific political disputes that reflect what Hisschemöller, *et al.* (2001) called the knowledge, power, and participation game. This kind of game represents a challenge for the promotion of sound energy governance (Janssen & Rutz, 2011; Rabe, 2014) for it may consolidate powerful elite regimes that foreclose pluralist forms of society participation in what we call the *'Energy Leviathan*[1]*'*.

2. The Gaucho Biodiesel Poles & Eagle Ford Shale

The Gaucho Biodiesel Pole (*GBP*) is the largest biodiesel energy landscape in Brazil. It is located in Brazil's third largest soybean production area (5.2 million hectares), where some 38,000 smallholders and 52,000 corporate farms supply nine biodiesel plants – three of the largest in the country– that account for 25% of Brazil's domestic biodiesel output (IBGE, 2017).

Several stakeholders and institutions are involved in the GBP governance: Large oilseed & soy processing business groups, such as the Biodiesel Producers Association (Aprobio) and the Biodiesel and Biokerosene League (Ubrabio); grain traders; labor unions; farmer's associations and cooperatives; government agencies, particularly the Oil, Natural Gas, and Biofuels National Agency (ANP); and the giant state-controlled energy company Petrobras.

The national biodiesel policy (PNPB) was conceived at the federal level to create innovative governance arrangements under the logic of the emerging biofuel economy (Maroun & Larovere, 2008; Balis & Baka, 2011). One of its main mechanism is a regulation that requires fuel dealers to blend biodiesel and mineral diesel. Official auctions guarantee biodiesel purchases from companies certified by the social fuel stamp (SFS) and offer subsidies in return for their purchasing of raw materials from smallholders and rural cooperatives. The social fuel stamp seeks to avoid the shortcomings of the ethanol policy, which fomented large-scale sugarcane plantations and precluded social participation. Policy-makers therefore tried to prevent a "bio-oil curse" and its negative outcomes on sustainable development (Hall, *et al.*, 2009 p.584).

The Eagle Ford Shale (EFS) is one of the largest and most profitable unconventional hydrocarbon reserves in the U.S. Located in southern Texas, this energy landscape

[1]The name of the biblical creature '*Leviathan*' was used as the title of the book by Thomas Hobbes, published in 1651, as a symbol of the emergence of a powerful political authority that was able to control society.

attracted huge investments (Dittrick, 2014) to develop terminals, plants and other facilities. Despite oil price drops that reduced the barrel to values under U$40 in 2015, the volume of physical and financial capital still makes EFS one of the most exploited shales in the world (Hughes, 2015).

EFS governance includes a large number of social groups, market organizations and state agencies: Leading U.S. oil and gas companies are represented by lobbies such as the Texas Oil & Gas Association (Txoga) and the South Texas Energy Economic Roundtable (Steer). The Railroad Commission (RRC) and the Texas Commission on Environmental Quality (TCEQ) are regulatory agencies in charge of issuing permits and supervising energy production. In the legislative branch, the Natural Resources and Economic Development Committee, in the State Senate, and the Committee on Energy Resources, in the House of Representatives, have prerogatives to implement taxes and to define energy policies.

The development of fracking technologies to explore unconventional reserves caused a 'shale boom' in a region that had experienced a conventional oil peak in the early 1980s. This boom resulted in an increase of tax sales revenues but was not translated into economic diversification or improvements in public services and facilities. Civil society and city authorities therefore faced the challenge to consolidate long-term planning and to redefine their local ordinances on oil and gas exploitation in order to avoid another resource curse (Tunstall, 2015).

3. Methods

We reviewed the federalist structures of Brazil and the United States and their respective energy policies to understand the hierarchy and the formation of political arenas and the prerogatives of government agencies, commissions, committees, and chambers. We sought to comprehend power relations amongst state actors, civil society organizations, and businesses. We traveled across eight municipalities and conducted 35 interviews in the GBP in Rio Grande do Sul state between May and June, 2014. Interviewees included government officials, farmers, labor unions, cooperative CEOs, rural associations, and directors of biodiesel plants. In the EFS, Texas, we conducted 17 interviews in five counties, between January and February, 2015. Interviewees included city judges, city managers, chambers of commerce managers, city councilmen, and local businessmen. Representatives from the energy companies and regulatory agencies declined our requests for interviews. We also participated in a community meeting and a public hearing held to debate oil and gas ordinances.

We used the data to build a governance index for each energy landscape. This index is based on four sub-indices, which are composed by a subset of 11 weighted indicators, as follows: **1)decentralization**: i) level of local government autonomy for energy regulation, ii) Other prerogatives delegated from central government; **2) participation**: i) presence of committees, councils or public audiences, ii) involvement of civil organizations, iii) representativeness; **3)transparency and accountability**: i) public access to technical and administrative data, ii) land planning iii) penalties and responsibility; and **4) equity**: i) stakeholders' parity of rights over energy resources, ii) society's influence over energy regulation (layout & implementation), iii) equity for applying revenues, fees and taxes.

We computed indicators in a two-step process: 1) we fed the primary data into a computer quality-data-assessment software and; 2) we rated the results in a Likert scale ranging from - 2 (worst scenario) to +2 (better scenario). We present the results on Table 1 and Table 2.

4. Results

4.1 Brazilian Biodiesel Governance: Gaucho Biodiesel Poles (GBP)

The National Council for Energy Policy (CNPE) and the Inter-ministerial Biodiesel Executive Commission (CEIB) – coordinated by the President's Chief of Staff- are the main political arenas of the Brazilian biodiesel policy. An important policy arena is the Oil and Biodiesel Chamber, an advisory forum coordinated by the Ministry of Agriculture. Within the Chamber, members of the Brazilian Congress, government officials, and lobbyists interact to debate policy and regulations.

The policy layout does not decentralize authority nor delegates regulatory autonomy to states or local governments (Table 1- line1). Regional agencies in the state of Rio Grande do Sul, such as the Agro-energy Chamber and the Science Innovation and Technology Secretariat offer complementary incentives, but do not have autonomy to debate ordinances that deal with production, trade and use of biodiesel. Accordingly, municipal governments have no prerogatives and, at best, they can create friendly environments to attract businesses.

PNPB was designed to be an innovative multi-actor governance arrangement. It did share regulatory authority with federal agencies and defined economic incentives to bring biodiesel producers and farmers close together. The political arrangements however remained top-down and allowed further influence of resourceful stakeholders as Aprobio and Ubrabio, particularly through their congressional lobby (FrenteBio).

Table 1: Gaucho Biodiesel Poles (GBP) governance index

Governance sub-indices and indicators	***Calculation Method***			
	Indices and indicators Weights	*Qualitative*	*Quantitative*	*Quantitative X Weight*
1)Decentralization	***0,25***			***-0,40***
i)Local Government autonomy on energy regulation	*0,60*	*VU*	*-2*	*-1,2*
ii)Other prerogatives delegated from central government	*0,40*	*U*	*-1*	*-0,4*
Sub-total	*1,00*			*-1,6*
2)Participation	***0,25***			***-0,25***
i)Committees, councils or public audiences	*0,50*	*U*	*-1*	*-1,0*
ii) Involvement of civil organizations	*0,25*	*F*	*1*	*1,0*
iii) Representativeness	*0,25*	*U*	*-1*	*-1,0*
Sub-total	*1,00*			*-1,0*
3)Transparency & Accountability	***0,25***			***-0,10***
i) Public access to technical and administrative data	*0,40*	*U*	*-1*	*-0,4*
ii)*Land Planning*	*0,30*	*N*	*0*	*0,0*
iii)*Penalties and responsibility*	*0,30*	*N*	*0*	*0,0*
Sub-total	*1,00*			*-0,4*
4) Equity	***0,25***	*U*	*-1*	***-0,36***
i)Stakeholders parity on distributive rights over energy resources	*0,40*	*U*	*-1*	*-0,4*
	0,35	*VU*	*-2*	*-0,35*

ii) Society's influence on energy regulation (layout & implementation)	*0,35* *1,00*			*-0,7* *-1,45*
iii) Decision equity for applying energy revenues, fees and taxes				
Sub-total				
Total				***-1,11***

Legends: Very Favorable (VF); Favorable (F); Neutral (N); Very Unfavorable (VU); Unfavorable (U).
Source: elaborated by the authors.

What policy makers have agreed to call participation (Table 1 – line2) within PNPB is restricted to the quotas offered to smallholders and their cooperatives in the grain supply chain. This 'market participation' did not promote voice and representativeness on biofuel development. Instead, it established the subordination of farmers to the large oilseed & soy processing companies that reap federal subsidies under social fuel stamp certification. This rationality spreads among several other local stakeholders, as summarized by one of the cooperatives CEO's: "farmer's participation is limited to soy supply and it makes no difference to them what buyers do with the grain".

Although the policy was aimed at enhancing collaboration among social movements, cooperatives, biodiesel companies, and state institutions, it created fierce competition in the soybean trade and its valuable co-products. In this sense, the policy failed to create political awareness and community empowerment for it did not create local arenas to support public engagement in biodiesel regulation. In other words, biodiesel governance failed to expand the public domain (Ribot, 2007).

The lack of public channels to access data on biodiesel production reinforces community alienation. This lack of transparency (Table 1 – line 3) is potentially harmful (Tavares, 2014). Biodiesel is an organic and biodegradable fuel, but its industrial production demands significant use of chemicals and large amounts of water. Residues from the washing process are unsuitable to be discharged into water basins, but at least two leakages were reported at GBP (Rodrigues, 2014). Industrial accidents, including explosions, are also common in biodiesel plants, but disclosure is low for "the effect of this information on public opinion could damage the image that biodiesel has as an environmentally clean energy solution" (Juarez, 2011 p.1).

It is worth noting that biodiesel plants are subject to the federal environmental licensing regime. However, for the Ministry of the Environment, the main issue concerning biodiesel is the lack of an environmental-economic zoning for soybean plantations, similar to the one applied to the sugarcane/ethanol chain. Additionally, until 2016, only 10% of the rural properties in the state of Rio Grande do Sul complied with the Rural Environmental Registry law (CAR) and the 2012 Forest Code (Bayer, 2016).

The concentration of political arenas at the federal scale resulted in a very unfavorable equity framework concerning the distribution of benefits of biodiesel production (Table 1 – line4). This is worsened by the weakness of civil society in policy implementation, a process in which its role is restricted to legitimizing 'participants' in a regulatory game that adds little to the construction of a sound sustainable energy governance.

4.2 Shale Governance in the US: the Eagle Ford Shale (EFS)

The Energy Policy Act (EPACT), framed under the U.S. federalism, delegates broad competence in oil and gas production to the 50 states of the Union and grants a

fair degree of autonomy to the local governments to define their own ordinances. Since the shale boom, however debates over decentralization vs. federalization and over local autonomy concerning energy regulation became highly controversial and a source of heated disputes all over the United States. In Texas, disagreements generated a political "powergrab" that redirected authority to state agencies. As a result, the majority of cities lost their prerogatives to define obstacles to fracking activities and to establish controls over companies and their accountability (Table 2 – line 1).

The state Senate House Bill 40 (HB40), passed in 2015, curtailed local autonomy. Some civil associations considered that bill the funeral of community rights concerning energy regulation (Fig. 1).This turf war seems to be the result of a conflict between two groups. On one side, those who wish to ban fracking in urban areas (as in Denton city) and claim for deeper public debate on shale exploitation (College City Citizens for Safe Fracking). On the opposite side are those who, as phrased by a city manager we interviewed, defend that "local governments can't overreact and create problems for oil companies". HB40 was, therefore, a welcome solution for an industry that accounts for 40 percent of Texas economy (Stapleton, 2015).

Figure 1: Local Control Tombstone. Lima (2016).

Table 2: Eagle Ford Shale (EFS) governance index

Governance sub-indices and indicators	***Calculation Method***			
	Indices and indicators Weight	*Qualitative*	*Quantitative*	*Quantitative X Weight*
1)Decentralization	***0,25***			***-0,35***
i)Local Government autonomy on energy regulation	*0,60*	*U*	*-1*	*-0,6*
ii) Other prerogatives delegated from central government	*0,40*	*VU*	*-2*	*-0,8*
Sub-total	*1,00*			*-1,4*
2)Participation	***0,25***			***-0,37***
i)Committees, councils or public audiences	*0,50*	*U*	*-1*	*-0,5*
ii) Involvement of civil organizations	*0,25*	*U*	*1*	*-0,25*
iii) Representativeness	*0,25*	*U*	*-1*	*-0,25*
Sub-total	*1,00*			*-1,5*
3)Transparency & Accountability	***0,25***			***-0,10***
i) Public access to technical and administrative data	*0,40*	*U*	*-1*	*-0,4*
ii)*Land Planning*	*0,30*	*U*	*0*	*-0,3*
iii)*Penalties and responsibility*	*0,30*	*F*	*0*	*0,3*
Sub-total	*1,00*			*-0,4*
4) Equity	***0,25***	*U*	*-1*	***-0,36***
i)Stakeholders' parity on distributive rights over energy resources	*0,40*			*-0,4*
ii) Society's influence on energy regulation (layout & implementation)	*0,35*	*U*	*-1*	*-0,35*

iii) Decision equity for applying energy revenues, fees and taxes	*0,35*	*VU*	*-2*	*-0,7*
Sub-total	*1,00*			*-1,45*
Total				***-1,18***

Legends: Favorable (F), Very Favorable (VF), Neutral (N), Unfavorable (U), Very Unfavorable (VU).
Source: elaborated by the authors.

Lack of participation is a pattern in EFS. Even before HB40*,* few cities invited communities and the population at large to attend council meetings or public hearings (Table 2 – line 2). As highlighted by Williamson and Archon (2005), besides the American political tradition, US decision-makers are not compelled to respond to public demands. In EFS, local authorities reproduce oil and gas ordinances passed elsewhere, skirting proper public engagement. According to a city judge we interviewed, this means that "sometimes dictatorships are much easier to run than democracies". Powerful private interests represented by associations as Txoga*,* and Steer, joined with city managers, mayors, and development agencies to get laws passed in the Texas Legislature. Such legislation overturned public representativeness and embraced the new shale boom as an "answer to a prayer, the answer to a dream" (RRC, 2015, p.3).
The development of transparency and accountability mechanisms did not follow the fast spreading of ordinances (Table 2 – line 3), which was unfavorable for monitoring and controlling energy businesses. Penalties and responsibilities are defined by Texas legislation, but the lack of channels to access monitoring procedures, fines, and adjustment measures raised doubts about RRC commitment to have companies comply and reduce health, safety, and environmental externalities (Earthworks, 2012 and 2014).Critiques are addressed also to the Texas Commission on Environmental Quality (TECQ*)*, which supposedly neglected threats to public health caused by leaks of volatile organic compounds and kept issuing permits that supported industry activities (Septof, 2013; Morris, *et al.*, 2014a and 2014b).
The U.S. Environmental Protection Agency (EPA) has voiced its concern about the effectiveness of regulatory agencies in Texas. As a result, several lawsuits involving RRC, TECQ and EPA reached the courts. These contentions are expressed by the statement of one RRC commissioner who believes the agency's "job is to make sure industry produces efficiently and economically […] and face federal overreach because Texans know how to oversee oil and gas production better than Washington does" (Malewitz, 2016,p.1). It is worth noting that until recently companies did not have to disclose data on disposals or chemical inputs used for hydraulic fracturing. This was one of the most controversial issues regarding loopholes on EPACT and it resulted in debates concerning the federalization of shale regulation (Davis & Hoffer, 2012).

The recentralization of community prerogatives to Austin authorities resulted in a very unfavorable equity framework (Table 2 – line4). It reflects a considerably unbalanced relationship among different stakeholders and institutions that easily respond to industry demands, but shuts out further debates on the distribution of benefits from oil and gas exploitation (Matz, 2015).

5. Discussion

Regardless of the material differences between biodiesel and shale and the contrasting aspects of Brazilian and American federalism, in both cases results reveal poor performances *(-1,11* and *-1,18* respectively) that indicate spurious governance systems. The main reason is related to the particularities of arenas, stakeholders, and policies, which, instead of promoting innovative and balanced relationships among state, society, and private actors, has been captured by the hegemonic values of the most resourceful stakeholders. Despite the differences in energy policies - one excessively centralized and other largely decentralized -, without due attention to participatory mechanisms and equity parameters, both systems are doomed to fail.

The indicators we applied show that both Brazilian biodiesel governance and U.S. shale governance failed to provide or maintain mechanisms of participation and representativeness that could counter-balance the interests and powers of an elite linked to these new energy resources. PNPB guidelines, for example, did not break away from traditional top-down structures and caused negative outcomes to biofuels production – as the ethanol policy - once biodiesel political arrangements fell under control of elite stakeholders. Its activities also (re)stimulated the spread of large monocultures (such as soybeans) as the main raw material. The North American shale governance at Texas in turn developed a throwback towards big-government rationality that abruptly changes game rules and curtails the historical autonomy of local control arenas and indulges the powerful interests of the traditional oil and gas sector.

Additionally, the parameters we applied showed little transparency in the governance mechanism in both energy landscapes. Channels of public access are absent. In both cases these conditions contributed to the high level of societal exclusion that reduced pressures on companies' accountability regarding social and environmental damages. The set of ordinances, bills, and policies we analyzed in GBP and EFS shows a neglect of precautionary principles, norms, and rules aimed at controlling the risks inherent to shale exploitation, as well as to manage the externalities of biodiesel production.

Conclusion

In this paper we analyzed power relations amongst state actors, civil society organizations, and businesses in two energy landscapes, the Gaucho Biodiesel Pole in Brazil and the Eagle Ford Shale in the U.S. We presented a governance index for each energy landscape, based on four sub-indices and a subset of 11 indicators. In both cases the governance index was similarly low. What lies behind such disappointing governance mechanisms is the development of severe asymmetries derived from alignments between key policy makers and the resourceful energy stakeholders. Those alliances overshadow public interest and pre-empt broad social representation.

Further research is necessary to detect whether the same flaws persist in other energy landscapes and their respective governance arrangements. Nonetheless, in both cases examined here, energy businesses have become so strong and pervasive in their influence and strategies over government structures, arenas, and policy controls that they shut out pluralist forms of democratic governance. This resulted in the formation of powerful elite regimes, or *Energy Leviathans*.

References

Bailis, R.; Baka, J. (2011). Constructing Sustainable Biofuels: Governance of the Emerging Biofuel Economy. *Annals of the Association of American Geographers*, 101(04) 827-838.doi: 10.1080/00045608.2011.568867

Bayer, L. (2016). *Subcomissão para tratar da implantação do Cadastro Ambiental Rural* (CAR). Assembléia Legislativa do Rio Grande do Sul. 66pp.

Davis, C.; Hoffer, K.. (2012). Federalizing energy? Agenda change and the politics of fracking. *Policy Sci*, (45) 221-241. doi: 10.1007/s11077-012-9156-8

Dittrick, P. W. (2014). Eagle Ford 2013 spending to reach U$ 23 billion. *Oil & Gas Journal,* (110) 12-13.

Earthworks. (2012).Enforcement Report RRC. Texas Railroad Commission*: Inadequate enforcement means irresponsible oil and gas development*. Retrieved from: http://www.earthworksaction.org/ /texasoilgasenforcementhepublicsrole.

Earthworks. (2014). Texas Oil & Gas Enforcement– *Public Participation. Citizen Complaints help uncover violations*. Retrieved from: www.earthworksaction.org/issue/detail/texasoilgasenforcementthepublicsrole.

Gerber, E. R., & Kollman, K. (2004). Authority migration: Defining an emerging research agenda. *Political Science and Politics*, 37(3) 397–401.doi: 10.1017/S104909650400455X

Hall, J.; Matos, S.; Severino, L.; Beltrão, N. (2009). Brazilian biofuels and social exclusion: established and concentrated ethanol versus emerging and dispersed biodiesel. *Journal of Cleaner Production*, (17) 577-585.doi:10.1016/j.jclepro.2009.01.003

Hisschemöller, M.; Hoppe, R.; Dunn, W.N.; Ravetz, J.R. (2001). Knowledge, Power and Participation in Environmental Policy Analysis. *Policy Studies Review Annual*, (12) Transaction Publishers, New Brunswick, New Jersey, 527p.

Hughes, J.D. (2015). *Eagle Ford Reality Check: The Nation's top tight oil play after more than a year of low oil prices*. Post Carbon Institute, California.

IBGE. (2017). Instituto Brasileiro de Geografia e Estatística. *Censo Agropecuário de 2017*. Retrieved from: https://censos.ibge.gov.br/agro/2017/

Janssen, R; Rutz, D. D. (2011).Sustainability of biofuels in Latin America: Risks and opportunities. *Energy Policy*, (39) 5717-5725.doi:10.1016/j.enpol.2011.01.047

Jordan, A.; Wurzel, R. K. W.; Zito, A. (2005) The rise of 'new' policy instruments in comparative perspective: Has governance eclipsed government? *Political Studies*, 53(3) 477-96. Doi:10.1111/j.1467-9248.2005.00540

Juarez, P. (2011). Explosões em usinas de biodiesel: o que fazer? *BiodieselBR*. July. Retrieved from: www.biodieselbr.com/revista/023/coluna-paulo-suarez.htm.

Lemos, M. C.; Agrawal, A. (2009). Environmental governance. *Annual Review of Environment and Resources*, (31) 297-325.doi: 10.1146/annurev.energy.31.042605.135621

Lima, A.; (2016). *Eco-governamentalidade e Governança de Recursos Energéticos: entre a prática e o discurso na ação coletiva dos Polos Gaúchos de biodiesel e dos folhelhos texanos de Eagle Ford Shale*. Doctoral dissertation, Sustainable Development, Center for Sustainable Development (CDS), University of Brasília, Brasília, Brazil.

Lima, A.; Toni, F. (2017). Energy Landscapes and Environmentality: Boundaries between Discourses and Practices in Energy Governance. *IJESD*, 8(09) 673-677. doi: 10.18178/ijesd.2017.8.9.1036

Malewitz, J. (2016). Environmentalists Ask EPA to Strip Texas Authority. *Texas Tribune Digital News*. January 12, 2016. Retrieved from:www.texastribune.org/plus/water/vol-4/no-1/environmentalists-ask-epa-strip-texas-authority.

Maroun, M. R.; Larovere, E. L. (2008). Ethanol and food production by family smallholdings in rural Brazil: Economic and socio-environmental analysis of micro distilleries in State of Rio Grande do Sul. *Biomass and Bioenergy*, 18(04) 885-98. doi: 10.1016/j.biombioe.2014.02.023

Matz, J.; Renfrew, D. (2015). Selling "Fracking": Energy in Depth and the Marcellus Shale. *Environmental Communication*, 9(3) 288-306.doi: 10.1080/17524032.2014.929157

Morris. J; Song, L; Hasemyer, D. (2014). Fracking boom spews toxic air emissions on Texas residents. *Pittsburg Post-Gazette*, February 25, 2014. Retrieved from: www.post-gazette.com/powersource/latest-oil-and-gas/2014/02/25/

Morris. J; Song, L; Hasemyer, D. *Big Oil, Bad Air: Fracking the Eagle Ford Shale of South Texas*. The Centre of Public Integrity, February 18, 2014. Retrieved from:: http://eagleford.publicintegrity.org.

Nadaï, A.; Van Der Horst, D. (2010). Introduction: Landscapes of Energies. *Landscape Research*, 35(02) 143-155. DOI: 10.1080/01426390903557543

Rabe, B. (2014). Governance concerns and government capacity to shale gas. In: Stern, P.C. (Org.) *Risks and Risk Governance in Shale Gas Development*. (1663-1692). Washington,: The National Academy Press.

Ribot, J. C. (2007). Representation, Citizenship and the Public Domain in Democratic Decentralization. *Development*, 50(1), 43-49. doi: 10.1057/palgrave.development.1100335

Rodrigues, F. (2014).Com os pés no chão. *BiodieselBR*, 7(42) 09-11.

RRC. (2015).Railroad Commission of Texas. *Eagle Ford Shale Task Force*. Report. Austin, 2013. Retrieved from: www.rrc.state.tx.us/media/30156/final-self-evaluation-report-2015.pdf.

Stapleton, S. (2015). Texas pushes forward bill that would ban fracking ban. *Reuters*, April 18. Retrieved from: https://www.rt.com/usa/250797-texas-bill-bans-fracking prohibit/.

Septof, A. (2013). *Fracking the Eagle Ford – TCQE's nondenial*. Earthworksaction.org, September 30. Retrieved from:www.earthworksaction.org/issue//frackingtheeaglefordtceqsnondenial.

Scheberle, D. (2004).*Federalism and environmental policy: Trust and the politics of implementation.* (2nd ed.)Washington: Georgetown University Press

Tavares, J. (2014). Bomba Relógio. *BiodieselBR*, 06(40)52-55.

Tunstall, T. (2015). Recent Economic and Community Impact of Unconventional Oil and Gas Exploration and Production on South Texas in the Eagle Ford Shale. *The Journal of Regional Analysis & Policy* 45(01) 82-92.

Verdonk, M.; Dieperink, C.; Faaij, A. (2007). Governance of the emerging bio-energy markets. *Energy Policy*, (35) 3909-3924. doi:10.1016/j.enpol.2006.12.028

Williamson, A.; Archon, F. (2004). Political Deliberation: Where We Are and Where We Can Go. *National Civic Review*, (01) 03-15.

2. Climate Change in Colombia: Trends and Perspective to Achieve Sustainable Development

Prof. Clara Pardo

ABSTRACT:
Colombia is recognized as a country that has at high-risk and vulnerability from climate change impacts, which can affect diverse human settlements, development and economic activities. Hence, in rural areas the main challenges are the means of living and food production, whereas, in urban contexts climate change should decrease heath conditions and quality of life. This research seeks to analyse and evaluate trends and perspectives of climate change in Colombia in the last decade using qualitative and quantitative methods that allow to determine whether in this country climate governance has contributed to the mitigation and adaptation to climate change, especially in vulnerable areas that are more likely to poverty. Results indicate that in the up coming 15 years in the most areas of the country the temperature will increase 1°C which should undermine development especially in poor and rural areas. Despite quite a climate governance, it is necessary to strength its application and to raise awareness about importance to promote sustainable development from housing to the productive sector to achieve mitigation and adaptation to decrease and control risks by new weather conditions. All findings of this study are important for policy makers and local government to improve the mechanisms to adapt and mitigate climate change in Colombia where climate change should increase poverty and inequality.

Keywords: Climate change, perception, survey, Colombia

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1. Introduction

In recent decades, the increase of anthropogenic greenhouse gas (GHG) emissions has transformed the composition of the atmosphere and changed the global climate system, including the amount and pattern of precipitation around the world (UNDP, 2004). GHG emissions have increased by an average of 2.2% per year during the period of 2000 to 2010, and in the last year, anthropogenic GHG emissions reached 49 ± 4.5 GtCO-eq; this increase in emissions has been related to changes in snow cover, ice extent, sea level and precipitation (IPCC, 2014).

These facts indicate that climate change is occurring, and it is important for policy makers, researchers, decision-makers and citizens to generate and deploy new and cleaner technologies and take actions and measures that involve some level of citizen participation; the instruments of policy mandates to active behavioral change should be adopted (Dietz and Stern, 2008, Shwom et al., 2010).

In this context, it is important to analysis trends and perceptions of population on climate change to determine different approaches on reality of climate change in Colombia that it is a country particularly vulnerable to climate change, given that its population has been established in areas that are prone to flooding and in unstable lands of the high sierras. Moreover, this country shows a high recurrence and amount of disasters related to climatic conditions (UNDP, 2010). From this context, the objective of this research is to gather and analyze the perceptions of the Colombian population regarding climate change and main trends.

This paper is divided in five sections beginning with the present introduction, second the main features of climate change in Colombia, third methods, fourth the main results and discussion and finally conclusions.

2. Climate Change in Colombia

Colombia is one of the countries that is most vulnerable to climate change because coastal and mountain ecosystems directly benefit 80% of the population. In the few last years, climate change has been wreaking havoc in different regions, generating flooding, landslides, and changes in water provisions, impacting human health and more; hence, it is critical to protect this country against climate impacts.

In the last few decades, this country has been working on different policies related to climate change (IDEAM et al., 2015a): In 1994, it promulgated law 164, which approved the United Nations Framework Convention on Climate Change (UNFCCC). In 2000, it promulgated law 629, which ratified the Kyoto Protocol and formulated the National Strategy for the Implementation of the Clean Development Mechanism (CDM). In 2001, it made the first national communication regarding climate change and the first national inventory of GHG emissions (1990 and 1994). In 2002, it generated the first policy guidelines on climate change and established the National Office of Climate Change. In 2005, it established the mitigation group of climate change. In 2009, it made a national inventory of GHG emissions (2000 and 2004). In 2010, it made a second national communication regarding climate change and created an adaptation fund. In 2013, it formulated the roadmap for climate change adaptation programs and plans. In 2015, it formulated the proposal of the national climate change policy. These facts demonstrated that the country has made large strides in improving the resilience of its citizens to the climatic changes that threaten their water sources and livelihoods through different strategies and policy instruments.

Moreover, this country has developed a Colombian Strategy of Low Carbon Development that included the following issues: i. An analytical phase to identify and formulate mitigation measured for productive sectors; ii. the development of action plans for mitigation and studies of the co-benefits of mitigation measures; iii. the implementation of a measuring system of mitigation actions; iv. capacity-building; and v. communication strategies. This strategy has allowed for the development of eight plans of action for the main productive sectors to improve sustainable development and decrease GHG emissions.

The last national inventory of GHG emissions for the year 2012 (IDEAM et al., 2015b) indicated that Colombia generated 178258 Gg of CO2 equivalents, for which energy, agriculture, forestry, and other land use accounted for 87% of the GHG

emissions (see Figure 1).

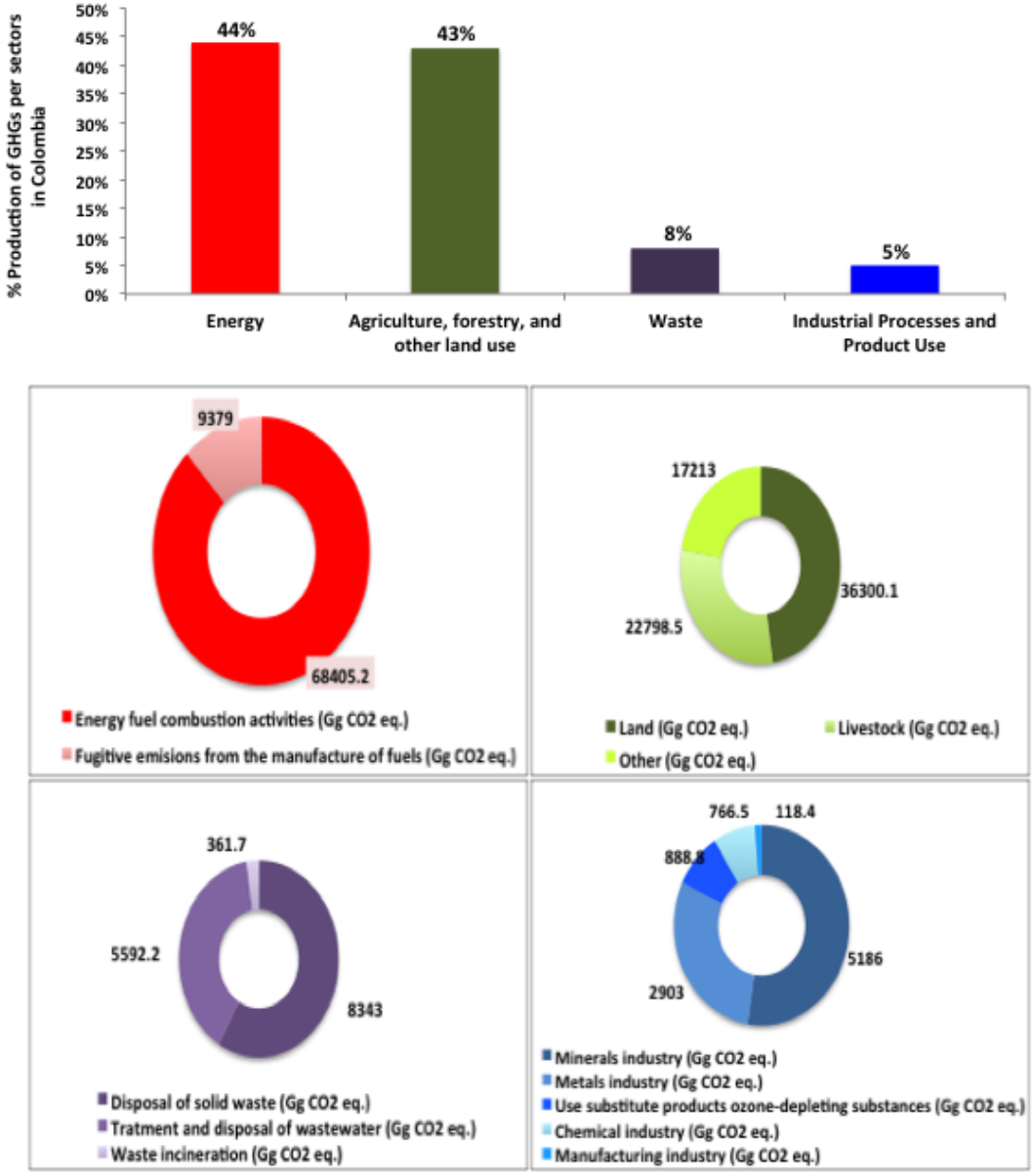

Figure 1. GHG emissions in Colombia in percentage and Gg of CO_2 equivalent (2012)

3. Methods

A nationally representative quota sample of the Colombian population aged 18 years and older was interviewed face-to-face in their own homes by OCyT-SEI between 1 April and 15 May 2016. Sampling was random and stratified, which allowed for a representative sample, and the technique used for the sample design was principal component analysis (PCA), an regions were assigned using the technique of optimal X allocation.

The questionnaire was designed taking into account the five categories: socio-demographic data, values and positions on climate change, information and communication, governance and behavior related to this issue.

4. Results and Analysis

This section shows the main results of this study on climate change that was calculated with statistical techniques of high reliability. Results indicates different approaches on perceptions and ideas of climate change in Colombia taking into account the socio-demographic characteristics. In general, Colombian population if it considers that climate change is happening and it is perceived through changes in temperature and rainfall, it is caused by human activities and in Colombia the actions in relation to climate change are limited.

A national representative quota sample of 1130 people aged 18 years and older was interviewed face-to-face in their own homes and represents 11754627 of Colombian citizens. The survey guarantees to gender-impartial composition the following manner: women 51.28% and men 48.72%. The majority of respondents (76.18%) had primary and secondary education.

Questions on beliefs and knowledge regarding climate change show the most important representations and their dynamics according to the respondents to be recognized. The majority of respondents believe that climate change is real (98.33%) and that human activity is the principal factor contributing to it (90.34%). On average, 56.77% consider that in their regions, the annual average temperature is warmer, and 36.56% consider that it has been variable over the last five years. The amount of rain has decreased according to 54.02% of respondents, and 31.22% have stated that rainfall has been variable in the last five years. Moreover, respondents relate to climate change with the following words: temperature, changes, droughts, and rainfall, among others (see Figure 2).

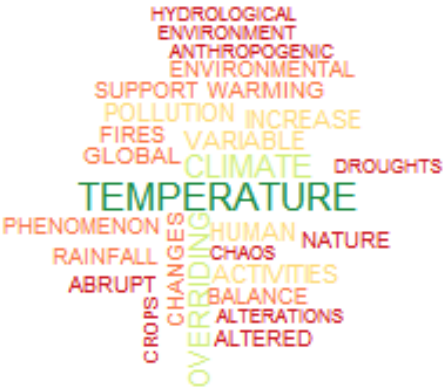

Figure 2. Words related to climate change in Colombia

The survey indicated that the main causes of climate change for respondents (see figure 3) are deforestation (30.33%), inadequate solid waste management (23.74%) and air pollution generated by industries (22.02%). In general, the trends by region, age, area and education level are similar considering the deforestation as the main cause of climate change, which concurs to data of IDEAM (2014) that demonstrated a gradual decline of Colombian natural forest from an area of 56.4% in 1990 to 51.7% in 2014.

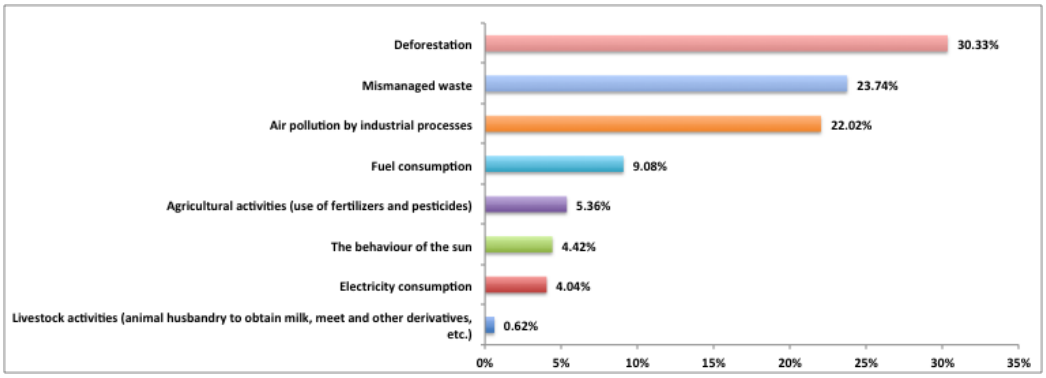

Figure 5. Main causes of climate change in Colombia and regions

25% of respondents consider that they are very well informed or informed, whereas 62.19% consider that they are not sufficiently well informed on climate change. In the regions (see Figure 6).

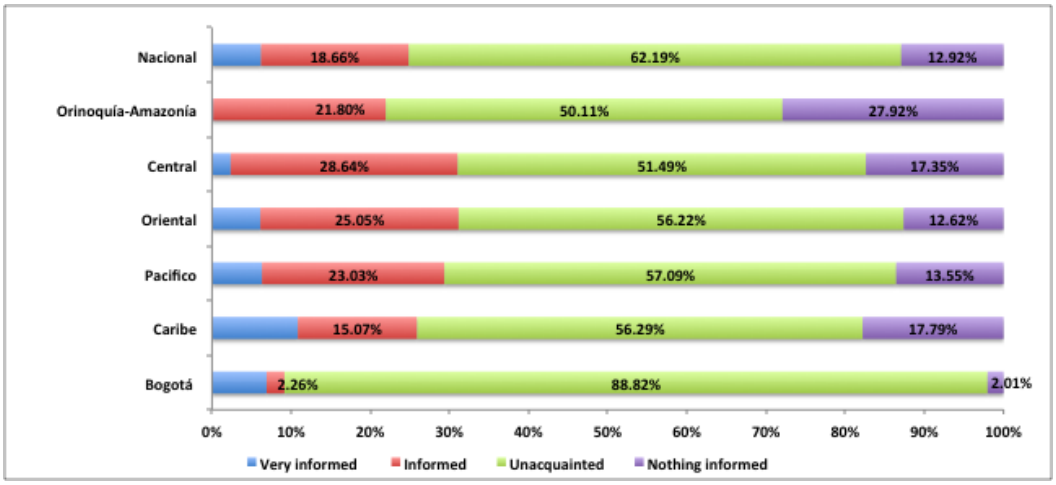

Figure 6. Level of information on climate change in Colombia and regions

The main media platform to inform them of climate change is television, followed by the Internet. The programs that are recognized to provide information about climate are mainly the Discovery Channel, Week radio_No Numeral, RCN newscast, etc. (See Figure 7).

Figure 7. Programs recognized to inform the public about climate change

To analyze the government actions or programs regarding climate, the survey included three questions in which investments for climate change, education campaigns and the formulation of policies and instruments are the actions executed by the Colombian government. However, over 40% of respondents consider that these actions for climate change are not executed in Colombia (see Figure 8).

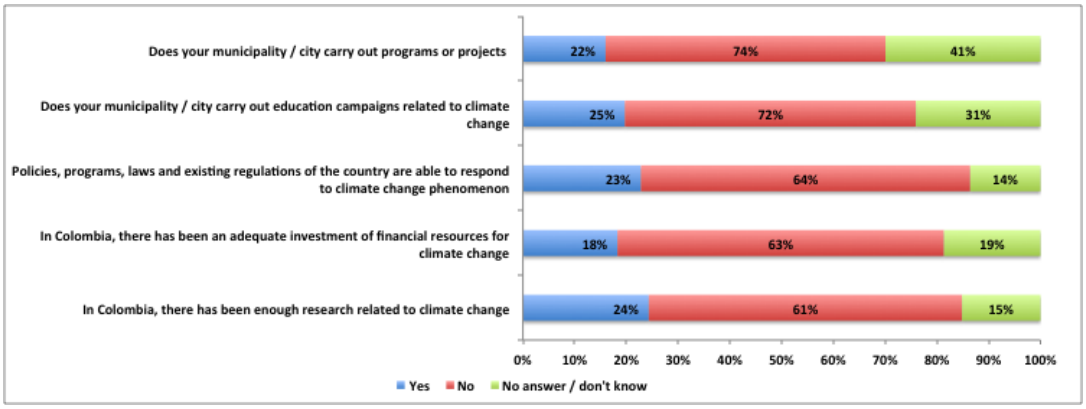

Figure 8. Perceptions related to institutional activities on climate change in Colombia

Less than 20% of respondents have used forums for public participation on climate change; alternatively, more have used the following: environmental municipal councils, committees of citizen participation and community action councils.

The government offices most recognized to conduct actions in response to climate change are the Ministry of the Environment, the National Unit for Disaster Risk Management, and IDEAM. However, for every entity, less than 20% of respondents identified these entities as promoting action to combat climate change.

The main activities identified by the respondents for adaptation to climate change are the following: reducing water consumption, changing of the manner of dress, and changes in infrastructure (see Figure 9).

Moreover, in regards to actions and practices for adaptation to climate change, 83% of respondents have not applied any practice or action, and 75% have applied new actions for local water management.

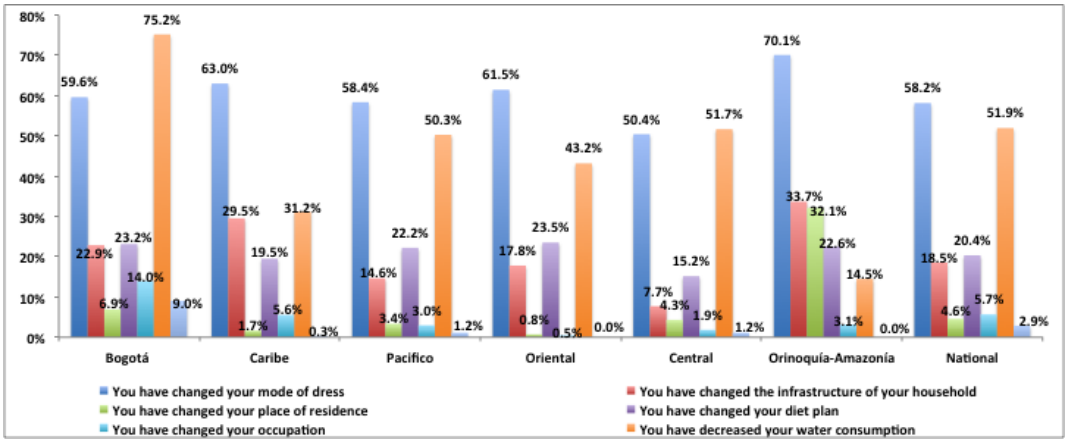

Figure 9. Activities for adaptation to climate change according to respondent answers of the survey in Colombia and regions.

The findings of this study indicate that the Colombian people have developed different

concepts and knowledge on climate change, for which it is important to design and apply new strategies to empower the population on the importance and actions for adaptation or mitigation of climate change. Additionally, the government should strengthen climate change governance, especially in the regions that are most affected by this situation.

5. Conclusions

The results of this study have demonstrated that the majority of the Colombians interviewed believe climate change to be an important issue. They note that it is real and that human activity is a contributing factor. The researchers have identified that the Colombian population has perceived changes in temperature and rainfall over the last five years, and these changes have generated threats to their habitat in the form of droughts, rising food prices, forest fires, among others. The main media platforms to inform the public on climate change are television and the Internet.

On the whole, this research reveals that climate change governance has gaps because over 60% of respondents consider that the country does not execute or apply actions to combat climate change, and less than 10% have used forums for public participation on climate change. Moreover, the majority of Colombians have not applied any practice or action to adapt to climate change.

It is important to design strategies and instruments in which citizens can become more involved in actions to prevent, mitigate and adapt to climate change and in which government and the media also play significance roles. Identifying current perceptions is not sufficient; it is also necessary to identify and analyze climate change from an integral perspective that guarantees effective migration strategies, such as the development of a low carbon economy.

References

Dietz, T. and Stern, PC., Public Participation in Environmental Assessment and Decision Making. Washington, DC: National Academies Press; 2008.

IDEAM, PNUD, MADS, DNP and Chancellery, First Biennial Report of update Colombia for UNFCCC, Bogotá, 2015a.

IDEAM, PNUD, MADS, DNP and Chancellery, National Inventory of Green House Gas Emissions in Colombia, Bogotá, 2015b.

IDEAM, Sub-direction of Ecosystems and Environmental Information. Forest Group 2014. Project: Monitor System of Forest and Carbon. Bogotá, D. C., Colombia, 2014.

Intergovernmental Panel on Climate Change (IPCC), Climate Change 2014, https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf, 2014.

Shwom, R., Bidwell, D., Dan, A., Dietz, T., Understanding US public support for domestic climate change policies, Global Environmental Change, Vol. 20, pp 472–482, 2010.

United Nations Development Programme (UNDP), World Energy Assessment: Overview 2004 Update. UNDP, World Energy Council, New York, 2004.

United Nations Development Programme (UNDP), Mainstreaming Climate Change in Colombia. Screening for risks and opportunity, http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/climate-change/mainstreaming-climate-change-in-colombia/CC%20risk%20Mainstreaming%20Climate%20Change%20in%20Colombia-EN.pdf, 2010.

3. Assessing Vulnerability and Resilience in the Face of Climate Change: A Case Study of North - East India

Ms. Sutandra Singha

ABSTRACT:
The North Eastern Region (NER) possesses ecological and strategic significance for India. Hence, socio- economic stability of the region is of utmost importance. However, the NER is critical from climate change perspective due to the majority of the rural population and the economy based on natural resources and climate-sensitive sectors - agriculture, water resource, and forestry. The region is not properly equipped to handle the adversities of climate change impacts. Analysis of climate change impacts and vulnerabilities at the state level of North-East India is, therefore, necessary to develop adaptation strategies. In this backdrop, the present study assesses the climate change vulnerability of eight North-Eastern states - Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura to climate change impacts, using the Vulnerability-Resilience Indicators Model (VRIM after Moss et al. 2001). For this purpose, proxies have identified and used for various sectors of climate sensitivities and coping-adaptive capacity. The outcome has analyzed at the state level regarding relating the values of VRIM with the respective socio-economic situation to find out the sources of vulnerability. This methodological framework will help policymakers, analysts and stakeholders to systematically evaluate individual as well as sets of indicators to identify the vulnerable areas and sectors. Concluding section of this study offers some practical policy measures that would substantially reduce vulnerability to climate change and improve long-term resilience in the NER.

Keywords: Climate Change, Coping-Adaptive Capacity, North Eastern Region, Sensitivities, Vulnerability-Resilience Indicators Model

Miss Sutandra Singha is a Ph.D. Scholar at the Centre for Russian and Central Asian Studies, School of International Studies, Jawaharlal Nehru University, India. Her research focus on environment, climate change, geopolitics of natural resources and non-traditional security threats. She possesses B.Sc., M.A. and M.Phil degree in Geography. She has awarded Lectureship Eligibility in Geography by the University Grants Commission, Govt of India and Doctoral Fellowship Award in International Studies by Indian Council of Social Science Research (ICSSR), Govt of India. She has received funds by ICSSR and Ministry of Science and Technology, Govt. of India to attend national workshops. She has presented as well as published research articles at various national and international conferences and journals. She is the advisory board member of the journal Geopolitics of Energy, published by the Canadian Energy Research Institute of Alberta. She has completed Ph.D. credit-certificate based short course "Agenda 2030: Poverty, Climate Change and Sustainability"- 2017 with full scholarship at the University of Bergen, Norway. Her M.Phil Dissertation entitle- "Carbon Dioxide Emission and Climate Change: A Case Study of Russian Federation, 1992 to 2013" and Ph.D. thesis entitle: "A Comparative Study of Anthropogenic Carbon Dioxide Emissions and Climate Change in BRICS Countries".

1. Introduction

Vulnerability to climate change is the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with the adverse impacts of climate change whereas, resilience is the degree to which geophysical, biological and socio-economic systems rebound, recoup or recovers from adverse effects of climate change (IPCC 2007). India is among the most critical countries in the world regarding

climate change sources and impacts. Heavy dependency on the environment for food and livelihood make Indians vulnerable to the climate change impacts. Socio-economic set up of an area determines the extent and intensity of vulnerability to climate change in that area. A better understanding of the future behaviour of the climate variability is, therefore, necessary for disaster mitigation and for developing adaptation strategies. In this context, assessing the vulnerability to climate change in India is an essential component of formulating adaptation strategies especially in the areas and sectors where vulnerability is high.

There are eight states in the North-East Region of India, covering about 26.2 million hectares of geographical area and approximates 40 million population (Ravindranath et al., 2011). Out of the total population, the rural community consists of 82 percent. Additionally low density of population, dominance of indigenous tribal communities (34-91 percent), dependence of the population on natural resources, and poor infrastructure development are some of the drawbacks of the region. The region relies on the southwest monsoon for agricultural purpose, which makes food production vulnerable to climate change.

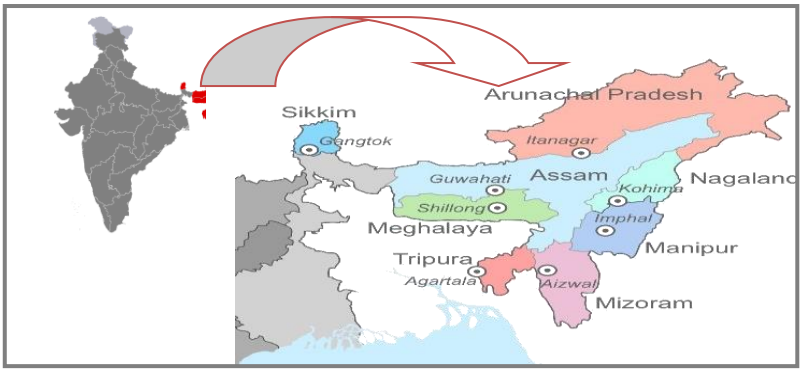

Figure 1: Location Map of the Study Area

Extensive deforestation, unsustainable jhum cultivation, land degradation, land fragmentation and biodiversity loss are threatening the natural resources of the states. Rural population growth, increase in livestock population, overgrazing, fuelwood extraction, mining, and forest fire, shortening of jhum cycle, lack of land ownership rights and rising horticulture are the major reasons of deforestation in North East India. Along with deforestation, hilly terrain and slope cultivation cause soil erosion and loss. Many districts face severe water crisis during the summer. In this article, the overall implications of climate change and vulnerability in each of the North East states has been assessed to identify the vulnerable sectors to climate change. State wise vulnerability profiles are developed for all the eight states. This is a first of its kind study conducted in North East India whereby the local scale of vulnerability assessment is utilized. Also, the Vulnerability-Resilience Indicators Model provides a comparable quantitative mechanism, which can be readily applicable to the other states of India.

2. Objectives

The present study has the following objectives:
(1) to assess the degree of vulnerability of India's North Eastern Region to climate change.
(2) to relate the vulnerability of each state with their respective socio-economic scenario.
(3) to compare the states regarding vulnerability to climate change.
(4) to offer practical policy measures to reduce vulnerability to climate change and improve long-term resilience.

3. Methodology and Data Sources

To assess the vulnerability and resilience capacity of North–East states to climate change impacts, this study aims to follow the method guided by Moss et al. (2001) to identify proxies for five sectors of climate sensitivities and three sectors for coping and adaptive capacity. Table: 1 lists the proxy variables that were used in constructing the subcomponents of the Vulnerability-Resilience Indicators Model (VRIM).

Table 1: Data-based sectors, indicators, and proxies for sensitivity and coping/adaptive capacity (After Moss et al. 2001)

	Sector	**Indicators/Data**	**Proxy for**
Sensitivity	Settlement or infrastructure sensitivity	Population without access to sanitation	Accessibility to basic services is buffer against climate change impacts
	Food Security	Cereals production/ cropland area	Availability of food offers a buffer against climate change impacts
		Protein consumption/ capita	Availability of alternate food sources during shortfalls in food crop
	Ecosystem Sensitivity	Percent of land managed	The degree of human interference into nature and land fragmentation/degradation
		Fertiliser use/cropland	Nitrogen/Phosphorous loading of ecosystem and stresses from pollution
	Human Health Sensitivity	Completed fertility Life expectancy	Composite of conditions affecting human health (nutrition, exposure to death risk) and access to health facilities
	Water Resource Sensitivity	Renewable supply and inflow Water use	Water supply from internal renewable sources and inflow from rivers Withdrawals to meet current or projected needs
Coping and Adaptive Capacity	Economic Capacity	GDP (market/capita)	Duration of access to markets, technology, and other resources required for adaptation)
		Gini Index (a measure of income equity)	The potential economic contribution of all people
	Human and Civic Resources	Dependency ratio	Availability of socio-economic resources after meeting other present requirements
		Literacy	Human capital and adaptability of the labour force

	Environmental Capacity	Population density	Population pressure and stresses on ecosystems
		Sulfur dioxide (SO_2)emissions/ state area	Air quality
		Percent of land unmanaged	Fragmented landscape

Reliable data is essential to maintain the validity, reliability, and generalizability in qualitative research. This study is based on secondary data (government statistics), extremely useful both in defining the population and in structuring the sample. Table: 2 provides proxy wise detail of data sources.

Table 2: Data Sources

Indicator	***Sector***	***Proxy***	***Data Source***
Sensitivity	Settlement/Infrastructure	Percent population without access to sanitation	Census of India 2011
	Food Security	Cereal production/ agricultural land	Agricultural Statistics at a Glance 2014, Ministry of Agriculture, GoI
		Protein consumption/capita	The 68th round of National Sample Survey Office (NSSO), Ministry of Health and Family Welfare, GoI
	Human Health	Completed fertility	Census of India 2011
		Crude Death Rate	Census of India 2011
	Ecosystems	Percent of land managed	Indiastat 2014
		Fertilizer use/ cropland area	Indian Fertilizer Scenario 2013, Department Of Fertilizers, Ministry of Chemicals and Fertilizers, GoI
	Water Resources	Renewable supply and inflow of water	Central Ground Water Board, Hydrology Project, Ministry of Water Resources 2014, GoI
Coping-Adaptive Capacity	Economic Capacity	GDP per capita	CSO 2014
		Gini Index	Planning Commission 2014, GoI
	Human and Civic Resources	Dependency ratio	Social And Cultural Tables, Census of India 2011
		Literacy	Census of India 2011
	Environmental Capacity	Percent of non-managed land	Indiastat 2014
		SO_2/area	Central Pollution Control Board 2014 and State Pollution Control Board 2014
		Population density	Census of India 2011

Following Moss and Malone (2012), the method to obtain VRI is hierarchical (Table: 3) with four levels. The vulnerability index (level 1) is derived from two indicators (level 2) - sensitivity (how systems could be affected by climate change) and coping-adaptive capacity (the capability of a society to minimize the loss or maximize gains for

welfare). Again, sensitivity and adaptive capacity are composed of sectors (level 3, the left-hand column of the table: 1). Each of these sectors is made up of 1 to 3 proxies (level 4, the middle column of the table). Next to this, table: 3 shows the method to calculate the final index. The values of each of the hierarchical level are obtained from the geometric means of the participating values. The values for VRIM for the NER states are obtained from the geometric mean of all the sector values.

Table 3: Method to construct the VRIM for North-East India, 2013-14

Steps in the hierarchy	- geometric mean of proxies > sector indices - geometric means of indices > sensitivity or coping-adaptive capacity - geometric mean of sensitivity and coping-adaptive capacity indices > Vulnerability-Resilience Index
Sensitivity Index	kept as positive value
Log Transforms	applicable when there are extremely high or low values in the data sets
Normalization of data	Z Score, $z = (x - \mu) / \sigma$ Where x= value, μ= mean, σ= standard deviation

4. Limitations and Scope of the Study

The study has the following limitations:

(1) Moss et al. (2001) identified 17 proxies for the construction of VRIM. However, data on "Population at flood risk from sea level rise" is not available for the North-Eastern states as these states are inland states; hence to maintain the continuity in the assessment, author removed this proxy and used 16 proxies.

(2) Since Life Expectancy data is not available for all of the North-East States, Crude Death Rate has considered as the proxy for Life Expectancy following the criteria are given by The Ministry of Development of North Eastern Region, Government of India.

(3) The author has used the data of 2013-14 for all of the proxies, which the latest data provided by the government source.

There is further scope for research in these limitations.

5. Sensitivity Index Analysis for the North Eastern States

5.1 Sensitivity Assessment for the Settlement/Infrastructure Sector

The population is vulnerable to climate variabilities when they don't have/ have less access to basic infrastructural facilities - clean water and sanitation. In Assam, maintenance of cleanliness and personal hygiene is an age-old practice, and environmental sanitation is also part and parcel of rural lifestyle of some of the communities. Open defecation is not practiced in rural areas. As per Census of India 2011, the percentage of service latrines in rural areas of NER states is much higher than all India average. Against the national figure of 1.2 percent, the statistics for NER states are high for the states of Manipur (9.4 percent), Arunachal Pradesh (5.3 percent), and Meghalaya (4.3 percent). The service latrines in urban areas are also higher than the all India average in some of the NER states. As against the national average of 1.6 percent of urban households using service latrines the percentage is as high as Arunachal Pradesh (11.6 percent), Manipur (9.3 percent) and Meghalaya (5.1 percent). Sikkim, Mizoram, Nagaland, Manipur, and Meghalaya are among the top ten cleanest (based on the

percentage of households having sanitary toilets and using them) states in India (PTI, Livemint, 2016). Access to basic and essential services acts as a buffer against climate variability and change. In the case of NER, the entire region is safe regarding possessing secure and safe settlement infrastructure (Figure: 2).

5.2 Sensitivity Assessment for the Food Security Sector

Food Security is a factor which enables the population to withstand the effects of climate change on their lives. Food security is relied on the agricultural productivity and access of farmers to mechanisms ensuring the protection of crops from the climate variability and change. Rice is a staple food of the entire NER. Assam, Tripura, Manipur, and Nagaland are leading rice-producing states among the NER. In spite of the acidic nature of soils in the states, pulse production is not encouraging. However, Assam (68.55 thousand tonnes) followed by Manipur (26.85 thousand tonnes) and Nagaland (34.63 thousand tonnes) are the top pulse producers in the NER. Regarding food grains production, the increase was highest in Manipur (66 percent in 2014 compared to between 2003). Northeastern India is a non-milk-drinking region; hence the demand for protein diet is supplemented by consuming eggs, meat, and fish, especially in the Assam, Tripura, Manipur, and Nagaland (Lewis, 2016). Hence, these states are more food secure than other NER states (Figure: 2).

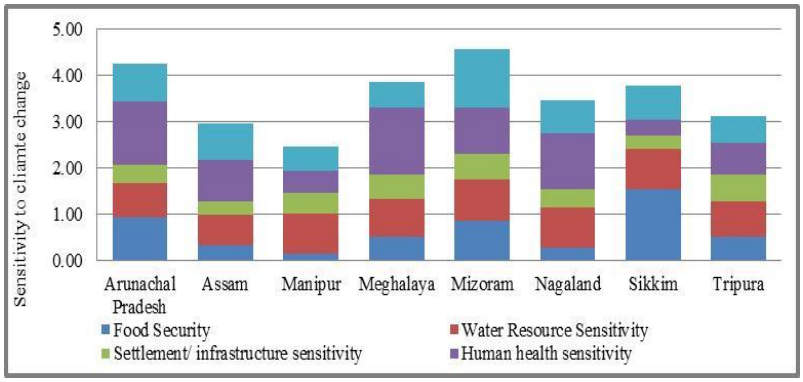

Figure 2: Sensitivity Index for North-East India, 2013-14

5.3 Sensitivity Assessment for the Human Health Sector

Total fertility rate and crude death rate represent the status of human health regarding nutrition, exposure to disease risks, and access to health facilities. Human health, if poor, is prone to be severely affected by climate change. North East is still backward from the point of modern health care services in many states in the region is still an issue. Hence, high fertility and high death rate are indicative of poor health status in the NER. Meghalaya and Nagaland have high levels of fertility. Whereas, the awareness of women to family planning is found to be rated highest in Sikkim with 88.0 percent followed by Manipur 80.8 percent (Singh, n.d.). Sikkim has the lowest fertility rate in India (NITI Aayog, 2017). Many of the NER states are yet to satisfy the existing population coverage norms in one or the other types of health centers. In many states, health centers lack essential facilities and equipment such as operation theatres, X-ray machine, labour rooms, stabilization units for newborn babies, water supply, electricity supply, communication and

most importantly well-trained doctors, nurses and health workers. (Saikia and Das, 2014, p. 98). The availability of public health care throughout Arunachal Pradesh is very poor regarding insignificant private participation in the health sector, inaccessibility of the remote, vulnerable poor inhabitants to modem health service facilities, followed by low life expectancy at birth (Saikia and Das, 2014, p. 86). In Assam, public health and healthcare are still weak. It has over 22 percent shortfall of doctors at Primary Health Center (PHC) level and nearly 43 percent shortfall of specialists at Community Health Centre (CHC) level, antenatal checkups coverage below 50 percent and 50 percent of all new mothers still bereft of post-natal services (MoHFW, 2015). In India, the maternal mortality rate is highest in Assam (Kalita, 2016). Tripura is the bottom 8th state in India regarding total fertility rate, but the death rate is 4.8 percent. Hence the states except for Sikkim and Manipur, are more sensitive to climate change impacts due to prevalent poverty, lack of fresh water and underdeveloped health sector (Figure: 2).

5.4 Sensitivity Assessment for the Ecosystems Sector

The sensitivity of an ecosystem is determined by the degree of human interference into the natural landscape and the use of fertilizer in the cropland area. Increase in both of these factors makes the ecosystem more vulnerable to the impacts of climate change. NER accounts for merely 0.1 percent of the total fertilizer consumption in India (Chanda, 2013). Higher use of fertilizer creates pressure on the resource of the environment followed by environmental degradation. Fertilizer use is the lowest at 2.29 kg/hectare in Arunachal Pradesh (Barah, 2001, p. 18). Arunachal Pradesh ranks first among the NER states regarding total area under Jhum Cultivation, which is 700 km^2. However, it is gradually doing away with the environment deteriorating the age-old practice of jhum cultivation or shifting cultivation (PTI, Times of India, 2013). Also, this state has least population density – only 17 people/km^2. In Assam, fertilizer consumption is 89 kg/hectare and has 696 km^2 of land under Jhum cultivation (North Eastern Secretariat, 2002, p. 42). The entire NER region is ecologically sensitive especially because of jhum cultivation tradition which is a high degree of human interference with the natural landscape. Mizoram's area under shifting cultivation is currently 63 thousand hectares. However, the total Jhum area and the total number of Jhumia families in Mizoram during 2010-11 are 28562 hectares and 68433 respectively (Economic Survey, GoM, 2016, p.45). As a consequence of the implementation of New Land Use Policy (NLUP), there was about 20.75 percent decrease in Jhum areas and 14 percent decrease in the number of Jhumia families in 2013-14 compared to 2010-11 (Planning and Programme Implementation Department, GoM, 2015, p.10). Being hilly region and mostly rural population, the NER accounts for the very low amount of SO_2 emissions. Arunachal Pradesh, Assam, and Mizoram are little more ecologically sensitive than others due to fertilizer use and shifting cultivation system (Figure: 2).

5.5 Sensitivity Assessment for the Water Resource Sector

The North East region possesses an enormous water resource potential which is 34 percent of India's total water resource (Sharma et al., 2010, p.3). The per capita and per hectare water availability in this region is the highest in India (PIB, Govt. of India, 2016). However, less than 5 percent of the existing water potential of the region is being utilized (Goswami, 2005, p. 1). Although the groundwater is available at a shallow depth

of within 20 meter, so far only 4.3 percent of the existing groundwater resource has been developed (Mahanta, 2006, p.3) Here access to the groundwater is not a reality due to some physiological reasons. In this region, the thrust faults such as Main Boundary Fault and Naga thrusts have intensified the steepness of the slope which in turn causes negligible infiltration of water (Islam, 2012, p.2). Expect some parts of Assam valley, most of the regions consist of hard crystalline granites, gneisses, and granulites that block infiltration of rainwater for groundwater recharge (Gupta, 2014). When the regions are already suffering from water availability, climate change can intensify this scarcity and make the community more vulnerable (Figure: 2).

6. Coping-Adaptive Capacity Index Analysis for the North Eastern States

6.1 Coping-Adaptive Capacity of the Economic Sector

Per capita GDP and income inequality have considered the two determinants of the strength or weakness of the economic sector. High GDP/capita indicates access to markets, technology, and other resources useful for adaptation to climate change. On the other hand, measures of income inequity (the Gini coefficient) represent the realization of the potential contribution of all people. Hence high GDP/capita is positively correlated with the coping capacity of a state whereas, Gini coefficients are negatively correlated. Both Sikkim and Mizoram have high per capita income even more than the national average (Rediff, 2012). Arunachal has high per capita income, with 3.5 lakh people living below poverty line. Arunachal has shown a dip of 6 percent in the poverty scale in 2013-14 than in 2004-05. In Tripura, around 6.3 lakh people are below the poverty line (Dey, 2013); however, there have been 23 percent decline in poverty scale in 2013-14 compared to 2004-05 (Chakravarty, 2012). In Manipur 12.5 lakh people are living below the poverty line and, poverty raised by 9.2 percent in 2013-14 than in 2004-05 (Staff Reporter, The Telegraph, 2012). For Meghalaya, per capita income is less than the national average. In Nagaland, although per capita income is pretty high, 4.1 lakh people live below the poverty line. Also, Nagaland has registered a rise of over 12 percent in poverty. Assam has 116.4 lakh persons living below the poverty line, and per capita income is also less than the national average (Staff Reporter, The Telegraph, 2012). Therefore, it can be summarised that Sikkim, Mizoram, Arunachal Pradesh and Tripura are economically more efficient to cope up with climate vulnerability than other NER states (Figure: 3).

6.2 Coping-Adaptive Capacity of the Human and Civic Resources Sector

In the present study, human and civic resources encompass dependency ratio and literacy rate as the determinants. Dependency ratio shows how much social and economic resources are available for adaptation after meeting the needs of dependents. Literacy rate shows the quality of the knowledge, skill, and competency of the labour force. Hence Coping-adaptive capacity tends to improve with declining dependency ratio in a society, whereas increased literacy rate represents skilled, efficient and competent workforce. According to Census of India 2011, the northeastern states have the least proportion of elderly population (people above 60 years) - Arunachal Pradesh is the lowest with 4.6 percent, followed by Meghalaya (4.7 percent), Mizoram (5.2 percent), Nagaland (6.3 percent), Sikkim and Assam (both 6.7 percent), Manipur (7.0 percent) and Tripura (7.69 percent). Tripura, Sikkim, Nagaland, and Mizoram are showing a high level

of human and civic resources primarily due to high literacy rates. Assam and Arunachal Pradesh lack of human and civic resource capacity due to relatively higher dependency ratio and lower literacy rate than other NER states (Figure: 3).

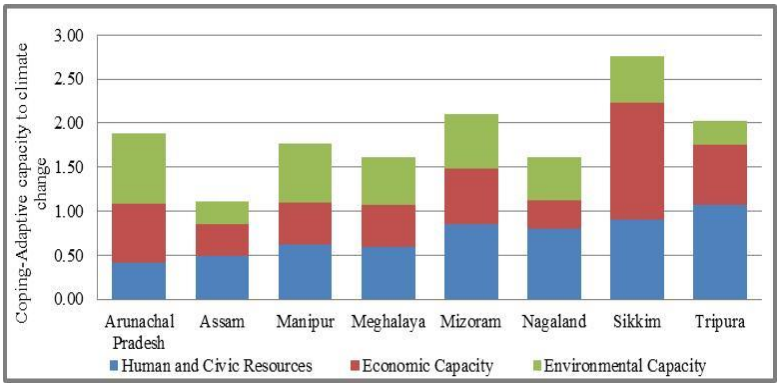

Figure 3: Coping - Adaptive Capacity Index for North-East India, 2013-14

6.3 Coping-Adaptive Capacity of the Environment Sector

This study takes into consideration the density of population, emissions of SO_2 and percentage of land unaffected by the anthropogenic activities as the driving factors of the coping-adaptive capacity of the environment of NER states. The environment becomes more vulnerable to climate change with increasing population density as population pressure and stresses the ecosystem. Also, SO_2 emissions increase pollution and stress the environment. On the contrary, less is the human interference into the land; more will be the resilience capacity of the ecosystem. Arunachal Pradesh (17 person/km^2), Mizoram (52 person/km^2), Sikkim (86 person/km^2) and Nagaland (119 person/km^2) are the bottom four states in the NER due to their remoteness and inaccessibility. These four states are endowed with a higher percentage of forest area to their respective total geographical area. Jhum cultivation system is also gradually reducing in Arunachal and Mizoram. Also, the northeast states have low SO_2 emissions owing to low industrial and transportation activity. However, Assam's coals contain high-sulfur compared to other states of India. The urban centers of Tripura have witnessed a significant increase in SO_2 in the air. Hence greater population density and relatively higher rate of SO_2 have contributed to the lower environmental coping-adaptive capacity for Assam and Tripura (Figure: 3).

7. Vulnerability-Resilience Indicators Model Analysis for the North-East India States

If we look at the VRIM model (Figure: 4), it can be seen that Mizoram, Sikkim and Arunachal Pradesh are showing higher vulnerability resilience than other NER states. These states are showing higher sensitivity than others. Still, these states have a higher coping-adaptive capacity, and therefore they are more. Still, these states have a higher coping-adaptive capacity, and therefore they are more resilient to vulnerability. Assam, Manipur, and Nagaland are less sensitive to climate change impacts however they have a lower adaptive capacity, and consequently, they are less resilient to climate change

vulnerability. Meghalaya and Tripura have a reasonable level of resilience capacity depending upon their coping-adaptive capacity.

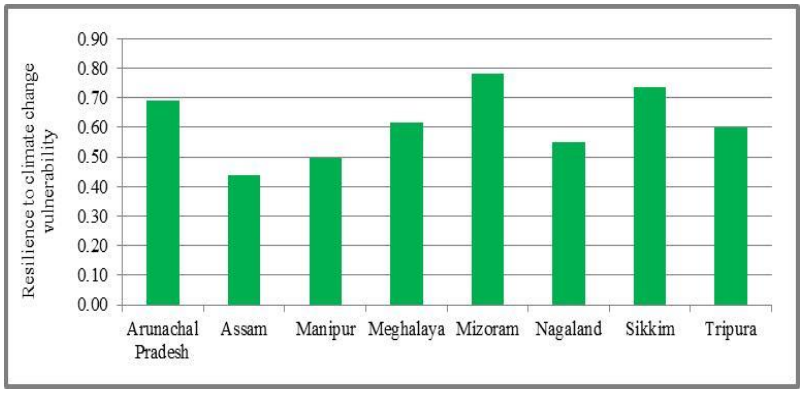

Figure 4: Vulnerability-Resilience Indicators Model for North-East India, 2013-14

8. Conclusion and Recommendations

Depending upon each of the state's performance, following measures can be suggested to the Governments, NGOs, policymakers, and analysts to strengthen the state's vulnerability resilience capacity:

- Arunachal Pradesh needs to improve its literacy rate. Other NER states have provided a primary school within a distance of 1 km - 3km., which is a fundamental minimum requirement to access primary school education facility. Due to connectivity problems, drop-out is very high and severely affecting the efficiency of primary education there. Also, a pupil in this state takes more than seven years to produce a primary graduate than ideally required (5 years). The goal of 100 percent literacy rate cannot be achieved until and unless Arunachal improves the education system. State government should look upon these matters so that people can develop their knowledge and skills to combat climate change variability. Government and NGOs need to promote more and more people to leave the jhum cultivation system and make them stable agricultural people. The state government's focus on agriculture, horticulture, and allied sectors can not only boost the local economy but also protect the environment.
- For Assam, the focus should be given to its economic and environmental capacity to improve its vulnerability resilience to climate change. Assam needs to improve its GDP/capita. The growth rate of state income has remained low for several decades, and it is currently lower even than the national average. Real mean consumption expenditure is declining in the rural areas of Assam. Even, the egalitarian nature of income distribution has not helped Assam to reduce rural poverty. The government can adopt measures to attract private investment, maintain the critical role of the public sector in areas like irrigation, infrastructure and the role of social sectors where private investment might not come forward and, prioritize those sectors that have both comparative advantage and high linkages with other sectors. In Assam, Bongaigaon power projects (three units) are under construction. Also, the government is setting up a mega-thermal power plant (1,600 MW) at Margherita in Tinsukia district, which would contribute to

more SO_2 emissions in future. Measures should be adopted well in advance for removal of sulfur from coal before combustion, to meet the environmental safety.

- Manipur especially requires improving its economic capacity by reducing poverty. The Manipuri population is very much income poverty ridden. Employment in organized and other sectors is low in numbers, and there is no entrepreneurship worth its name. With predominantly tribal population, shifting agricultural economy, the absence of industries and least of urbanization, and improper implementation of Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), the hill districts of Manipur present a scene of unemployment and poverty. The state and central government require to look after these issues. Improve economic condition would undoubtedly help the people to cope up with the climate vulnerability.
- Meghalaya requires to improve its per capita income (which is currently lower even than the national average). There has been a minimal effort by the state government to improve own generation as evident by the low tax GSDP ratio or to recover the huge loss of revenue to the state on account of evasion of taxes. But no sincere efforts have been made by the state government in this regard. The government has not been very proactive in effective and productive expenditure management. There is a dearth of measures to improve the technical and allocative efficiency in public expenditure. The Government of Meghalaya needs to bring accountability and transparency in the budgets, public funds, and projects. The government should support the cultivation of indigenous rice varieties and Eri silk production.
- Jhum cultivation in Mizoram, one of the main form of agriculture and livelihood of the villagers, is the sources of deterioration of air quality. State government should arrange for alternate means of livelihood for the people and promote them to adopt the stabilized lifestyle.
- Nagaland is suffering in acute poverty. Difficult terrain and poor infrastructure are the major reason behind chronic poverty in this state. Government and NGOs could adopt proper measures to develop infrastructure and reduce poverty as far as possible. Central Government should give special concession for investment in these regions, and More Public Sector Undertakings should be established in these states.
- The government needs to come forward to take proper measures to reduce SO_2 emissions in the thermal power plants in Tripura.

For the overall development of vulnerability resilience of the North - East region, preparation and assistance in implementing State Action Plans on Climate Change, training and awareness building programmes on climate change, proper implementation of water policies and water security plans at village level and inputs for the integrated land and water resources management can be proved fruitful.

References

Barah, B. C. (2001). Prioritization of strategies for agricultural development in northeastern India. *Proceedings 9: National Centre for Agricultural Economics and Policy Research (ICAR)*, 1-126.

Census of India. (2011). *Availability and Type of Latrine Facility: 2001-2011*, New Delhi.

Chakravarty, M.(2012, March 22). The Tripura model and other thoughts on the poverty numbers. *Live Mint*. Retrieved from http://www.livemint.com/Opinion/fAvT3RCQi89dd3ngDsParM/The-Tripura-model-and-other-thoughts-on-the-poverty-numbers.html.

Chanda, T.K. (2013, October) Vol. 13, Issue 80, Fertiliser Consumption: State Wise Pattern. *Geography and You*. 13 (80).

Dey, S. (2013, January 20). Poverty increases in four NE states: Planning Commission, Guwahati. *Business Standard.* Retrieved from http://www.business-standard.com/article/economy-policy/poverty-increases-in-four-ne-states-planning-commission-112032100002_1.html.

Economic Survey (2016). *Economic Survey 2015 – 2016*. Research and Development Branch. Govt. of Mizoram.

Goswami, D. C. (2005). Management of Water Resources of North-East India: Need for an Integrated Regional Plan. *Ishani*, 1(6), 1-12.

Gupta, S. (2014). *Ground Water Scenario of Himalayan Region, India, Himalayan region of India*, Central Ground Water Board, New Delhi.

Islam, A. (2012). Water Scarcity in the North Eastern States of India: Mechanisms and Mitigations. *Indian Streams Research Journal*, II (XI), 1-7.

Kalita, P. (2016, August 10). Assam tops maternal mortality list. *Guwahati News-Times of India*. Retrieved from https://timesofindia.indiatimes.com/city/guwahati/Assam-tops-maternal-mortality-list/articleshow/53626877.cms.

Lewis, M.W. (2016). India: Milk in the Northwest; Meat in the Northeast. *Geo-Currents*. Retrieved from http://www.geocurrents.info/cultural-geography/culinary-geography/the-indian-diet-milk-in-the-northeast-meat-in-the-northeast.

Mahanta, C. (2006). Water Resources of the Northeast: State of the Knowledge Base. *Background Paper No. 2*, 1-25.

MoHFW. (2015). Rural *Health Statistics 2014 – 2015*. Govt. of India.

Moss, R.M. and Malone, E. L. (2012). The Vulnerability-Resilience Indicators Model. *Pacific Northwest National Laboratory and Joint Global Change Research Institute*. Prepared for the Committee for the Marine Transportation System.

Moss, R.M. H., Brenkert, A. L., and Malone, E. L. (2001). Vulnerability to climate change: a quantitative approach. *Pacific Northwest National Laboratory (PNNL-SA-33642)*. Prepared for the US Department of Energy, 155-167.

Niti Aayaog. (2017). *State Statistics: Total Fertility Rate (TFR) (Birth/ woman)*. National Institution for Transforming India), Government of India.

PIB. (2016). Country's *Farmers can be Benefitted only when the New Agricultural Technologies are Utilized by them at the Field Level*. Press Information Bureau. Ministry of Agriculture and Farmers Welfare, Government of India.

Planning and Programme Implementation Department. (2016). *Performance Budget 2014 – 2015*. Research and Development Branch. Govt. of Mizoram.

PTI, Times of India. (2013, August 09), Area under jhum cultivation significantly reduced in Arunachal Pradesh. Itanagar News-Times of India. Retrieved from https://timesofindia.indiatimes.com/home/environment/flora-fauna/Area-under-jhum-cultivation-significantly-reduced-in-Arunachal-Pradesh/articleshow/21728980.cms.

Ravindranath, N. H., Rao, S., Sharma, N., Nair, M., Gopalakrishnan, R., Rao, A. S. and Krishna, N. (2011). Climate change vulnerability profiles for North East India. *Current Science*, 384-394.

Rediff .(2012, September 12). Indian states with highest per capita income. Rediff.com.

Saikia, D. (2014). Health Care Infrastructure in the Rural Areas of North-East India: Current Status and Future Challenges. *Journal of Economic and Social Development*. 10. 83-99.

Sharma, B. R., Riaz, M. V., Pant, D., Adhikary, D. L., Bhatt, B. P., and Rahman, H. (2010). *Water poverty in the northeastern hill region (India): potential alleviation through multiple-use water systems: cross-learnings from Nepal Hills* (Vol. 1). IWMI.

Singh, I., Lahiri, R., and Singh, N. D. (n.d.) Health Care Information for Women and Children: A Case Study of North Eastern States. *Health Administrator*, 140-146.

Staff Reporter. (2012, March 19). Decline in Tripura, Arunachal; increase in Assam, Nagaland, Manipur. *The Telegraph*. Guwahati.

4. Noise Mitigation and Related Factors of High Speed Railways

Mrs Inara Watson, PhDc, Dr. Amer Ali, Dr. Ali Bayyati

ABSTRACT:
Railway transport, particularly High-Speed Railways (HSR) offer many advantages compared with other modes of transportation. HSR may mean more noise and vibration which reduce the quality of life, negatively affect health in addition to other impacts on the wild life and nature in general. Therefore, it is very important for the development of HSR systems to consider effective measures to reduce the level of noise and vibration among its most important goals. This paper reports on a research that takes the form of an investigation and critical evaluation of the key existing factors that contribute to noise emissions from HSR and discusses possible ways to reduce them. A comparison of different influential factors and mitigation measures concerning a selected HSR systems will be reported. From the evidence that has been gathered from different resources and related critical evaluations, conclusions can be made to show that in some cases the increases in speed would not only be a threat to the environmental sustainability but also affect the economical sustainability of HSR systems. The expected outcomes of this research will contribute to the development and advances of more sustainable HSR systems.

Keywords: High-speed rail, noise mitigation, environment, sustainability

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1. Introduction

Transport systems provide access and mobility for society and support an increase in economic growth. However, the environmental and social costs of transport increases. Very often the most obvious form of pollution from transport is noise. The noise level is continually increasing, and the majority of these increases have been drawn by the increasing amount of transport on roads and expansion of airports. Noise reduces the quality of life, disturbs sleep, negatively affects health and reduces property prices. It was estimated that in the EU around 40 per cent of the population are exposed to road traffic noise of 55dB(A), and 20 per cent are exposed to levels exceeding 65 dB(A), which is defined as an unacceptable level of noise (Whitelegg and Haq, 2003). Road traffic accounts for 64% of total noise levels, rail traffic 10% and air traffic 26% (Efficient Transport for Europe, 1998). The number of people affected by rail noise is substantially

less than the number of people affected by road noise. Noise is one of the most important environmental emissions for people who are living next to railway lines. Noise and vibration generated by trains increase with the increase in speed. The basic unit used to measure sound or noise is the Decibel or dB(A). People are more sensitive at higher frequencies than to lower frequencies (Wolf, 2010). The biggest concern about HSR is the amount of noise produced by trains and the number of people who may be affected by it. Until recently, the most popular method to reduce noise was to use noise barriers and to insulate windows.

2. Factors Affecting Noise Level

The noise generated by HSR can be less than the noise from a conventional line with mixed traffic. Many different factors can affect the noise level; it can be the age of the infrastructure and materials that have been used to build the track, level of maintenance, rolling stock and the way in which the railway is operated. If a railway track is in a poor state and has a low level of maintenance then it would emit 10 dB(A) more than a new one (Transport Policy and the Environment, 1990). Table 1 shows that there is a strong relationship between noise level and speed. Also, there is a strong relationship between noise level and distance to the receiver and between noise level and infrastructure type. The noise level was influenced more by the distance than by changes in speed. To reduce the noise level propagation, it is more effective to put the railway line in cuttings, but such a solution can be expensive.

Table 1. Maximum and realised noise emissions of existing high-speed trains (Source: Clausen et.al, 2012; Feilden, Wickens and Yates,1995)

Speed in km/h	Maximum noise emission according TSI NOISE in dB(A)	Current emission of German HS Trains in dB(A)	Difference in dB(A)
200		>80	
250	87	87-94	0-7
300	91	91-95	0-4
320	92	92-96	0-4

TSI NOISE- European Railway Technical Specification for Interoperability for Noise, defines the maximum noise levels for Rolling Stock (RS). For high speed trains, the noise level emission is a big concern. For the German ICE with a speed of 200 km/h, at 25 metres from the track it was recorded that the noise level was over 80 dB(A), and at a speed of 300 km/h the noise level was around 90 dB(A) (Feilden, Wickens, and Yates,1995). This is a major problem for numerous countries, where the railway tracks pass densely-populated areas. Doubling the speed will approximately increase the aerodynamic noise level by 18 dB(La).

Many different elements contribute to the total noise emission from trains including pantograph noise, aerodynamic noise generated by the car bodies, running noise generated from the underbody and noise from concrete structures. Pantograph noise consists of aerodynamic noise generated at the pantograph and pantograph shield, friction noise is caused by the collector running on the catenary and sparking noise between the collector and catenary. Aerodynamic noise generated by the air flow over the

carriage is only relevant to high-speed trains (Martens et.al, 2018).
To reduce the negative impact of pantograph noise, bus cables were installed between pantographs to reduce sparking noise. Even if one pantograph bounces off the catenary, current still flows through the other pantograph, preventing sparks. Reducing the noise from the car body can be achieved with smoother surfaces of cars.

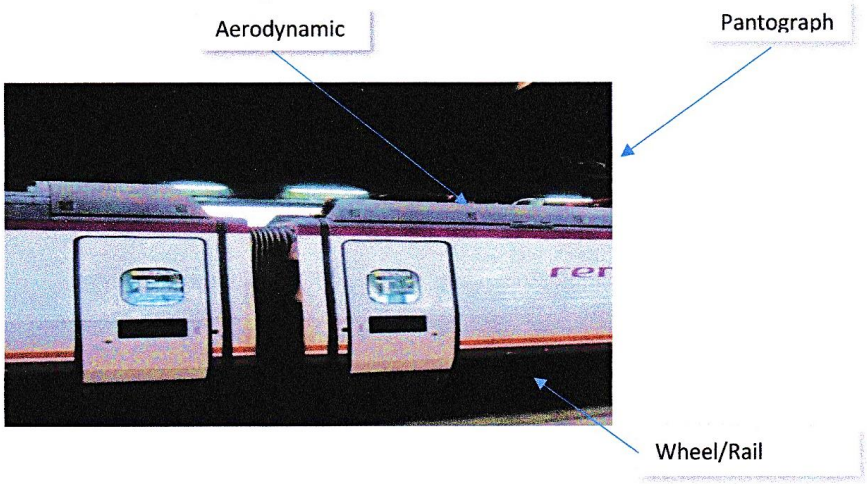

Figure 1. Major exterior noise sources on high-speed trains

Figure 1 shows the major exterior noise sources on high-speed trains which are: aerodynamic, pantograph and wheel-rail interaction noises. These noise sources are speed dependent. Traction noise, which is generated by the electric traction system, is distributed between the bogie height and the roof of the train. Noise from the cooling system will be the dominant traction noise (Zhang, and Jonasson, 2006). The level of traction noise varies for different types of locomotive or EMU and for different operational conditions. Noise from wheel-rail interactions is dependent on the wheel and rail roughness and on the speed of train. This type of noise can be partially mitigated by rail grinding. Aerodynamic noise becomes more important for HSR trains than the rolling noise (Zhang, 2010). It consists of noise generated from the pantograph, noise of the train, roughness of the RS body and gaps between cars, etc. Intensity of aerodynamic noise pollution depends on train speed.
Modern HSRS (High Speed Rolling Stock) has metal panels on top of the coaches to improve aerodynamic profile of coaches and pantograph. The pantograph is important as it is not sheltered by noise barriers. Moreover, the number of pantographs needed to collect the current for the train set could be reduced, and as a result, this would reduce the aerodynamic noise sources. This type of noise is insignificant for low and medium speed ($V<200$ km/h), important for high speed ($200<V<300$ km/h) and dominant for very high speed ($V>300$ km/h). Mechanical noise is dominant at low speed, wheel-rail interaction noise is dominant at speed up to 300 km/h whilst the aerodynamic noise is dominant at speeds of over 300km/h (Giesler, 2011). The modern HSRS in the majority has a distributed power system which reduces noise emissions. However, a distributed power system increases the noise level inside the coaches. People inside the train are

affected by different types of noise; traction noise, rolling and aerodynamic noises.

Table 2. HSRS in selected countries (Source: Adapted from Uic.org, 2018)

Country	Owners or Operators	Class	Train set Formula	Type of power
France, Belgium, UK	Eurostar	373 e300 TGV-TSMT	2 Locomotives 18 Trailer Coaches	Concentrated
France, Belgium, Netherlands	Thalys	Thalys PBKA	2 Locomotives 8Trailer Coaches	Concentrated
Germany	DB AG	401(ICE1)	2 Locomotives 12 Trailer Coaches	Concentrated
Germany	DB AG	403(ICE3)	4 Motor Coaches 4 Trailer Coaches	Distributed
Italy	Trenitalia	ETR460	6 Motor Coaches 3 Trailer Coaches	Distributed
Italy	Trenitalia	ETR500	2 Locomotives 12 Trailer Coaches	Concentrated
Spain	Renfe	S102	2 Locomotives 12 Trailer Coaches	Concentrated
Spain	Renfe	S103	4 Motor Coaches 4 Trailer Coaches	Distributed
China	CR	CRH1A	5 Motor Coaches 3 Trailer Coaches	Distributed
China	CR	CRH2G	4 Motor Coaches 4 Trailer Coaches	Distributed
Japan	JRW	500-7000	8 Motor Coaches	Distributed
Turkey	TCDD	HT65000	4 Motor Coaches 2 Trailer Coaches	Distributed
USA	Amtrak	Acela	2 Locomotives 6 Trailer Coaches	Concentrated

Table 2 shows the type of power of HSRS in selected countries. With increasing the speed, the noise inside the train cars increases (Soeta and Shimokura, 2013). For HSR the noise from the bogie area has the larger impact on interior noise than aerodynamic noise. It is important to reduce the noise level inside passenger coaches for Electro-Multiple-Unit (EMU) with distributed power components as traction motors are located beneath the passenger saloon. The floor of passenger carriages must be sound proofed (Zhang et.al,2016). Passenger cars must be designed to reduce noise inside the passenger saloon by using advanced materials and suitable design. Equipping the car bodies with shielding and acoustical absorption can provide cost-effective noise reduction. Countries such as Japan, China, and Turkey have only HSRs with a distributed traction system, but the USA uses rolling stock for their HSR with a concentrated traction system. Countries in Europe, such as Italy, France, Spain, Germany and UK have rolling stock for HSRs with both types of traction systems; distributed and concentrated.

A significant contribution to noise level is the interaction between wheels and rails. Rolling noise occurs during the rolling movement of the wheel. The roughness of the wheel and rail generate the rolling noise when the wheel travels along the rail, but it also

depends on the load and speed of the train. Articulated trains have less effect of running noise on passengers (Japanese railway technology today, 2001). Wheel and rail rolling noise is proportional to the third power of train speed (Lynch, 1998). To reduce this negative impact of running noise, different types of wheels were developed: solid wheels, resilient wheels and wheels provided with constrained layers. The most common is the solid wheel, which is used for high speed trains. It consists of a single steel part, but sometimes layers of viscoelastic material are placed between the web and a stiff constraining plate to reduce the wheel noise emission (Scott, 2009). The railway insulation pads which are placed between the rail and sleepers can sufficiently reduce the noise level radiated by the track.

The type of track, and the surface of the rail can make a difference by more than +/-10 dB(A). Also, buildings and civil engineering works can affect noise levels, or amplify or attenuate such levels (Feilden, 1995). There are measures to mitigate the rail-wheel noise including rail lubrication, grinding, noise barriers, damping etc. The most-cost efficient one is the reduction of roughness of rail by rail lubrication and grinding (Tuler and Kaewunruen, 2017). To reduce the noise level from the contact between the wheels and rail, wheel-track absorbers also can be used. This potentially reduces noise level by 1-3 dB(A) (Oertli, and Hubner, 2010). Mitigation of wheel noise is a difficult task as wheels interact not only with the rail but also with the substructure.

Today HSR often use ballastless tracks such as concrete slab-track. This type of rail support is not good for reducing noise and vibration emission (Sheng, Zhong and Li, 2017). Concrete structure noise is proportional to the second power of train speed. Embedding a viscoelastic material can reduce the level of noise emission from ballastless track. To reduce the noise level from the concrete, grooved slab mats can be placed in the general area of the rail (Japanese Railway Technology Today, 2001).

3. Measures of Reduction in Noise Level

There are three ways to reduce noise: at the source, which is the most effective way, around the noise source and at the receiver end. The decision-making process concerning the layout of railways is the most efficient stage for the reduction of noise and vibration. A straight track is the lowest noise generator, whilst curving slab track is the noisiest. Railways with sharp curves have a significant problem of wheel squeal. The corrugated track depending on brake type, can increase the noise level between 10dB(A) and 20 dB(A) (The Railways, 1995). Elevated rails along the top of embankments, bridges and viaducts propagate noise over long distances and result in noise levels at a range of 75÷105 dB(A). Furthermore, stiff embankments can be a source of high frequency vibration (Connolly et.al, 2014).

Different techniques for reducing noise at the source have been developed such as improving the infrastructure and rolling stock design, traffic management, using preventative maintenance, acoustical rail grinding, rail dampers, etc. Increasing the operational restrictions such as reducing the train weight, putting a limit on speed, operational time and reducing the number of trains using the line will reduce the level of noise.

There are various measures to control noise along the railway line which includes: noise barriers of various heights. Noise barriers can reduce the noise level between 5 and 15

dB(A) (Oertli, and Hubner, 2010). Usually for railways 2-metre-high noise barriers are used, but for HSR it needs to be 4 meters or more, as a high proportion of noise come from pantographs (Transport Policy and the Environment, 1990). The height of trains (Table 3) varies from 3.36m for S102 type train to 4.32m for Acela train. The width and height of trains influence the aerodynamic performance of running trains. Also, a coach length and inter coach connection can sufficiently affect the noise level.

In some cases, the noise barrier looks as if a box is completely covering the rail which sounds like a train running in a tunnel. This noise barrier sometimes has a partial or fully covered top. The barrier internally is covered with absorbent material. Pantographs are especially important because they are located on the roof of trains and not so much sheltered by noise barriers (Iglesias, Thompson, and Smith, 2017). In some cases, due to the topography nature of the area where a railway line is passing it can be necessary to use cuttings and tunnels. Also, it can be used to mitigate the noise level. However, this is a more expensive measure than using conventional noise barriers. Railways have a long tradition of tunnels as many HSR lines were constructed in long tunnels. The 327 km Hanover-Wurzburg line in Germany includes 62 tunnels totalling 118km (Transport Policy and the Environment, 1990). Tunnels can reduce noise level, but they can also generate noise. Entering a tunnel of a high-speed train generates the sonic boom effect and on top of this more noise emission will be produced from the ventilation shafts.

It would be more effective to minimise noise level from railway tracks by keeping the level of rails as low as possible as the ground and vegetation attenuate the occurring sounds. However, with changing climate and increasing extreme weather events there is a need to consider future possibilities of flooding for which the elevation of rails on top of embankment can become a necessity.

Measures to reduce the noise level inside a building are double or triple glazing and acoustic insulation. It is important to provide measures to reduce noise level in buildings at the design stage. Every doubling in distance from the HSR to the recipient will reduce the noise by approximately 3 to 4.5 dB(A) which depends on the ground condition i.e. soft ground with vegetation or hard surface covered by concrete or asphalt (Wolf, 2010). Insulation inside the building can reduce the noise between 5 to 30 dB(A) (Jehanno, 2011). The most significant and sustainable lowering of the noise level can be achieved by a combination of RS and infrastructure related measures which will facilitate reducing the needs of noise barriers.

The railway stations and surrounding areas also exposed to higher noise level. Train dynamics, acceleration and deceleration, speed changes of through trains, etc. have considerable impact on the resultant noise level (Džambas, Lakušić, and Dragčević, 2018). In order to reduce the noise levels, absorbent material can be used to cover station furniture, trackside walkways and walls.

Table 3. Comparison of selected HSRS, their maximum operational speed, noise values and density of population (Source: Poisson, Gautier, and Letourneaux, n.d.; Uic.org, 2018; Worldometers.info, 2018)

Country	Class of Train	Maximum Operational Speed in km/h	Maximum Axle Load in ton	Train Width, in mm	Train Length, in m	Pass-by Noise Values in dB(A)	Density of Population by Country in P/km²

France, Belgium, UK	373 e300 TGV-TSMT	300	17	2814	394		119 380 275
France, Belgium, Netherlands	Thalys PBKA	300	17	2904	200	90-92	119 380 507
Germany	401(ICE1)	280	19.5	3020	358		236
Germany	403(ICE3)	300	16	2950	200	89	236
Italy	ETR460	250	13.5 (unloaded)	2800	237		202
Italy	ETR500	300	17	2860	354	90.5	202
Spain	S102	300	17	2960	200,244		93
Spain	S103	300	<17	2950	200		93
China	CRH1A	200	16.5	3328	213,5		151
China	CRH2G	250	15.45	3380	201,4		151
Japan	500-7000	285	N/A	3380	204		349
Turkey	HT65000	250	N/A	2920	158,5		106
USA	Acela	241	23	3175	203		36
TSI Limits		*300*				*91*	

Table 3 shows some characteristics of selected HSRS, noise values and density of population in selected countries. With the increasing wealth society getting less tolerant to noise pollution and mitigation measures getting more expensive. The majority of people affected by railway noise live in Western and Central Europe, primarily in Germany, Italy, Switzerland, France and Belgium. Approximately 60% of the population affected by noise are in Germany and France and the highest level recorded was along the south-north corridor Genoa-Rotterdam (Vos, 2016). Railways around the world spent a substantial amount of financial resources to reduce or mitigate noise pollution from railways. One of the long-term goals of the German DB Railway is to cut noise emissions by half by 2020. The total cost of this will be € 2.3 billion including noise barriers and double-glazed widows. France will invest €193 million in noise barriers and rail dampers (Clausen et.al, 2012). The cost of noise varies between 0.1 and 0.5 per cent of Europe's GDP (Banister, 2000). Approximately €150-200 million will be spent in Europe annually on noise barriers and window insulation (Oertli and Hubner, 2010). Increased cost of noise pollution can sufficiently affect economic sustainability of HSR.

Conclusions

Encouraging people to use the railway transport systems will improve air quality, reduce the noise level, deliver safety benefits and improve the quality of life. However, increasing traffic volumes and urbanisation increase noise pollution. National governments are required to implement policies and legislations, which should lead to a reduction in noise levels. Further increases in train speed, wagon loading, and traffic intensity will inevitably increase noise levels. Around 30% of population in Europe are exposed to road noise. Currently most HSR services do not run during the night time when people are most sensitive to noise emissions, but in the future, this may change and lead to an increase in HSR traffic as a result of the continuing rise in demand for daily

travel including night time services.

Reducing the level of noise can be done through targeted investments, using new quieter technologies and developing new noise absorbing materials, reducing noise through regular maintenance of infrastructure and RS and through law enforcement concerning noisier trains. Improved designs of rolling stock can reduce the amount of noise pollution from the engine, air-conditioning and ventilation systems. Reducing noise from 72dB(A) to 52dB(A) in an average daily noise level will produce an annual saving of about €158 per person (Micheli, Farne, 2016). The future development of HSR transportation systems must consider railway noise emission reduction as one of the most important goals for developing sustainable HSR systems.

References

Banister, D. (2000). *European transport policy and sustainable mobility*. London: Spon Press, p.78.

Clausen, U., Doll, C., Franklin, F., Franklin, G., Heinrichmeyer, H., Kochsier, J., Rothengatter, W. and Sieber, N. (2012). *Reducing Railway Noise Pollution*. [online] Europarl.europa.eu. Available at: http://www.europarl.europa.eu/RegData/etudes/etudes/join/2012/474533/IPOL-TRAN_ET(2012)474533_EN.pdf [Accessed 30 Apr. 2018].

Connolly, D., Kouroussis, G., Woodward, P., Alves Costa, P., Verlinden, O. and Forde, M. (2014). *Field testing and analysis of high speed rail vibrations*. [online] Available at: (https://www.sciencedirect.com/science/article/pii/S0267726114001857 [Accessed 30 Apr. 2018].

Džambas, T., Lakušić, S. and Dragčević, V. (2018). Traffic noise analysis in railway station zones. *Applied Acoustics*, [online] 137, pp.27-32. Available at: https://www.sciencedirect.com/science/article/pii/S0003682X17310964 [Accessed 1 May 2018].

Efficient Transport for Europe, (1998). Paris: OECD Publishing and European Conference of Ministers of Transport, p.25.

Feilden, G., Wickens, A. and Yates, I. (1995). *Passenger transport after 2000 AD*. London: Published by E & FN Spon for the Royal Society, p.p.76.

Feilden, G., Wickens, A. and Yates, I. (1995). *Passenger transport after 2000 AD*. London: Published by E & FN Spon for the Royal Society, p.p.76.

Giesler, N. (2011). *HS2 London to the West Midlands Appraisal of Sustainability*. [online] Gov.uk. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/370568/HS2_London_to_the_West_Midlands-_sustainability_appraisal.pdf [Accessed 30 Apr. 2018].

Iglesias, E., Thompson, D. and Smith, M. (2017). Component-based model to predict aerodynamic noise from high-speed train pantographs. *Journal of Sound and Vibration*, [online] 394, pp.280-305. Available at: https://www.sciencedirect.com/science/article/pii/S0022460X17300512 [Accessed 1 May 2015].

Japanese railway technology today. (2001). Tokyo: The Foundation, pp.21,90.

Jehanno, A. (2011). *High Speed Rail and Sustainable Mobility*. [ebook] Paris: UIC. Available at: http://www.apta.com/mc/hsr/previous/2011/presentations/Presentations/High-Speed-Rail-and-Sustainable-Mobility-A-Focus-on-Environmental-and-Social-Issues.pdf [Accessed 30 Apr. 2018].

Lynch, T. (1998). *High speed rail in the US*. Amsterdam: Gordon & Breach, p.83.

Martens, A., Wedemann, J., Meunier, N. and Leclere, A. (2018). *High speed train noise - sound source localization at fast passing trains*. [online] Available at: http://webistem.com/acoustics2008/acoustics2008/cd1/data/fa2002-sevilla/forumacusticum/archivos/noi03007.pdf [Accessed 30 Apr. 2018].

Micheli, G. and Farné, S. (2016). Urban railway traffic noise: Looking for the minimum cost for the whole community. *Applied Acoustics*, [online] 113, pp.121-131. Available at: https://www.sciencedirect.com/science/article/pii/S0003682X1630175X [Accessed 1 May 2018].

Oertli, J. and Hubner, P. (2010). *Railway Noise in Europe a 2010 report on the state of the art*. Paris: UIC, p.12.

Poisson, F., Gautier, P. and Letourneaux, F. (n.d.). *Notes on Numerical Fluid Mechanics and Multidisciplinary Design Noise and Vibration Mitigation for Rail Transportation Systems*. [online] Available at: https://uic.org/cdrom/2008/11_wcrr2008/pdf/S.1.1.4.4.pdf [Accessed 30 Apr. 2018].

Scott, N. (2009). *Railway transportation*. New York: Nova Science Publishers, p.p.242.

Sheng, X., Zhong, T. and Li, Y. (2017). Vibration and sound radiation of slab high-speed railway tracks subject to a moving harmonic load. *Journal of Sound and Vibration*, [online] 395, pp.160-186. Available at: https://www.sciencedirect.com/science/article/pii/S0022460X17301189 [Accessed 1 May 2018].

Soeta, Y. and Shimokura, R. (2013). Survey of interior noise characteristics in various types of trains. *Applied Acoustics*, 74(10), pp.1160-1166.

The railways. (1995). Sheffield: Advanced Railway Research Centre, p.23.

Transport policy and the environment. (1990). Paris: Organisation for Economic Co-operation and Development, pp.120, 131.

Tuler, M. and Kaewunruen, S. (2017). Life cycle analysis of mitigation methodologies for railway rolling noise and groundbourne vibration. *Journal of Environmental Management*, [online] 191, pp.75-82. Available at: https://www.sciencedirect.com/science/article/pii/S0301479716310684 [Accessed 2 May 2018].

Uic.org. (2018). *World High Speed Rolling Stock*. [online] Available at: https://uic.org/IMG/pdf/20180401_high_speed_rolling_stock.pdf [Accessed 30 Apr. 2018].

Vos, P. (2016). *Railway Noise in Europe-State of the Art Report*. [online] Uic.org. Available at: https://uic.org/IMG/pdf/railway_noise_in_europe_2016_final.pdf [Accessed 21 May 2018].

Whitelegg, J. and Haq, G. (2003). *World Transport*. London: Earthscan Publications Ltd, p.19.

Wolf, S. (2010). *California High-Speed Train Project*. [online] Hsr.ca.gov. Available at: http://www.hsr.ca.gov/docs/programs/eir_memos/Proj_Guidelines_SoundFactSht.pdf [Accessed 30 Apr. 2018].

Worldometers.info. (2018). *Population by Country (2018) - Worldometers*. [online] Available at: http://www.worldometers.info/world-population/population-by-country/ [Accessed 30 Apr. 2018].

Zhang, J., Xiao, X., Sheng, X., Zhang, C., Wang, R. and Jin, X. (2016). SEA and contribution analysis for interior noise of a high speed train. *Applied Acoustics*, [online] 112, pp.158-170. Available at: https://www.sciencedirect.com/science/article/pii/S0003682X16301414 [Accessed 1 May 2018].

Zhang, X. (2010). The directivity of railway noise at different speeds. *Journal of Sound and Vibration*, [online] 329(25), pp.5273-5288. Available at: https://www.sciencedirect.com/science/article/pii/S0022460X10004384 [Accessed 1 May 2018].

Zhang, X. and Jonasson, H. (2006). Directivity of railway noise sources. *Journal of Sound and Vibration*, [online] 293(3-5), pp.995-1006. Available at: https://www.sciencedirect.com/science/article/pii /S0022460X05007972 [Accessed 1 May 2018].

5. Comparative Study of Leading Cruise Lines' Sustainability Practices and Environmental Stewardship in Contribution to SDGs' Sea and Water Conservation Goal

Hesam Pakbeen

ABSTRACT:
Cruise vacation is one of the fastest growing segments of tourism industry. Cruise Lines International Association (CLIA) reports that in 2017 nearly 26 million ocean cruise passengers were carried globally, which is expected to reach 27.2 million passengers in 2018. In terms of environmental impacts, however, the growth of the industry has raised increased concerns. Accordingly, environmental regulations, policies and commitments urge the cruise lines to conduct sustainability practices and report on their environmental stewardship. In contribution to UN's Sustainable Development Goals (SDGs), the cruise industry can be a significant enabler for positive impact, distinctly on environmental goals. The present paper reviews environmental stewardship and practices of the leading cruise lines in contribution to goal No.14 of SDGs, referring to "life below water". The objective of this study is to investigate how sustainability strategies and practices of leading cruise companies responded to water and sea conservation goal. The study includes an outline of cruise industry, growth and impacts following by exploratory review of sustainability and corporate responsibility reporting of major cruise lines. The findings of the research are based on evaluation and comparison of (1) practices and actions, (2) strategies and goal settings, and (3) cooperation and partnership of cruise lines, in regard with water and sea conservation goal of SDGs.

Keywords: Cruise industry, Environmental stewardship, SDGs (Sustainable Development Goals), Sea and Water conservation

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1. Cruising and Impacts

Cruise travel is one of the largest segments of tourism and hospitality industry and attracting increasing interest from holiday makers. It is also the fastest growing category of tourism industry, experiencing an average growth rate of 7.5% annually since 2008 (Cruise Market Watch, 2018a). CLIA: Cruise Lines International Association (2018a) reports over 27 million cruise passengers in 2018 are expected to travel globally that demonstrates a dramatic increase compared to 7 million passengers in 2000. CLIA's report also shows that the demand for cruising only from 2011-2016 has increased by 20.5%. Due to the steadily rising demand from travel makers, a significant number of new cruise ships are on order. In 2018 and 2019, 17 and 25 new ships will be built respectively in different shipyards. For example, Meyer Group Shipyards (including Meyer Werft yard in Germany and Meyer Turku yard in Finland) have a total number of 21 ships in their order books from 2018 to 2024.

By the rise of interest in cruising and development of the cruise travel, the impacts of the industry are growing in scale (Jones et al., 2016; Aguirre & Brida 2008). That includes economic, social and environmental impacts. In regard with economic impacts, for

example, CLIA (2017a) reports that in 2016 cruise expenditures generated nearly 126 billion USD globally and employment contribution of cruise sector expenditures accounts for over 1 million employees, which indicates 7.6% and 6.8% rise respectively, compared to 2015. As for the cruise ship building industry, the total order book value is nearly 65 billion USD from 2018 through 2027 (Cruise Industry News, 2018)

In terms of environmental impacts, however, cruising is still receiving much criticism as one of the notorious means of travel. The major part of environmental impacts of cruise ships include air pollutions and particles, sea discharges such as ballast water, grey water, swage, noise pollution and solid waste (Andersson et al., 2016).

2. Overview of Cruising Environmental Practices

In response to concerns about environment and climate, cruise industry has undertaken notable actions. IMO (2018a): International Maritime Organization, which is the United Nations specialized agency responsible also for prevention of marine pollution by ships, states that thank to the contribution of the industry, currently, the maritime industry has the least environmental impact in comparison to other means of transport. CLIA (2018b) relates environmental practices and actions of cruise lines to the success of the industry and states that in tourism sector, cruise industry is the leader of environmental stewardship. CLIA cruise line members are committed to environmental policies and practices which may exceed international regulations such as zero discharge policy for untreated sewage, implementing advanced solid waste and waste water management systems. As for future scenario of the industry, energy efficiency and sustainability will shift to the top of the design priority list. As an example, CLIA cruise line members are investing 1 billion USD in development of environmentally-friendly technologies and fuel alternatives such as LNG (Liquefied Natural Gas) that 21 new built ships from 2018-2027 will be LNG powered. In addition, in cooperation with International Maritime Organization (IMO), CLIA develops compulsory measures for lowering CO2 emissions of new built ships by 30% as of 2025 (CLIA, 2018b). Despite the promising progress of the industry in reducing environmental impacts, there is still a need for more effort to accelerate sustainability transition of the industry.

Sustainability improvements of cruise ships are mainly the result of two drivers: (1) Cruise lines' sustainability initiatives and actions, which include technological improvements, strategies and policies. For instance, Carnival Cruise Line commits to continuously improve the quality of air emissions by developing exhaust gas cleaning systems, resulting in the reduction of sulfur compounds (Carnival Corporation, 2018), and Royal Caribbean Cruises (2018) take the advantage of smart HVAC system that reduces cooling consumption by 25%; (2) Stringent regulations that are increasingly applied to cruising sector, aiming to decrease the environmental footprints of ships. For example, as of January 2019, if the new vessel does not operate an approved sewage treatment plant, discharges in the Baltic Sea will be strictly banned (IMO, 2016).

3. Cruise Industry and Sustainable Development Goals (SDGs)

The SDGs consist of 17 goals set by the UN in relation with the "2030 Agenda

for Sustainable Development". The goals include a comprehensive range of social, economic and environmental issues in regard with people, planet, prosperity, peace and partnership (UN, 2018a). UN encourages business sectors and industries to respond to SDGs by firstly conducting business responsibility and then "pursue opportunities through innovation and collaboration" (UN Global Compact, 2018). Expectedly, one of the major principles highlighted by UN for industries is environmental protection.

In the framework of tourism industry, UNWTO (world tourism organization) has demonstrated the impact of tourism collaboration in realization of the SDGs, stating that "tourism has the potential to contribute directly or indirectly to all of the goals (UNWTO, 2017). Accordingly, cruising as a large segment of tourism industry can have significant potentials of contribution in achieving SDGs. In format of a booklet (2016) International Maritime Organization (IMO) addresses the contribution possibilities of maritime and shipping industry and highlights that different sectors of maritime including cruise industry are important enablers for the majority of the SDGs. Similarly, CLIA (2017b) announces the commitment of its cruise line members to the SDGs and as an example of partnership for the SDGs, UN reports that CLIA cruise members and SPTO (South Pacific Tourism Organization) have shown common interest and commitment to promote cruise tourism in the region and improve sustainable development of the region (UN, 2018b).

In a research conducted by DNV.GL, a classification society for enabling organizations to advance their sustainability, which works directly with maritime and cruising industry, the relevance of SDGs for shipping industry is studied and concluded that the industry has a critical role to play in meeting majority of goals (DNV.GL, 2017).

In response to Sustainable Development Goals, some directly and some indirectly, many of the cruise lines updated and reported their strategies and practices. For instance, Costa Cruise Line has directly referred to SDGs in its latest sustainability report (2017), and showed the commitment of the company to contribute to SDGs. Also TUI Group announces that the company including its cruise line is recognized by RobecoSAM researcher as one of the most sustainable tourism companies with remarkable contribution to SDGs (TUI, 2018). Disney Cruise Lines underlines the importance of their role in SDGs and notes that the company uses the SDGs as a guideline to inform their sustainability policies, practices and engagement (Disney Cruise Lines, 2017). On the other hand, some companies such as AIDA Cruises and Norwegian Cruise Line indirectly refer to SDGs in their sustainability and responsibility reports (AIDA, 2017; NCLH, 2017).

3.1 Cruising and Goal 14 of the SDGs: Life Below Water

Goal 14 of the SDGs comprises "Conserve and sustainability use of the oceans, seas and marine resources for sustainable development". This goal requires the stakeholders and participants to contribute to the following targets:

1. By 2025, prevent and significantly reduce marine pollution

2. By 2020, sustainability manage and protect marine and costal ecosystems to avoid significant adverse impacts

3. Minimize the impacts of ocean acidification, including through scientific cooperation

4. By 2020, effectively regulate harvesting and end overfishing

5. By 2020, conserve at least 10% of costal and marine areas

6. By 2020, prohibit certain forms of fisheries subsidies resulting in overfishing
7. By 2030, increase the economic benefits to small island developing states and least developed countries from the sustainable use of marine resources

Expectedly, contribution of tourism industry and cruising sector, in particular, to the SDG 14 is of crucial importance. UNWTO (2017) highlights the remarkable role of responsible tourism in achieving SDG 14 and declares the targets of tourism contribution in wildlife and ecosystem protection, pollution reduction, waste treatment, offsetting actions, green purchasing, increasing awareness and community involvement. IMO also emphasizes the importance of SDG 14 and demonstrates that SDG 14 is "central to International Maritime Organization (IMO, 2018b). In regard with SDG 14, IMO specifies its responsibility for measure to improve the quality of international shipping in variety of fields such as preventing pollution from ships, protecting maritime wildlife, underwater noise reduction from ships and preventing harmful discharges from ships.

DNV.GL study (2017) clarifies the role of shipping and cruising industry in regard with SDG 14, which has a direct effect on the achievement of goal. The study indicates that the shipping industry can contribute to SDG 14 in the following ways: (1) reducing discharges to sea such as ballast water, chemicals, waste, oil and sewage; (2) setting requirements for suppliers and ship builders within ship design and construction phase; (3) reducing air emissions which results in lowering ocean acidification; (4) setting regulations on biofouling; (5) committing to maritime regulatory and implement policies and innovative practices; (6) contributing in clean-up activities in the ocean and sea; (7) sharing knowledge and data throughout their operation about water conditions; and (8) reducing disturbance of marine life in terms of noise and protecting sensitive areas. CLIA also emphasizes the impact of cruise industry specifically on SDG 14, in the areas of ballast water management as well as sewage treatment and discharge (CLIA, 2017a).

4. Method

The major objective of the present study is to investigate how cruise industry responded to SDG 14 for conserving sea and water. The study is conducted in exploratory approach and research data in is drawn from cruise lines' official websites and publications in regard with sustainability, environmental practices and corporate responsibility. The cruise lines that are chosen for this study are selected based on two factors: (1) cruise line's passenger capacity and revenue (Cruise Market Watch, 2018b); (2) Availability of updated reports on corporate responsibility, sustainability or environmental initiatives. Given that, six cruise companies namely *AIDA Cruise Line, Carnival Corporation, Cosa Cruises, Norwegian Cruise Line, Royal Caribbean Cruises and TUI Cruises,* were selected for this study. This research was conducted in June 2018 and the most recent reports and publications of the mentioned cruise companies were used as study materials. This study does not try to measure companies' initiatives for SDG 14, but merely to explore the available data communicated by cruise lines. Moreover, this research is based on selected information provided by cruise companies, thus the author does not have any responsibility in conducting fact-check and investigating the transparency of claimed data. Said that, this research seeks to address how cruise companies' respond to SDG 14 and communicate their initiatives with public.

To explore the response of cruise lines to SDG 14, this paper refers to the following

targets of SDG 14 as DNV.GL (2017) suggests:
14.1. By 2025, prevent and significantly reduce marine pollution
14.2. By 2020, sustainability manage and protect marine and costal ecosystems to avoid significant adverse impacts
14.3. Minimize the impacts of ocean acidification, including through scientific cooperation
As DNV.GL study shows, the industry can have direct effect on these three targets which indicates the relevance of the targets to environmental initiatives and stewardships of cruise industry.
However, reviewing sustainability reports of cruise lines indicates that a large number of sustainability initiatives and practices of cruise companies can fit in more than one of the above mentioned targets. For example, waste water treatment initiatives reduce not only marine pollution (target 14.1) but also decreases the adverse impacts on marine ecosystem (target 14.2). For this reason, this paper does not categorize the sustainability practices of cruise lines into distinct three targets but chooses them according to the relevance of the practices and initiatives to SDG 14 targets. The author is aware of the limitations in the study and does not try to provide a detailed comparative analysis of sustainability practices of cruise lines. On the contrary, the paper is merely a preliminary attempt to review and compare the overall sustainability initiatives of cruise industry in response to SDG 14.

5. Findings and Discussion

Reviewing the sustainability and responsibility reports of selected cruise lines shows significant similarities in the approach of companies towards SDG 14 that can be divided into the followings:
(1) Energy efficiency, fuel and emission management (relevant to targets 14.1, 14.2, 14.3 for the direct effect on sea and ocean acidification);
(2) Water and wastewater management (relevant to targets 14.1, 14.2);
(3) Waste management (relevant to targets 14.1, 14.2);
(4) Biodiversity and ecosystem protection (mainly relevant to target 14.2).
Each of the mentioned initiatives is considered by leading cruise companies in variety of levels.
1- Energy efficiency, fuel and emission management:
In response to this category, selected cruise lines offer and report variety of initiatives and practices. AIDA emphasizes its commitment to reduce the energy consumption as well as CO2 emissions through different technologies such as use of dual fuel engines, heat recovery systems and energy consumption tracking and monitoring systems. AIDA Cruise Line announces to introduce the first and the second cruise ships in the world capable of using solely LNG (Liquefied Natural Gas) which is known to be an efficient source of power. In addition, the company is determined to develop cold ironing as well as studies on the use of fuel cells onboard for new ships. The latest report of AIDA, called AIDA Cares 2017 indicates that the company has been successful in achieving desired targets in reducing CO2 emissions and energy consumption, compared to previous years. Carnival Cruise Lines, which hold AIDA brand under its corporation, similarly reports the use of LNG as a remarkably successful initiate in energy efficiency, which results in the reduction of sulfur emission to 0, carbon emission reduction by 25%

and nitrogen oxides reduction by 85%. The company reports its attempt to deliver considerably more energy efficient new ships by optimized hull design, waste-heat use system and use of energy efficient equipment onboard. Carnival also reports that 40% of their vessels are equipped with cold ironing capabilities and nearly 60% of the ships are equipped with Exhaust Gas Cleaning Systems. The company also states its commitment to decrease intensity of CO2e (equivalent carbon dioxide) emission from operation by 25% by 2020, compared to 2005. Costa Cruise Line also belongs to Carnival Corporation, which in turn follows the major initiatives of the company. Costa reports its gradual transition from conventional fuels to LNG powered ones, implementing Exhaust Gas Cleaning systems, use of low sulfur fuels in emission control areas, installation of waste-heat recovery systems and use of automatic lighting control system. It is worth mentioning that Costa report is designed based on SDGs and the framework of the report is written in response to SDGs.

Norwegian Cruise Line stewardship shows the company's effort in energy and consumption efficiency in different ways such as biofouling management to improve hydrodynamics efficiency and lowering the consumption, energy efficiency data collection onboard to track the efficiency, lighting upgrade, use of new paint system for low friction coating, waste-heat recovery and exhaust gas cleaning system on a number of ships. Norwegian to the best of my knowledge, however, did not report initiatives towards alternative fuels such as LNG.

Royal Caribbean Line states the strategy of the company towards future generation of cruises which will be considerably more energy efficient through using technologies in LNG, fuel cells, use of air lubrication system that coats the underside of ship and reduces the friction, and advanced emission purification systems (exhaust scrubbers). The company also reports the use of smart HVAC (heating, ventilation and air conditioning) system which reduces cooling by 25%. In terms of high-tech energy solutions, Royal Caribbean uses advanced energy management software which identifies ships' optimal balance, speed, route and the number of engines must be used including their settings.

TUI group published its sustainability report not only about TUI cruises but also other services of the company such as aviation and land trips. Nevertheless, the report is mainly based on SDGs and shows company's commitment, policy and practices towards achieving sustainable development goals. TUI's sustainability report 2017 indicates that the cruise sector of the company achieved 1.5% more carbon efficiency improvements compared to 2015. TUI new built cruises combine different technologies such as smart energy management system, efficient air conditioning, lighting controls and use of engine waste heat to save fuel. TUI ships also use scrubber technology to treat exhaust fumes which results in nearly 99% lower sulfur emission in new-built ships. As the report states, TUI cruises minimized sulfur intensity by nearly 22% in comparison to 2016.

2- Water and wastewater management:

Sustainability initiatives and practices of cruise lines in regard with water conservation and wastewater treatment showed notable similarity. All the selected cruise lines emphasized their approaches for the following practices: *(a) Reducing water consumption onboard,* for example Carnival encourages guests to reuse towels and uses low flow showers in cabins. Royal Caribbean uses special ice makers which consumes 65% less water than previous ones and also re-uses clean condensate water from ship's air conditioning units in laundry areas. Onboard production of clean water from sea water is one of the main practices of

all the cruise lines in different scales and methods; *(b) Waste water (grey water, black water and water from food waste) treatment,* for example AIDA underlines the use of AWWPS (Advanced Waste Water Purification Systems) which produces "almost drinking water" quality. Costa also shows its improvement in wastewater in the report for a period of two years since 2014. The overview of the research in this area shows that all of the cruise lines meet or exceeds the requirements of water conservation and wastewater treatment. *(c) Bilge water (wastewater collected in machinery and engine spaces) treatment,* in a similar approach, all of the cruise lines are equipped with devices which analyses and separates the bilge water from any potential oil. The device automatically stops the discharge in the analysis does not meet the measures. *(d) Ballast water (sea water brought to ship to help stabilization) treatment,* cruise lines report their commitment to IMO Ballast Water Convention. Royal Caribbean as an example states that one of its vessels called Quantum of Seas was equipped with ballast water treatment system before the declaration of international requirements. Norwegian reports that all its new ships built as of 2013 were equipped with ballast water treatment system. All in all, due to the IMO regulation, all of the cruise lines are required to follow and implement the system accordingly.

3- Waste mitigation and management:

Despite the fact that all the cruise lines have their own way to handle waste generated onboard, the relevant part of waste management initiatives to SDG 14, include the ones which minimize waste discharges to water. In this particular topic, the selected cruise lines follow almost the same approach which includes separation of solid waste to be landed ashore, strategies to separate the waste onboard, and minimizing food waste. Donation is also a part of the policy of some cruise lines such as Royal Caribbean and Norwegian. AIDA as well as Carnival explain that according to regulations food waste is compressed and drained and as the by-product of the system is biologically degradable substance, will be partially delivered to certified disposal organizations and those food waste smaller than 25mm are permitted to be discharged in the sea if outside the 12 mile-zone. Regarding waste regulations, cruise lines must follow the international MAPROL Convention which prevents pollution from ships. It should be emphasized that the present study does not confirm or deny the action of cruise lines as it is entirely depends on the transparency of the claims and actions of companies.

4- Biodiversity and ecosystem protection:

In this field cruise lines have conducted a large variety of initiatives in two categories. Firstly, they endeavor to participate in research projects, sustainability-related actions and communities, and biodiversity conservation practices. Secondly, cruise companies report their practices and plans towards saving the marine ecosystem as well as reducing the impacts on the wildlife and life under water. AIDA, for example, is a member of Futouris e.V. sustainability program, focusing on welfare of animals. The cruise line also increase awareness of sea life for passengers in different ways. In addition, AIDA tries to lower the fouling with underwater coating as well as regular hull cleaning to prevent foreign organisms to enter the sea. Carnival Corporation also reports its close cooperation with many research centers working on maritime ecosystems such as The Nature ConserVancy. Additionally, Carnival introduces and promotes its TravlDeep brand, Fathom (Responsible Cruising) as of 2016 that gives the guests the opportunity to be involved in local projects and cooperate with communities. Costa cruise has an agreement with CNR (Italian National Research Council) for long-term collaboration in the field of

oceanography and marine science. In addition, Costa announces that one of its top priorities in regard with marine conservation is to protect the environment of Giglio Island in Italy in which a number of research organizations and academic centers are involved. As for Royal Caribbean initiatives, the cruise line provides a close collaboration with University of Miami's Rosenstiel School of Marine and Atmospheric Science, in order to operate labs onboard for ocean and climate related researches. To support the marine ecosystem, this cruise company contributed in a project with World Wildlife Fund (WWF) to increase awareness about shark and ray tourism. Norwegian Cruise Line, is also considerably active in conducting partnership with research and conservation programs for marine ecosystem. As an example, the company has developed policies to reduce the impact of operation on marine mammals (whales) through lowering the speed, keeping safe distance from them, training crews for sighting the whales and identifying the mammals. Norwegian, also, conduct cleanup activities while docking in selected ports to collect plastic waste from sea. As previously mentioned, the selected cruise lines have significant roles in ecosystem conservation projects as well as research projects, of which this paper named some of them.

6. Conclusion

The present exploratory study set out to determine sustainability initiatives and practices of major cruise lines in response to SDG 14, "life below water". As discussed, SDG 14 was underlined by different organizations related to maritime industry, as one of the main goal of SDGs on which cruise industry can have a significant impact. In this study we chose targets 14.1, 14.2 and 14.3 of SDG 14 due to the impact of cruising on them.

In the study, 6 cruise companies were selected and their latest sustainability, responsibility or stewardship reports were reviewed. The results of the study showed that all of the cruise lines (directly or indirectly) set their sustainability reports in response to UN's SDGs, and one of the most highlighted part of their report consisted of water, sea and ocean conservation. As reported the major initiatives of cruise lines in response to SDG 14 was focused on four topics including energy and fuel efficiency, water and wastewater treatment, waste management, and conservation of ecosystem. In regard with the first practice, cruise lines have taken considerable initiatives and actions to reduce the energy consumption and utilize alternative fuels and power sources. However, the majority of innovations and practices are implemented on newly-built ships while these technologies are not utilized on a considerable number of previously-built vessels on operation. Concerning water and wastewater treatment, cruise companies have conducted similar actions, for example, the use of wastewater treatment technologies, lowering water consumption and treating bilge water. In this particular topic, regulations and rules urge the cruise industry to conduct necessary practices which may explain the similarity of the practices done by companies. Also, in terms of waste management strategies and practices, cruising industry must be committed to certain regulations for waste handling to ashore and discharges to water. Reviewing the cruise lines' initiatives, the author suggests that despite the effort of the industry in waste management, there is still need for improvements in the following two: (1) regulations concerning waste handling and discharges to water; (2) providing more transparency from cruise lines in terms of

promoting their effort and actions.

Partnership with research and ecosystem conservation projects was one of the highlighted initiatives of all the selected cruise lines. The efforts range from cooperation with individual researchers and collaboration with research projects, to cleanup and conservation of maritime ecosystem of a selected area. The present study suggests that sustainability-related efforts of selected cruise lines in this topic include variety of practices and initiatives. Taken together, the exploratory study of selected cruise lines indicates that the industry has responded to SDG 14 positively and conducted variety of practices and initiatives. Despite the exploratory nature, the author believes this study offers some insights into sustainability improvements of cruise industry in response to SDGs. Although the current study does not offer practical suggestions to improve cruise lines' practices in regard with SDG 14, it can provide an overview of the current situation of the industry and suggests that further researches can evaluate and compare the actual impact of the initiatives of each cruise line in terms of water and sea conservation.

References

Aguirre, S.Z., and Brida, J.G. (2008). *The Impacts of the Cruise Industry on Tourism Destinations, Sustainable tourism as a factor of local development*, Monza, Italy 7-9/11-2008

AIDA Cruise Line. (2017). *AIDA Cares 2017: Sustainability report.* Retrieved from: https://media.aida.de/fileadmin/user_upload/v4/Unternehmen/Nachhaltigkeit/Tabellen/2017/AIDAcares_2017_-_EN_-_komprimiert.pdf

Andersson, K., Brynolf, S., Lindgren, J.F., and Wilewska-Bien, M. (eds.). (2016). *Shipping and the environment.* Berlin: Springer

Carnival Corporation. (2018). *Sustainability from ship to shore*. Retrieved from: http://carnivalsustainability.com/

CLIA. (2017a). *The contribution of the international cruise industry to the global economy in 2016*. Retrieved from: https://cruising.org/docs/default-source/research/global_economic_contribution_2016.pdf?sfvrsn=2

CLIA. (2017b). *Cruise industry committed to United Nations' sustainable development goals*. Retrieved from: https://globenewswire.com/news-release/2017/10/24/1152502/0/en/Cruise-Industry-Committed-to-United-Nations-Sustainable-Development-Goals.html

CLIA. (2018a). Cruise industry outlook. Retrieved from: https://cruising.org/docs/default-source/research/clia-2018-state-of-the-industry.pdf?sfvrsn=2

CLIA. (2018b). *Environmental sustainability report*. Retrieved from: https://www.cruising.org/about-the-industry/press-room/press-releases/clia-releases-environmental-sustainability-report

Costa Cruise Line. (2017). *On course for the future: Sustainability report 2016 results and and outlook*. Retrieved from: https://web.costacrociere.it/B2C/GuidelinesV5/sostenibilita/pdf/Costa_BdS_ENG_03.pdf

Cruise industry news. (2017). *New cruise ship orderbook now 106 ships going 2027*. Retrieved from: https://www.cruiseindustrynews.com/cruise-news/18668-new-cruise-ship-orderbook-now-106-ships-going-to-2027.html

Cruise Market Watch. (2018a). *Growth of the ocean cruise line industry*. Retrieved from: https://www.cruisemarketwatch.com/growth/

Cruise market watch. (2018b). *World cruise line passenger capacity*. Retrieved from: https://www.cruisemarketwatch.com/capacity/

Disney Cruise Lines. (2017). *Corporate social responsibility update.* Retrieved from: https://www.thewaltdisneycompany.com/wp-content/uploads/2017disneycsrupdate.pdf

DNVGL. (2017). *Sustainable development goals: exploring maritime opportunities.* Retrieved from: https://www.rederi.no/globalassets/dokumenter-en/all/fagomrader/smi/dnv-gl-sdg-maritime-report.pdf

IMO. (2016). *Annex10, resolution MPEC.275(69).* Retrieved from: http://www.imo.org/en/KnowledgeCentre/IndexofIMOResolutions/Marine-Environment-Protection-Committee-%28MEPC%29/Documents/MEPC.275%2869%29.pdf

IMO. (2016). *IMO and sustainable development*: *How international shipping and the maritime community contribute to sustainable development* . Retrieved from: http://www.imo.org/en/MediaCentre/HotTopics/Documents/IMO%20SDG%20Brochure.pdf

IMO. (2018a) , *Marine environment*. Retrieved from: http://www.imo.org/en/OurWork/Environment/Pages/Default.aspx

IMO. (2018b). *IMO and Sustainable development goals*. *Retrieved from:* http://www.imo.org/en/MediaCentre/HotTopics/Pages/SustainableDevelopmentGoals.aspx#number14

Jones, P., Hillier, D., and Comfort, D. (2016). *The Environmental, Social and Economic Impacts of Cruising and Corporate Sustainability Strategies. Athens Journal of Tourism*. 3(4). 273-285

NCLH: Norwegian Cruise Line Holdings LTD. (2017). *Stewardship report*. Retrieved from: http://files.shareholder.com/downloads/ABEA-5WOY6H/4353190173x0x938799/EE369DF0-9BDD-482E-BBD5-5002D5E0CACE/Final_Environmental_Report_for_Distribution_4.24.2017.pdf

Royal Caribbean. (2018). *The commitment to oceans*. Retrieved from: http://sustainability.rclcorporate.com/

TUI Group. (2018). *Recognition for TUI group's sustainability strategy*. Retrieved from: https://www.tuigroup.com/en-en/media/stories/2018/2018-02-06-recognition-for-tui-groups-sustainability-strategy

UN Global Compact. (2018). *Global goals for people and planet*. Retrieved from: https://www.unglobalcompact.org/sdgs/about

UN: United Nations. (2018a). *Transforming our world*. Retrieved from: https://sustainabledevelopment.un.org/post2015/transformingourworld

UN: United Nations. (2018b), *Cruise tourism development*. Retrieved from: https://sustainabledevelopment.un.org/partnership/?p=7708

UNWTO. (2017). *Tourism and the Sustainable Development Goals*: *Journey to 2030, Highlights,* UNWTO, Madrid. DOI: 10.18111/9789284419340

6. Modeling Multiple Interacting Nutrient Stocks: Application to the Baltic Sea

Dr. Natalia Kuosmanen, Dr. Timo Kuosmanen

ABSTRACT:
Eutrophication of water bodies is a worldwide ecological problem caused by excessive amounts of nutrients. This paper develops an accounting method for modeling multiple interacting stocks of nutrients, which applies the dynamic nutrient balance approach to calculate empirical nutrient budgets. The proposed model of multiple interacting stocks draws an explicit connection between nutrient stocks on land and nutrient stocks in the sea, which in turn links estimated marine nutrient stocks with the empirical data of nutrient concentrations. The model is applied to the Baltic Sea, where stocks of nitrogen and phosphorus are calculated for six basins, drawing distinction between surface, middle and deep water layers of the basins, and taking into account spatial interactions of nutrients within the water layers and between the basins. The model is calibrated using empirical data on nutrient loads and concentrations. Finally, we apply the model to forecast future development of nitrogen and phosphorus concentrations under different abatement scenarios.

Keywords: Dynamic Nutrient Model; Multiple Interacting Stocks; Nitrogen; Phosphorus; Eutrophication; Baltic Sea

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1. Introduction

Eutrophication of water bodies such as sea coasts, lakes, and rivers is a worldwide environmental problem (e.g., Ryther and Dunstan, 1971; Vollenweider, 1971). The Baltic Sea is particularly vulnerable to eutrophication due to its delicate mixture of salt water from the North East Atlantic and fresh water from surrounding rivers and streams, which gives rise to a highly sensitive and interdependent marine ecosystem with unique flora and fauna (see, e.g., Voipio, 1981; Larsson *et al.*, 1985; Wulff *et al.*, 2001a). The enrichment of seawaters with nutrients leads to an accelerated growth of algae and higher forms of plant life. The two essential nutrients causing eutrophication of the Baltic Sea are compounds of nitrogen and phosphorus. Nitrogen occurs in various forms including nitrate, ammonium, and bioavailable organic nitrogen, and phosphorus is in the form of phosphate and bioavailable organic phosphorus.

Management of the Baltic Sea eutrophication is challenging due to complexity of the ecological system, involvement of multiple actors in the nutrient abatement efforts, as well as societal differences of countries in the region (e.g., HELCOM 2009, 2014, 2017). The first step towards addressing the problem is to understand the dynamics of the nutrient flows and stocks. There is a large and growing literature on eutrophication of the

Baltic Sea, which can be divided into three broad streams: 1) direct measurement, 2) simulation models, and 3) empirical nutrient budgets.

The first stream of literature relies on *direct measurement* of nutrient loads and concentrations, qualitative and quantitative indicators of eutrophication, as well as metrics that combine those indicators (e.g., HELCOM 2006, 2009, 2015; Andersen *et al.*, 2006, 2011, 2017; Ærtebjerg *et al.*, 2003). The standard approach to estimate amounts of nutrients in the Baltic Sea is to measure concentrations of nitrogen and phosphorus compounds from samples of seawater collected at different measuring stations during the winter season. Other commonly used indicators include chemical and biological measurements of water quality, such as water transparency, chlorophyll *a* concentrations, phytoplankton and oxygen concentration, among others. The HELCOM Eutrophication Assessment Tool (HEAT) is an example of a multi-metric indicator-based approach specifically developed to assess the eutrophication status in coastal as well as open see waters of the Baltic Sea (Andersen *et al.*, 2011; HELCOM, 2014).

While direct measurement is clearly important, there are several challenges worth noting. The measured nutrient concentrations are known to be sensitive to the season, water depth, and distance to the coast (e.g., Rahm and Danielsson, 2007). This is also evident from empirical data that has large temporal and spatial fluctuations and wide confidence intervals (e.g., HELCOM, 2009; Wasmund *et al.*, 2001; Hänninen and Vuorinen, 2015). The eutrophying nutrients are available in various chemical compounds that occur in relatively low concentrations (between 5 to 40 micromoles per liter), and are not uniformly mixed in the seawater. Further, the reported measurements of nutrient concentrations are usually from the water samples taken at the depth of 0–10 meters in the surface water layer. It is more difficult to measure nutrient concentrations in middle and deep water layers.

To address the difficulties in the direct measurement, the second stream of literature builds elaborate micro-level simulation models in order to analyze the ecological status of the Baltic Sea (e.g., Eilola *et al.*, 2009, 2011; Savchuk and Wulff, 2007, 2009; Gustafsson *et al.*, 2012; Savchuk *et al.*, 2012). The simulation models are also used as a tool to evaluate possible management options for reducing eutrophication (e.g., Ahlvik and Pavlova, 2013; Ahlvik *et al.*, 2014; Ahlvik and Iho, 2016; Iho *et al.*, 2017). The complexity of the ecological system makes detailed micro level modeling a challenging task, requiring the use of relatively large numbers of parameters and assumptions. High resolution simulation models that combine hydrogeological and biochemical information (see, e.g., Savchuk *et al.*, 2012) are also computationally intensive. Savchuk *et al.* (2012) note that "*with such models a simulation of the entire Baltic Sea over several decades still requires many days of computation even at supercomputer centers, which greatly hinders numerical experimentation needed for both model calibration and sensitivity analysis, including scenario responses*."

To balance the advantages and disadvantages of direct measurements versus high resolution computer simulations, the third approach applies relatively simple macro-level models calibrated to match the data from direct measurements to calculate empirical nutrient budgets. Wulff *et al.* (2001b), Savchuk (2005), and Savchuk and Wulff (2007) were among the first to evaluate the nitrogen and phosphorus budgets in different basins of the Baltic Sea and investigate their dependence on the nutrient inputs. These studies aptly reveal the high interconnectivity of the Baltic Sea basins as well as the slow and relatively weak responses of the Baltic Sea trophic state to reductions of the nutrient

loads. Savchuk (2005) aptly summarizes the advantages of this approach as follows: "*the empirical budgets, based on actual measurement, will remain a powerful tool both to derive overall system properties from the data and to verify theoretical budgets constructed from simulations*." However, the empirical nutrient budgets published thus far build upon the general mass balance model assuming a linear system at a steady state. The model focuses on the nutrient flows, but ignores the accumulation of nutrient stocks over time. Thus, these models cannot forecast the dynamics of the nutrient stocks and concentrations, or how the effects would be distributed over time in the interconnected basins (Savchuk, 2005).

This paper proposes an alternative approach to calculate the empirical nutrient budgets based on the dynamic nutrient balance approach developed in Kuosmanen and Kuosmanen (2013). Making use of the country level nitrogen and phosphorus stocks in agricultural land (Kuosmanen, 2014), we model the flow of nutrients to six basins of the Baltic Sea: Baltic Proper, Gulf of Finland, Gulf of Riga, Bothnian Sea, Bothnian Bay, Danish Straits and Kattegat. Drawing a distinction between surface, middle, and bottom-water layers, we account for nutrient accumulation in each basin and compartment using the dynamic nutrient balance model with multiple stocks. Following Håkanson and Bryhn (2008), we utilize data of water fluxes between the basins to model the interactions of nutrient stocks between and within the basins by separating compartments of each basin into different water layers.

We believe the dynamic nutrient balance approach can offer insights and information beyond the direct measurements, micro-level simulation models, and empirical nutrient budgets. Firstly, the dynamic nutrient balance accounting of interacting stocks builds a natural connection between nutrient stocks on the land and nutrient stocks in the sea via nutrient run-offs from agricultural land. Secondly, this approach provides a dynamic framework for analyzing the development of nutrient stocks in different basins and different water layers over time. The dynamic model can also be used for forecasting the development of nutrient stocks over time under alternative policy scenarios. Thirdly, data from direct measurements can be used for calibrating the model parameters in the dynamic material balance model, which allows us to compare and contrast the empirical evidence from the direct measurements, simulations as well as nutrient budget approaches. Therefore, we see the dynamic nutrient balance approach considered in this paper not as a competitor but as a complement to the existing toolbox.

The rest of the paper is organized as follows. Section 2 presents the theoretical framework for the dynamic model of multiple interacting nutrient stocks. Section 3 describes the empirical application to the Baltic Sea and its basins and compartments. Section 4 presents the results and insights gained through the dynamic nutrient balance approach. Section 5 applies the dynamic nutrient balance model to forecast the development of nutrient stocks under alternative policy scenarios. Section 6 summarizes our findings and draws the concluding remarks. More detailed results for each basin and compartment of the Baltic Sea are provided in Appendices 1 and 2 (available as online supplement).

2. Modeling Nutrient Stocks

2.1 Modeling Multiple Nutrient Stocks with Interactions

Nitrogen and phosphorus can be naturally found as compounds in various forms

in the seawater. Regardless of the chemical form, nutrients such as nitrogen and phosphorus exist in the sea at any given point of time, forming the total nutrient stock. Nitrogen and phosphorus can cycle within aquatic community by changing its molecular form by being locked in biomass, for example, when aquatic plants or fish obtain these nutrients from the sediment and seawaters, and then again release these elements.

This section introduces a simple discrete time model for multiple interacting stocks based on the dynamic nutrient balance approach (Kuosmanen and Kuosmanen, 2013). Similar to empirical nutrient budget studies (e.g., Savchuk, 2005; Savchuk and Wulff, 2007), the sea is divided into homogenous basins and compartments, which refer to a water layer in a basin of the sea (e.g., deep, middle and surface water layers). The basins and the compartments of the Baltic Sea will be introduced and discussed in more detail in Section 3.

The compartments are indexed as $i = 1,\ldots, K$ and the time periods as $t = 1,\ldots,T$. The stock of nutrient in compartment i period t is denoted by Z_{it}. The stock is governed by the following discrete time dynamic nutrient balance equation:

$$Z_{it} = (1-\delta_i)Z_{i,t-1} - \sum_{\substack{j=1 \\ j\neq i}}^{K} \rho_{ij} Z_{i,t-1} + \sum_{\substack{j=1 \\ j\neq i}}^{K} \rho_{ji} Z_{j,t-1} + z_{it} \quad (1)$$

In equation (1), parameter δ_i represents decay of the stock, which occurs through various ecological processes such as sedimentation and air-sea gas exchange. Parameters ρ_{ij} are the interaction terms that indicate the proportion of the nutrient stock in compartment i that flows into compartment j through water circulation and settling of nutrients from the surface towards the bottom compartments. The last parameter z_{it} indicates the net inflow of nutrient in compartment i. In the context of the Baltic Sea, the major nutrient inflows include losses of nutrients from diffuse sources, such as nitrogen and phosphorus run-offs from agricultural land; nutrient discharges from point sources, such as waste water treatment plants and industries; and atmospheric deposition of nitrogen and phosphorus to surface waters caused by air pollution.

Equation (1) is more elegantly restated using the notation of matrix algebra. Let vector $\mathbf{Z}_t = (Z_{1t}, Z_{2t}, ..., Z_{Kt})$ denote the stocks of nutrients in all compartments in period t, and similarly, denote the net inflows of nutrients to all compartments by vector $\mathbf{z}_t = (z_{1t}, z_{2t}, ..., z_{Kt})$. Using this notation, the dynamic discrete-time model of K interacting stocks can be stated as

$$\mathbf{Z}_t = \mathbf{\Delta}\mathbf{Z}_{t-1} + \mathbf{z}_t, \quad (2)$$

where the square matrix $\mathbf{\Delta}$ contains the model parameters:

$$\mathbf{\Delta} = \begin{pmatrix} 1-\delta_1 & \rho_{12} & \cdots & \rho_{1K} \\ \rho_{21} & 1-\delta_2 & \cdots & \rho_{2K} \\ \vdots & \vdots & \ddots & \vdots \\ \rho_{K1} & \rho_{K2} & \cdots & 1-\delta_K \end{pmatrix}. \quad (3)$$

Parameters δ_i in the diagonal of $\mathbf{\Delta}$ are the decay rates of stocks $i = 1,\ldots, K$. The off-diagonal elements ρ_{ji} determine the interactions between the stocks, as discussed above. Note that in general $\rho_{ji} \neq \rho_{ij}$, and therefore, matrix $\mathbf{\Delta}$ is generally not symmetric.

To calculate the nutrient stocks in period t using equation (2), the following information

is needed: 1) the parameter values to construct matrix $\mathbf{\Delta}$, 2) data of nutrient inflows $\mathbf{z}_t$, and 3) the starting values of the stocks $\mathbf{z}_0$ in period 0. We discuss in detail how the model can be calibrated and applied to the case of the nitrogen and phosphorus stocks in the Baltic Sea in the next section.

Equation (3) implicitly assumes that the elements of matrix $\mathbf{\Delta}$ are constant over time, but differ across compartments. The interaction parameters ρ_{ij} are the key drivers of the model. It seems natural to assume that a constant proportion of a nutrient stock is exchange with the neighboring stocks through water cycle and settling processes. The fact that the decay rates δ_i can differ across compartments allows us to model nonlinearities in the decay function (for example, Ahlvik *et al.*, 2014, assume quadratic decay functions for nitrogen and phosphorus) as well as interdependence between nitrogen and phosphorus decay functions (cf. e.g., Boeykens et al., 2017). Since the stocks of nutrients are relatively stable over time, for analytical convenience, we assume that the decay rates δ_i are approximately constant over time. Note that the volume of decay does adjust to possible changes in the stocks of nutrients over time. Moreover, note that the assumption of constant $\mathbf{\Delta}$ over time can be easily relaxed by introducing parameters $\mathbf{\Delta}_t$, $t = 1,\ldots,T$, that change over time, but in that case, one would need to make additional assumptions to be able to estimate the parameter values from empirical data (there is no free lunch).

In the present context, we see the simplicity and the minimal information needs as advantages of the proposed dynamic material balance framework. The development of the nutrient stock can be calculated without a need to resort to optimization, estimation or simulation. The parameter values in matrix $\mathbf{\Delta}$ can be calibrated to match the available empirical data from direct measurements. The nutrient inflows $\mathbf{z}_t$ can also be based on the direct measurements, or outflows from the land-based nutrient stocks as in this study. Finally, the starting values $\mathbf{z}_0$ can be estimated using the perpetual inventory method, as described in Kuosmanen and Kuosmanen (2013). The stock equations are based on a simple accounting identity, and hence do not assume the system to be in a steady-state equilibrium, in contrast to Savchuk (2005) and Savchuk and Wulff (2007). Finally, the dynamic material balance can also be used for forecasting the development of nutrient stocks and concentrations in the future based on some plausible scenarios concerning the development of nutrient inflows $\mathbf{z}_t$, for example, under alternative policy scenarios for nutrient abatement.

2.2 Linking Nutrient Stocks to Concentrations and Flows

The long term average concentration of nutrients in the seawater can be derived from the estimated nutrient stock as:

$$C_{it} = Z_{it} / V_i \quad (4)$$

where C_{it} is the average concentration of nutrient in compartment i in period t (μmol per liter), Z_{it} is the total stock of nutrient in compartment i in period t (tons), and V_i is the total volume of water in compartment i (taken here as a time-invariant constant).

Equation (4) shows that, on average in the long run, the direct measurement of concentrations in water samples, averaged over large number of samples collected over time, must yield exactly the same result as the nutrient stock accounted at the macro level, divided by the water volume to obtain the average concentration. In the empirical

application of this study (Section 4), we make use of this this mathematical fact to calibrate the parameter matrix $\mathbf{\Delta}$ such that the average surface concentrations of nutrients reported by HELCOM (2009) match as closely as possible with the concentrations derived from the estimated nutrient stocks obtained by the multiple interacting nutrient stocks model.

The dynamic nutrient balance model also helps to clarify the association between nutrient loads and concentrations. Clearly, the nutrient flow z_{it} in compartment i during period t does indeed affect the concentration C_{it}. Specifically, combining equations (1) and (4), we find that the marginal effect of the nutrient input z_{it} is

$$dC_{it}/dz_{it} = (1/V_i) \cdot dZ_{it}/dz_{it} = 1/V_i \quad (5)$$

Equation (5) shows that the marginal effect of the input z_{it} is positive, but extremely small because the volume of the basin V_i is generally very large.

Several empirical studies apply correlation and regression analysis to examine the statistical association of nutrient inputs and nutrient concentrations using time series data (see, e.g., HELCOM, 2009; Box 1, p. 21). If one regresses time series of nutrient concentrations C_{it} on inflows z_{it} using linear regression and data from the Baltic Sea, one will find a good empirical fit and much larger coefficients than $1/V_i$. For example, HELCOM (2009; Box 1, p. 21) report the coefficients of determination (R^2) as high as 0.63 for the dissolved inorganic nitrogen (DIN) concentration and 0.55 for the total nitrogen (TN) concentration in the open waters in the Kattegat and Danish Straits. We suspect that such high empirical correlation between the nutrient load and concentration is likely due to the fact that the time series of nutrient concentrations C_{it} and net inflows of nutrients z_{it} both have a decreasing trend over time, and the linear regression simply captures that time trend. Such a misleading statistical association is known as "*spurious regression*" in econometrics (e.g. Granger and Newbold, 1974, 1977; Phillips, 1986), and it is a common problem in time series data.

It is worth to emphasize that the problem of spurious regression in time series data of nutrient loads and concentrations is not only of concern in empirical studies; the calibration of parameters in simulation models is often based on regression analysis (e.g., Ahlvik *et al.*, 2014). We hope that the explicit links between the stocks, flows and concentrations established in equations (1) – (5) and drawing attention to the problem of spurious regression might help to reduce the temptation to just casually regress time series data on nutrients without careful attention to modeling the time trends. As noted above, the dynamic nutrient balance approach considered in this paper avoids this problem as the parameter values $\mathbf{\Delta}$ are calibrated based on estimates of water exchanges between basins and compartments such that the nutrient stocks correspond to the average nutrient concentrations observed in direct measurements from water samples through equation (4).

3. Modeling Nutrient Stock in the Baltic Sea

3.1 Study Area

In order to model interacting stocks of nitrogen and phosphorus in the Baltic Sea, we first divide the water area into the following basins: Baltic Proper (BP), Gulf of Finland (GF), Gulf of Riga (GR), Bothnian Sea (BS), Bothnian Bay (BB), and Danish Straits and Kattegat (DS+KT), as shown in Figure 1. We then follow the studies by

Savchuk (2005), Håkanson and Lindgren (2010) and subdivide the basins into three compartments: the *surface-water layer* (SW), *middle-water layer* (MW) and *deep-water layer* (DW). The compartments' physical characteristics including depths of the basins and the surface area are presented in Table 1.

Figure 1. *Basins and catchment areas of the Baltic Sea (the Sound and the Danish Belt Sea are included as the southern part of the Kattegat catchment area). Source: Larsen (2008).*

As can be seen from Table 1, the basins of the Baltic Sea differ substantially in their physical characteristics, such as size, volume and depth. The water volumes are reported at the basin level; the water volumes of the compartments were estimated based on the surface area, the depth levels, and the bottom topography maps of the Baltic Sea and its basins. In this study, the Baltic Proper and the Gulf of Finland include three compartments: surface, middle and deep water layers; the Bothnian Sea, the Bothnian Bay and the Gulf of Riga include surface and deep water layers; and the Danish Straits plus Kattegat include only one compartment – the surface water layer. The surface water layer is considered to be up to 44 meters deep, the middle water layer is between 44 and 75 meters (except for the Bothnian Sea), and the deep water layer takes up to 105 meters for the Gulf of Finland and 459 for the Baltic Proper. Regarding the Bothnian Sea, even though its depth is 301 meters, we prefer to model it as a basin with two compartments – the surface and deep water layers in line with the calculations of water exchange between the basins as in the study of Håkanson and Lindgren (2010).

Table 2 reports the values of the parameter matrix $\boldsymbol{\Delta}$ used in this study. The decay rates δ_i were calibrated to match the direct measurements of nutrient concentrations reported by Helsinki Commission (HELCOM).[2] We set the decay rate of nitrogen as 3 % for all basins and compartments. The decay rate of phosphorus is set at 0.1 % for all basins and compartments, except for the Gulf of Riga and Bothnian Bay. Note that the decay rates

[2] HELCOM: http://www.helcom.fi/helcom-at-work/projects/completed-projects/plc-5-5/

are small in comparison to interactions with other compartments through water exchange.

Table 1. Physical characteristics of the basins.

Basin – Compartment	Abbreviation	Area, km²	Volume, km³	Depth, m
Baltic Proper – Surface Water	BP_SW	211 069	8 622	0 – 43
Baltic Proper – Middle Water	BP_MW	–	3 622	43 – 75
Baltic Proper – Deep Water	BP_DW	–	801	75 – 459
Gulf of Finland – Surface Water	GF_SW	29 600	823	0 – 43.8
Gulf of Finland – Middle Water	GF_MW	–	203	43.8 – 75
Gulf of Finland – Deep Water	GF_DW	–	74	75 – 105
Gulf of Riga – Surface Water	GR_SW	16 300	320	0 – 39.2
Gulf of Riga – Deep Water	GR_DW	–	105	39.2 – 56
Bothnian Sea – Surface Water	BS_SW	79 000	3 022	0 – 42.5
Bothnian Sea – Deep Water	BS_DW	–	1 348	42.5 – 301
Bothnian Bay – Surface Water	BB_SW	36 800	1 059	0 – 41.4
Bothnian Bay – Deep Water	BB_DW	–	977	41.4 – 56
Danish Straits and Kattegat	DS+KT	42 408	1 422	0 – 109

Table 2. Parameter matrix Δ. Diagonal elements represent one minus the decay rate of the nitrogen stocks (phosphorus in parenthesis) and the off-diagonal elements are the portion of stock exchanged with adjacent basins and within the layers.

	Baltic Proper			Gulf of Finland			Gulf of Riga		Bothnian Sea		Bothian Bay		DS
	SW	MW	DW	SW	MW	DW	SW	DW	SW	DW	SW	DW	+KT
BP_SW	0.970 (0.999)	0.029	0	0.285	0	0	0.100	0	0.087	0	0	0	0.045
BP_MW	0.011	0.970 (0.999)	0.046	0	0.103	0	0	0.146	0	0	0	0	0.010
BP_DW	0	0.008	0.970 (0.999)	0	0	0.285	0	0	0	0	0	0	0.006
GF_SW	0.024	0	0	0.970 (0.999)	0.285	0	0	0	0	0	0	0	0
GF_MW	0	0.006	0	0.070	0.970 (0.999)	0.034	0	0	0	0	0	0	0
GF_DW	0	0	0.026	0	0.012	0.970 (0.999)	0	0	0	0	0	0	0
GR_SW	0.003	0	0	0	0	0	0.970 (0.700)	0.141	0	0	0	0	0
GR_DW	0	0.004	0	0	0	0	0.046	0.970 (0.700)	0	0	0	0	0
BS_SW	0.022	0	0	0	0	0	0	0	0.970 (0.999)	0.058	0.072	0	0
BS_DW	0	0.003	0	0	0	0	0	0	0.023	0.970 (0.999)	0	0	0
BB_SW	0	0	0	0	0	0	0	0	0.014	0	0.970 (0.850)	0.167	0
BB_DW	0	0	0	0	0	0	0	0	0	0.003	0.150	0.970 (0.850)	0
DS+KT	0.026	0	0	0	0	0	0	0	0	0	0	0	0.970 (0.999)

The interaction terms ρ_{ji} were calibrated based on the estimates of annual water fluxes for the Baltic Sea presented in Håkanson and Bryhn (2008) and Håkanson and Lindgren (2010), assuming the total volume of water in each basin remains constant. Obviously, water is exchanged only with the adjacent basins; the zero values of parameters ρ_{ji} mean that no water exchange occurs between the compartments. For example, consider the Danish Straits and Kattegat where 2.6 percent of nutrients mixed with water are moving annually to surface waters of the Baltic Proper and join the stock of nutrients present in this compartment. Further, 28.5 percent of the surface waters of Baltic Proper join the nutrient stock present in the surface water layer of the Gulf of Finland, and 10.3 percent of water with mixed in it nutrients moves annually from middle water layer of Baltic Proper to the middle water layer of the Gulf of Finland.

3.2 Nutrient Inputs to the Baltic Sea

In order to estimate nutrient stocks in the Baltic Sea and its basins, we need the following information about nutrients' flows. Firstly, we need to know how much nutrients enter each basin annually. The main inflows of nitrogen and phosphorus that influence the total amount of nutrient stocks in the Baltic Sea are: nutrient run-offs from diffuse sources, such as agriculture, managed forestry and scattered dwellings; nutrient discharges from point sources, such as waste water treatment plants, industries and aquaculture; and atmospheric deposition of nutrients to the sea due to air pollution in this region. The data on discharges of nutrients from point sources and atmospheric deposition to the Baltic Sea are readily available from HELCOM for the years 1994–2010 (see footnote 1). However, estimation of nutrient run-offs from agriculture is not as straightforward, as discussed in the following sub-section.

Secondly, we need information about the exchange of nutrients between and within the basins, which was discussed in the previous sub-section. Thirdly, to estimate nutrient stocks we need information about the major nutrient outflows from the stocks. Those include the permanent sediment burial, denitrification, and export to the Skagerrak and North Sea. All these flows of nutrients are also taken into account in the calibration of parameter matrix $\boldsymbol{\Delta}$ (see Table 2).

3.2.1 Nutrient Run-offs from Agricultural Land

As has been mentioned above, nutrient run-offs from agricultural land are the largest source of nitrogen and phosphorus enrichment in the Baltic Sea region. In order to estimate nutrient losses from agriculture, we apply the dynamic nutrient balance approach developed in Kuosmanen and Kuosmanen (2013). For the purposes of our application of nutrient stocks estimation in the Baltic Sea, we assess agricultural stocks and run-offs of nitrogen and phosphorus in the following countries: Finland, Germany, Sweden, Denmark, Estonia, Latvia, Lithuania, Poland and Russia.

Following Kuosmanen (2014), we use readily available data of gross nutrient balances obtained from the Eurostat statistical databases[3] and construct agricultural stocks for each country under analysis. Eurostat's gross nutrient balances represent a measure, which is calculated as total nutrient inputs minus total nutrient outputs and expressed in tons of nutrient per year. Further, to estimate nutrient run-offs from agriculture to the basins of the Baltic Sea, we apply the riverine monitoring data from HELCOM to the estimated agricultural stocks of nitrogen and phosphorus in order to calibrate the leaching rates. The purpose is to estimate the portion of the total agricultural run-off in each country specifically to the Baltic Sea basins.

The HELCOM data of riverine loads of nitrogen and phosphorus are typically used as measures of agricultural run-offs of nutrients and nutrient loading in the Baltic Sea. However, the monitoring data are based on direct measurement of nutrient concentration in water samples in different monitored and unmonitored areas, and hence the results show unrealistically high fluctuations from one year and another. Applying the dynamic nutrient stock model provides more stable estimates of nutrient discharges from the diffuse sources, such as agriculture.

For the nitrogen stocks in Finland, Germany, Sweden and Denmark, we use the estimates reported in Kuosmanen (2014). For other countries we calculate the agricultural stocks

[3] EUROSTAT: http://ec.europa.eu/eurostat/data/database

and run-offs of nitrogen utilizing the Eurostat's gross nutrient balance data and the HELCOM riverine data. However, since gross nutrient balance data are unavailable for Russia, we use the HELCOM data for this country, calibrated with the help of the dynamic nutrient model. Below we present some illustrative results for the selected countries.

Run-off of total nitrogen and phosphorus from agricultural activities in Sweden are depicted in Figures 2 and 3, respectively. The broken line indicates the monitoring riverine data of HELCOM and the solid line is agricultural run-off of total nitrogen and phosphorus estimated by the dynamic nutrient balance model.

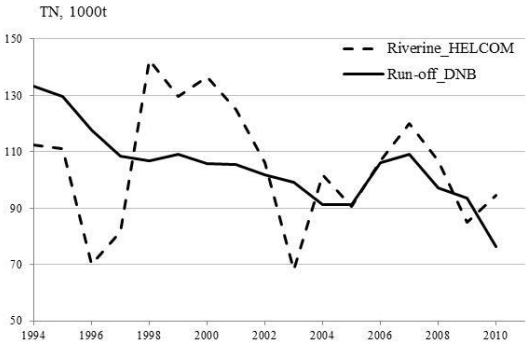


Figure 2. Development of agricultural run-off of total N (thousand tons per year) in Sweden; the broken line is the HELCOM riverine and the solid line is the estimated agricultural run-off.

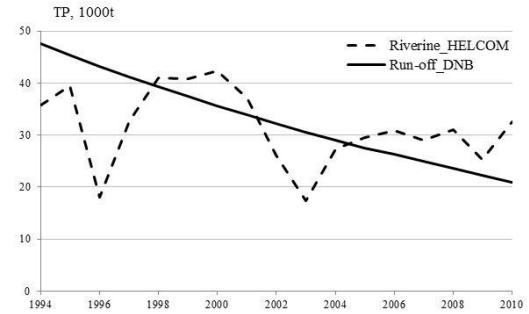


Figure 3. Development of agricultural run-off of total P (thousand tons per year) in Sweden; the broken line is the HELCOM riverine and the solid line is the estimated agricultural run-off.

As can be seen from Figures 2 and 3, the estimated nutrient run-offs for both nitrogen and phosphorus is much smoother compared to the riverine data of HELCOM. This is due to the fact that the HELCOM data is based on the direct measurements of nutrient concentrations in water samples in discrete points of time. For other countries of the Baltic Sea region, a similar comparison of the development of total nitrogen and phosphorus run-offs from agriculture compared to the riverine data of HELCOM can be found in the Appendix 1.

3.2.2 Eutrophication, Forms of Nutrients and Summary Statistics of Total Inputs

Dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) are the forms of nitrogen and phosphorus that are readily available to phytoplankton, and

are hence particularly responsible for the formation of blooms. However, when phytoplankton blooms, DIN and DIP in surface water layers can be totally consumed. Therefore, these types of nutrients are usually measured in winter, when biological activity of plankton is at its lowest stage. Total nitrogen (TN) and total phosphorus (TP) include all forms of nitrogen and phosphorus, and are considered to be more robust measures, which can be assesses throughout the year.

We stress that application of the dynamic nutrient balance model is not limited to any specific form of nutrient. To be more specific, in this study we focus on dissolved nitrogen and phosphorus, that is, DIN and DIP. Estimated nutrient run-offs from agricultural activities, atmospheric deposition of nutrients and nutrient discharges from point sources are represented by TN and TP. To find a portion of DIN and DIP in TN and TP, we use the HELCOM data of winter means of inorganic nutrients in the surface layer and annual means of total nutrients in six basins of the sea. Table 3 presents summary statistics of the estimated inflows of DIN and DIP into the six basins of the Baltic Sea. As can be seen from this table, the Gulf of Riga is the main receiver of DIN, whereas the Gulf of Finland is the main receiver of DIP.

Table 3. Descriptive statistics of the inflow of DIN and DIP (t per km^3 measured quarterly).

DIN	Baltic Proper	Gulf of Finland	Gulf of Riga	Bothnian Sea	Bothnian Bay	Danish straits and Kattegat
Mean	1.60	7.90	11.10	0.90	2.72	8.08
Median	1.52	7.79	11.16	0.90	2.67	7.59
Std.Dev.	0.15	0.34	0.37	0.11	0.36	1.17
Min	1.44	7.47	10.49	0.75	2.18	6.29
Max	1.93	8.49	11.65	1.09	3.31	10.26
DIP						
Mean	0.21	1.66	1.26	0.13	0.13	0.50
Median	0.21	1.69	1.22	0.12	0.12	0.48
Std.Dev.	0.04	0.09	0.28	0.02	0.03	0.11
Min	0.09	1.46	0.84	0.09	0.09	0.36
Max	0.17	1.77	1.77	0.17	0.17	0.74

4. Results

In this section we report the main results of the empirical study. Using nutrient inputs discussed in sub-section 3.2, we estimate interacting stocks of nitrogen and phosphorus in six basins of the Baltic Sea and their compartments using equation (2). We first present results on estimated nitrogen and phosphorus stocks in six basins of the Baltic Sea and their compartments, calculated quarterly in tonnes. We then present nitrogen and phosphorus concentration measures, which are derived from the estimated stocks using equation (4), reported in in μmol per liter to be consistent with the measurement data of HELCOM.

Table 4 reports values of nitrogen and phosphorus stocks in each basin of the Baltic Sea and their compartments (in 1,000 tonnes) during the period 1995–2010. According to our results, nitrogen and phosphorus stocks have decreased in all basins and their compartments. The largest decline occurred in nitrogen stocks in the Danish Straits and Kattegat. The smallest change in nitrogen stock took place in the Gulf of Riga. However,

phosphorus stocks in the Gulf of Riga showed the most notable decrease.

Table 4. Development of nitrogen (DIN) and phosphorus (DIP) stocks by basin during 1995 – 2010 (1000 tonnes) and the mean annual percentage change (Ch. %).

		DIN					DIP				
Basin	**Layer**	**1995**	**2000**	**2005**	**2010**	**Ch.%**	**1995**	**2000**	**2005**	**2010**	**Ch.%**
Baltic Proper	**SW**	608	587	547	523	-0.93	61.37	56.08	48.42	41.80	-2.13
	MW	140	134	128	120	-0.92	46.73	37.44	31.96	27.67	-2.72
	DW	20.4	19.5	18.4	17.3	-1.07	31.65	30.66	27.29	23.82	-1.65
Gulf of Finland	**SW**	71.8	69.7	65.6	63.1	-0.78	12.34	11.73	11.09	9.69	-1.43
	MW	13.7	13.4	12.7	12.1	-0.78	2.56	2.46	2.16	1.86	-1.83
	DW	2.0	1.9	1.8	1.7	-1.01	4.26	4.20	4.01	3.71	-0.86
Gulf of Riga	**SW**	43.2	42.9	40.9	39.7	-0.54	8.32	7.69	6.67	5.66	-2.13
	DW	8.2	8.0	7.7	7.4	-0.63	2.26	1.87	1.61	1.41	-2.52
Bothnian Sea	**SW**	167	163	150	140	-1.10	22.64	21.26	18.51	15.83	-2.01
	DW	49.3	47.2	44.9	41.6	-1.04	10.83	10.96	10.63	9.98	-0.52
Bothnian Bay	**SW**	72.3	69.7	62.9	56.5	-1.45	3.67	3.47	3.03	2.61	-1.93
	DW	55.6	54.2	50.1	44.9	-1.28	7.09	6.30	5.66	4.95	-2.01
DS +KT		61.7	57.0	50.3	47.1	-1.58	11.56	10.64	9.32	8.12	-1.99

We next convert the estimated stocks into concentration measures using equation (4). Table 5 reports the concentrations of nitrogen and phosphorus in each basin and each compartment in μmol l^{-1}.

Table 5. Development of nitrogen (DIN) and phosphorus (DIP) concentrations by basin and compartment during 1995 – 2010 (μmol l^{-1}).

		DIN				DIP			
Basin	**Layer**	**1995**	**2000**	**2005**	**2010**	**1995**	**2000**	**2005**	**2010**
Baltic Proper	**SW**	5.03	4.86	4.53	4.33	0.23	0.21	0.18	0,16
	MW	2.75	2.65	2.51	2.37	0.42	0.33	0.28	0,25
	DW	1.84	1.74	1.64	1.54	1.28	1.24	1.10	0,96
Gulf of Finland	**SW**	6.19	6.04	5.69	5.47	0.48	0.46	0.44	0.38
	MW	4.81	4.70	4.45	4.24	0.41	0.39	0.34	0.30
	DW	1.99	1.89	1.79	1.69	1.87	1.84	1.76	1.63
Gulf of Riga	**SW**	9.65	9.60	9.15	8.86	0.84	0.78	0.67	0.57
	DW	5.58	5.49	5.28	5.06	0.70	0.58	0.50	0.43
Bothnian Sea	**SW**	3.95	3.84	3.55	3.30	0.24	0.23	0.20	0.17
	DW	2.61	2.50	2.38	2.20	0.26	0.26	0.25	0.24
Bothnian Bay	**SW**	4.87	4.70	4.24	3.81	0.11	0.11	0.09	0.08
	DW	4.06	3.96	3.66	3.29	0.23	0.21	0.19	0.16
DS +KT		3.10	2.86	2.52	2.36	0.26	0.24	0.21	0.18

Similar to the results of nutrient stocks, the nitrogen concentrations have been gradually decreasing during the study period (**Table 5**). Interestingly, the nitrogen concentrations are highest in the surface water layers (SW) and decrease towards the middle (MW) and deep water (DW) layers. There are at least three explanations for this pattern. First, the nutrient inputs such as riverine inflow and atmospheric deposition enter the surface water layers first, and are subsequently transmitted to other layers through settling and water exchange. Second, nitrogen decay via sedimentation processes occurs in the bottom

layers. Third, the inflow of salty water from Kattegat to the Baltic Proper occurs through the bottom layers. In our model, parameters vector **Δ** takes into account all these three effects.

Figures 4 and 5 display the development of dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) concentrations in the Gulf of Finland in years 1994 – 2005. The broken lines are the concentrations of DIN and DIP from the direct measurements reported by HELCOM. These concentrations are winter means in the surface waters (0–10 m) (HELCOM, 2009). The solid lines represent the concentrations of DIN and DIP estimated by the dynamic material balance approach. These measures are converted from the estimated stocks estimates of DIN and DIP from tonnes into μmol per liter. In contrast to HELCOM estimates, the concentrations obtained by the DNB method are calculated for the surface water layer of the Gulf of Finland (0–44 m).

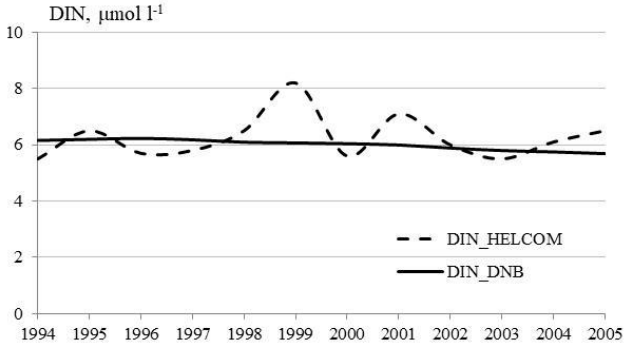


Figure 4. Development of DIN concentrations in the Gulf of Finland in 1994–2005 according to HELCOM and the proposed DNB method.

Figure 4 illustrates that the DIN concentration estimated by the dynamic material balance approach matches well the data from direct measurements based on samples of seawater. In the case of phosphorus (Figure 5), the DIP concentrations are of the similar magnitude, but the average concentrations derived from the phosphorus stock are notably lower than concentrations obtained from direct measurements. This can be at least partly explained by the fact that in our calculations the surface water layer in the Gulf of Finland is considered to be up to 40 meters deep, and the empirical samples of the HELCOM are taken only at depth of 10 meters or less. Comparing the results of both DIN and DIP, we see that average concentrations from the direct measurements are much more volatile than the results of the dynamic material balance approach. For other basins and compartments, similar figures depicting the developments of DIN and DIP concentrations are presented in Appendix 2.

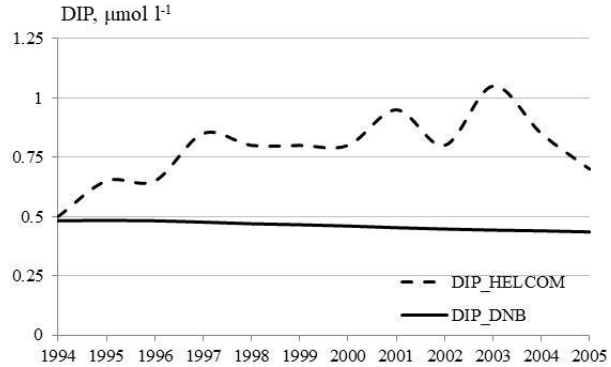


Figure 5. Development of DIP concentrations in the Gulf of Finland in 1994–2005 according to HELCOM and the proposed DNB method.

5. Forecasting Future Nutrient Trends in the Baltic Sea

We noted in Section 2 that the dynamic nutrient balance approach could be useful for forecasting the future development of nutrient stocks and concentrations under alternative policy scenarios. As an illustration, in this section we consider alternative scenarios for future development of nutrient abatement in the Baltic Sea area, and analyze how this will affect the stocks and the concentration levels of DIN and DIP. The three scenarios considered are the following:

1) *Baseline*: the current trend of nutrient reduction continues as is.
2) *HELCOM:* the targets of the Baltic Sea Action Plan are reached by 2021.
3) *Reduction of agricultural run-offs* by 20 % (Scenario 3a) and 30 % (Scenario 3b).

In the *baseline scenario* we simply assume that the same trend of nutrient reduction continues in the future. This would obviously require taking further abatement measures. In the *second scenario*, we adjust our model so that the maximum allowable inputs defined in the HELCOM Baltic Sea Action Plan (HELCOM, 2013) are reached by 2021. The maximum allowable inputs are predefined targets of water- and airborne nitrogen and phosphorus. According to HELCOM, despite the different amounts of reduction targets for different basins, annual phosphorus reduction can be reached even by implementing all possible measures, including the most stringent and expensive ones. In the *third scenario* we examine how nutrient stock and concentration levels change in response to a reduction of agricultural run-offs. Two sub-scenarios consider reducing the run-offs by 20 percent (3a) and 30 percent (3b) relative to the current level, respectively. Scenario 3 is motivated by an ongoing large-scale pilot on gypsum application to agricultural fields is currently taking place in southwestern Finland. This pilot testes a new water protection method of applying gypsum to the agricultural soils (Ekholm *et al.*, 2011; Uusitalo *et al.*., 2012; Iho and Laukkanen, 2012). This method suggests that gypsum can reduce the phosphorus load by half without requiring changes in farming practices or a decrease in cultivation area or yields (Jaakkola *et al.*., 2012; Ekholm *et al.*, 2012).

The forecasted development of DIN and DIP concentrations during the period 1995 – 2050 in the surface layer of the Gulf of Finland are depicted in Figures 6 and 7.

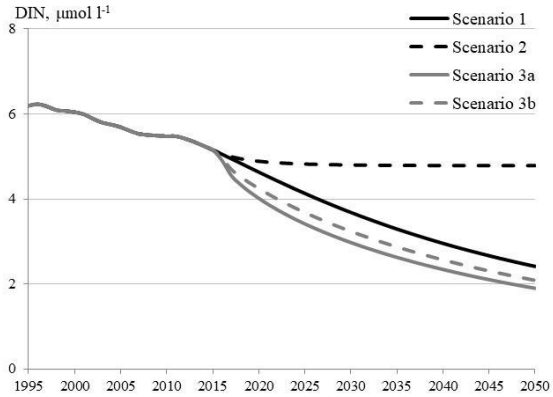


Figure 6. Development of DIN concentrations in the surface layer of the Gulf of Finland according to three forecasting scenarios.

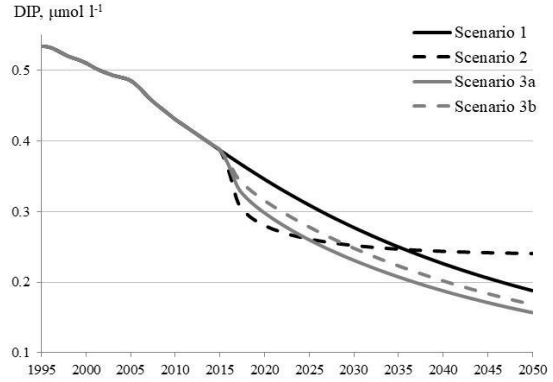


Figure 7. Development of DIP concentrations in the surface layer of the Gulf of Finland according to three forecasting scenarios.

In the baseline scenario the DIN and DIP concentrations continue the current downward trend, as expected. In the second scenario, reaching the HELCOM targets has little impact on the DIN concentration. This is because the HELCOM targets are already met in most regions: reaching lower DIN concentration would require more stringent targets and policy measures. The HELCOM scenario shows a quick effect on the DIP concentration, which then gradually levels off as the targets are reached. The different pattern of the DIN and DIP concentrations is due to the fact that the phosphorus cycle is much slower than that of nitrogen. Finally, Scenario 3 indicates that reduction of agricultural run-offs would likely be the most effective and cost efficient policy measure. Note that the impact of immediate reductions continues far into future because the dynamic material balance model takes into account the development of nutrient stocks in the agricultural lands. Reducing nutrient input to agricultural lands would gradually affect the run-offs to the Baltic Sea, and gradually affect the nutrient stocks accumulated in the seawater.

6. Conclusions

This paper considered an alternative approach to modeling empirical nutrient budgets using the dynamic nutrient balance approach with multiple interacting nutrient stocks. The flow of nutrients to six basins of the Baltic Sea was modeled using the country level nitrogen and phosphorus stocks in agricultural land, drawing a distinction between surface, middle, and bottom-water layers. The calibration of model parameters was based on available data of water fluxes between the basins and compartments and the average concentrations in the direct measurements from water samples.

We believe the macro-level dynamic nutrient balance approach provides insights beyond the direct measurements, high-resolution micro-level simulation models, as well as conventional empirical nutrient budgets. Firstly, the dynamic nutrient balance accounting of interacting stocks helps to build natural connections between nutrient stocks and concentrations, as well as nutrient stocks on the land and nutrient stocks in the sea. Secondly, this approach provides a simple macro-level accounting approach to analyzing the development of nutrient stocks in different basins and different water layers over time. The dynamic model can also be utilized to forecast the development of nutrient stocks over time under alternative policy scenarios. Thirdly, all model parameters of the dynamic material balance model can be calibrated to fit the average nutrient concentrations from direct measurements, which allows us to compare and contrast the empirical evidence from micro-level simulations as well as other nutrient budget approaches. Therefore, we see the dynamic nutrient balance approach considered in this paper not as a competitor but as a complement to the existing toolbox of eutrophication research.

The results of our empirical analysis confirmed that both nitrogen and phosphorus stocks declined in each basin of the Baltic Sea and all water layers over the last decade. Regarding nutrient concentrations of dissolved inorganic nitrogen and phosphorus, which we obtained from the estimated nutrient stocks, we discovered that our estimated nitrogen concentrations fit very well to the empirical measures of HELCOM's concentrations, which were obtained from water samples. However, the estimated phosphorus concentrations are generally smaller than the direct measurements suggest. The estimated nutrient concentrations are notably more stable over time than the direct measurements data. Finally, we conducted three forecasting scenarios to find out which of the reduction schemes would result in largest nutrient abatement. According to the results of our forecasting exercise, the largest reduction in both nitrogen and phosphorus would be reached by reducing agricultural run-offs of these nutrients.

References

Ærtebjerg, G., Andersen, J.H., Hansen, O.S. (2003). *Nutrients and eutrophication in Danish marine waters. A challenge for science and management*. National Environmental Research Institute, 126 pp.

Ahlvik, L., Ekholm, P., Hyytiäinen, K., Pitkänen, H. (2014). An economic-ecological model to evaluate impacts of nutrient abatement in the Baltic Sea. *Environmental Modelling and Software*, 55, 164–175.

Ahlvik, L., Iho, A. (2016). *Cost-benefit rules for geoengineering*. Working paper, Natural Resource Institute Finland.

Ahlvik, L., Pavlova, Y. (2013). A strategic analysis of eutrophication abatement in the Baltic Sea. *Environmental and Resource Economics*, 56, 353–378.

Andersen, J.H., Axe, P., Backer, H., Carstensen, J., Claussen, U., Fleming-Lehtinen, V., Järvinen, M., Kaartokallio, H., Knuuttila, S., Korpinen, S., Laamanen, M., Lysiak-Pastuszak, E., Martin, G., Møhlenberg, F., Murray, C., Nausch, G., Norkko, A., Villnäs, A. (2011). Getting the measure of

eutrophication in the Baltic Sea: towards improved assessment principles and methods. *Biogeochemistry*, 106, 137–156.

Andersen, J.H., Carstensen, J., Conley, D.J., Dromph, K., Fleming-Lehtinen, V., Gustafsson, B.G., Josefson, A.B., Norkko, A., Villnäs, A., Murray, C. (2017). Long-term temporal and spatial trends in eutrophication status of the Baltic Sea. *Biological Reviews*, 92, 136–149.

Andersen, J.H., Schlüter, L., Ærtebjerg, G. (2006). Coastal eutrophication: recent developments in definitions and implications for monitoring strategies. *Journal of Plankton Research*, 28(7), 621–628.

Boeykens, S.P., Piol M.N., Samudio Legal, L., Saralegui, A.B., Vázquez, C. (2017) Eutrophication decrease: Phosphate adsorption processes in presence of nitrates. *Journal of Environmental Management*, 203(3), 888 – 895.

Eilola, K., Gustafsson, B.G., Kuznetsov, I., Meier, H.E.M., Neumann, T., Savchuk, O.P. (2011). Evaluation of biogeochemical cycles in an ensemble of three state-of-the-art numerical models of the Baltic Sea. *Journal of Marine Systems*, 88(2), 267–284.

Eilola, K., Meier, H.M., Almroth, E. (2009). On the dynamics of oxygen, phosphorus and cyanobacteria in the Baltic Sea; a model study. *Journal of Marine Systems*, 75(1), 163–184.

Ekholm, P., Jaakkola, E., Kiirikki, M., Lahti, K., Lehtoranta, J., Mäkelä, V., Näykki, T., Pietola, L., Tattari, S., Valkama, P., Vesikko, L. (2011). The effect of gypsum on phosphorus losses at the catchment scale. *The Finnish Environment*, 33, 2011.

Ekholm, P., Valkama, P., Jaakkola, E., Kiirikki, M., Lahti, K., Pietola, L. (2012). Gypsum amendment of soils reduces phosphorus losses in an agricultural catchment. *Agricultural and Food Science*, 21(3), 279–291.

Granger, C.W.J., Newbold, P. (1974). Spurious regressions in econometrics. *Journal of Econometrics*, 2, 111–120.

Granger, C.W.J., Newbold, P. (1977). *Forecasting Economic Time Series*. New York: Academic Press.

Gustafsson, B.G., Schenk, F., Blenckner, T., Eilola, K., Meier, H.M., Müller-Karulis, B., Neumann, T., Ruoho-Airola, T., Savchuk, O.P., Zorita, E. (2012). Reconstructing the development of Baltic Sea eutrophication 1850–2006. *Ambio*, 41(6), 534–548.

Håkanson, L., Bryhn, A.C. (2008). *Eutrophication in the Baltic Sea: Present situation, nutrient transport processes, remedial strategies*. Springer Science & Business Media.

Håkanson, L., Lindgren, D. (2010). Water transport and water retention in five connected subbasins in the Baltic Sea—simulations using a general mass-balance modeling approach for salt and substances. *Journal of Coastal Research*, 26(2), 241–264.

Hänninen, J., Vuorinen, I. (2015). Riverine tot-P loading and seawater concentrations in the Baltic Sea during the 1970s to 2000—transfer function modelling based on the total runoff. *Environmental Monitoring and Assessment*, 187(6), 343.

HELCOM (2006). *Development of tools for assessment of eutrophication in the Baltic Sea*, Baltic Sea Environment Proceedings, 104, 64 pp.

HELCOM (2009). *Eutrophication in the Baltic Sea, an integrated thematic assessment of the effects of nutrient enrichment in the Baltic Sea region*. Baltic Sea Environment Proceedings, 115B, 148 pp.

HELCOM (2013). Copenhagen Declaration "Taking Further Action to Implement the Baltic Sea Action Plan - Reaching Good Environmental Status for a healthy Baltic Sea". Adopted 3 October 2013.

HELCOM (2014). *Eutrophication status of the Baltic Sea 2007–2011 – a concise thematic assessment,* Baltic Sea Environmental Proceedings, 143, 40 pp.

HELCOM (2015). Guidelines for the annual and periodical compilation and reporting of water borne inputs to the Baltic Sea (PLC-Water).

HELCOM (2017). *Baltic Sea Action Plan*. Adopted by the HELCOM Ministerial meeting, Krakow, Poland 15th November 2017.

Iho, A., Ahlvik, L., Ekholm, P., Lehtoranta, J., Kortelainen, P. (2017). Optimal Phosphorus Abatement Redefined: Insights from Coupled Element Cycles. *Ecological Economics*, 137, 13–19.

Iho, A., Laukkanen, M. (2012). Gypsum amendment as a means to reduce agricultural phosphorus loading: an economic appraisal. *Agricultural and Food Science*, 21(3), 307–324.

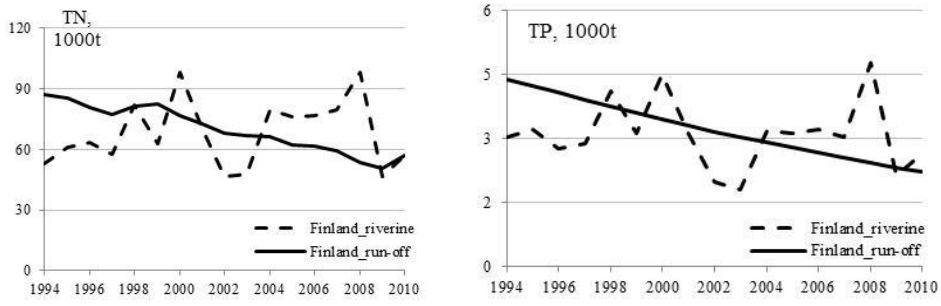
Jaakkola, E., Tattari, S., Ekholm, P., Pietola, L., Posch, M., Bärlund, I. (2012). Simulated effects of gypsum amendment on phosphorus losses from agricultural soils. *Agricultural and Food Science*, 21(3), 292–306.

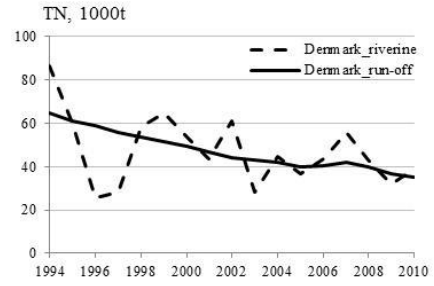
Kuosmanen, N. (2014). Estimating stocks and flows of nitrogen: Application of dynamic nutrient balance model to European agriculture. *Ecological Economics*, 108, 68–78.

Kuosmanen, N., Kuosmanen, T. (2013). Modeling cumulative effects of nutrient surpluses in agriculture: A dynamic approach to material balance accounting. *Ecological Economics*, 90, 159–167.

Larsen, H.G. (2008). Scaling the Baltic Sea environment. *Geoforum*, 39(6), 2000–2008.
Larsson, U., Elmgren, R., Wulff, F. (1985). Eutrophication and the Baltic Sea: Causes and Consequences. *Ambio*, 14, 9–14.
Phillips, P.C.B. (1986). Understanding spurious regressions in econometrics. *Journal of Econometrics*, 33, 311–340.
Rahm, L., Danielsson, Å. (2007). Spatial heterogeneity of nutrients in the Baltic Proper, Baltic Sea. *Estuarine, Coastal and Shelf Science*, 73(1), 268–278.
Ryther, J.H., Dunstan, W.M. (1971). Nitrogen, Phosphorus, and Eutrophication in the Coastal Marine Environment. *Science*, 171, 1008–1013.
Savchuk, O.P. (2005). Resolving the Baltic Sea into seven subbasins: N and P budgets for 1991–1999. *Journal of Marine Systems*, 56(1), 1–15.
Savchuk, O.P., Gustafsson, B.G., Müller-Karulis, B. (2012). *BALTSEM–A Marine Model for the Decision Support within the Baltic Sea Region*. Baltic Nest Institute Technical Report, (7), pp.55.
Savchuk, O.P., Wulff, F. (2007). Modeling the Baltic Sea eutrophication in a decision support system. *AMBIO: A Journal of the Human Environment*, 36(2), 141–148.
Savchuk, O.P., Wulff, F. (2009). Long-term modeling of large-scale nutrient cycles in the entire Baltic Sea. *Hydrobiologia*, 629(1), 209–224.
Uusitalo, R., Ylivainio, K., Hyväluoma, J., Rasa, K., Kaseva, J., Nylund, P., Pietola, L., Turtola, E. (2012). The effects of gypsum on the transfer of phosphorus and other nutrients through clay soil monoliths. *Agricultural and Food Science*, 21(3), 260–278.
Voipio, A. (Ed.) (1981). *The Baltic Sea*. Elsevier, Amsterdam, 418 pp.
Vollenweider, R. (1971). *Scientific fundamentals of the eutrophication of lakes and flowing waters, with particular reference to nitrogen and phosphorous as factors in eutrophication*, OECD Technical Report DAS/CSI/68.27, OECD, Paris.
Wasmund, N., Andrushaitis, A., Łysiak-Pastuszak, E., Müller-Karulis, B., Nausch, G., Neumann, T., Ojaveer, H., Olenina, I., Postel, L., Witek, Z. (2001). Trophic status of the south-eastern Baltic Sea: a comparison of coastal and open areas. *Estuarine, Coastal and Shelf Science*, 53(6), 849–864.
Wulff, F., Rahm, L., Hallin, A.K., Sandberg, J. (2001b). A nutrient budget model of the Baltic Sea. In Wulff, F., Rahm, L., Larsson, P. (Eds.): *A systems analysis of the Baltic Sea*, 353–372. Springer Berlin Heidelberg.
Wulff, F., Rahm, L., Larsson, P. (Eds.) (2001a). *A Systems Analysis of the Baltic Sea*. Ecological Studies, Vol. 148. Springer-Verlag, Berlin, 455 pp.

Appendix 1. Development of nutrient loads to the Baltic Sea from different countries during 1994–2005 according to HELCOM and the DNB method.

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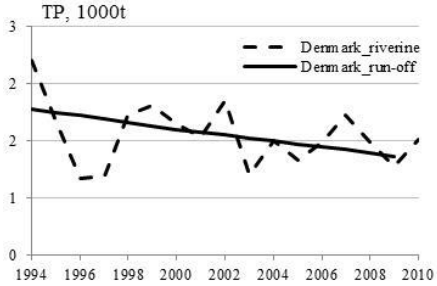
Denmark_run-off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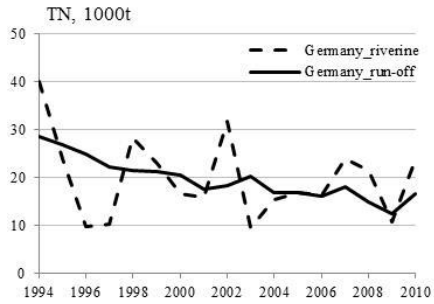
Denmark_run-off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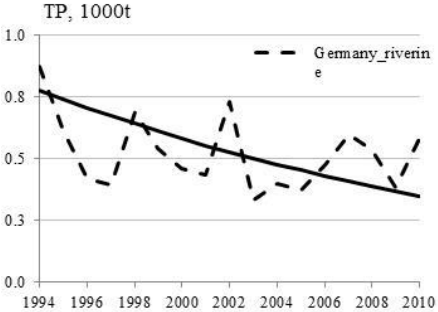
Germany_run-off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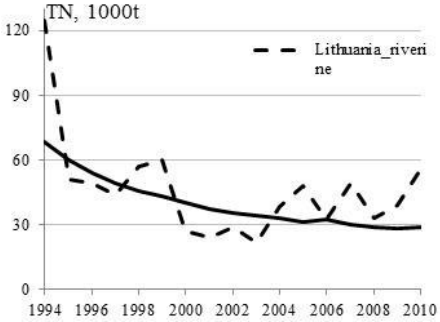
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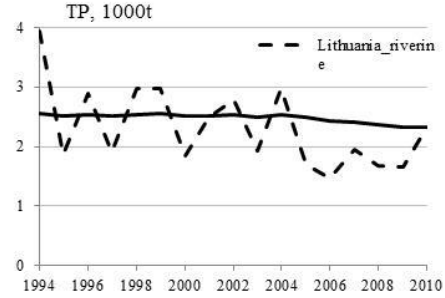
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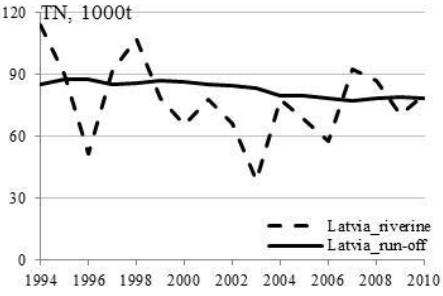
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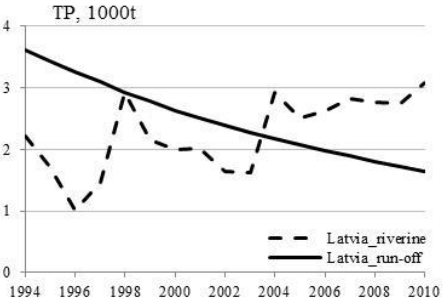
Latvia_riverine
Latvia_run-off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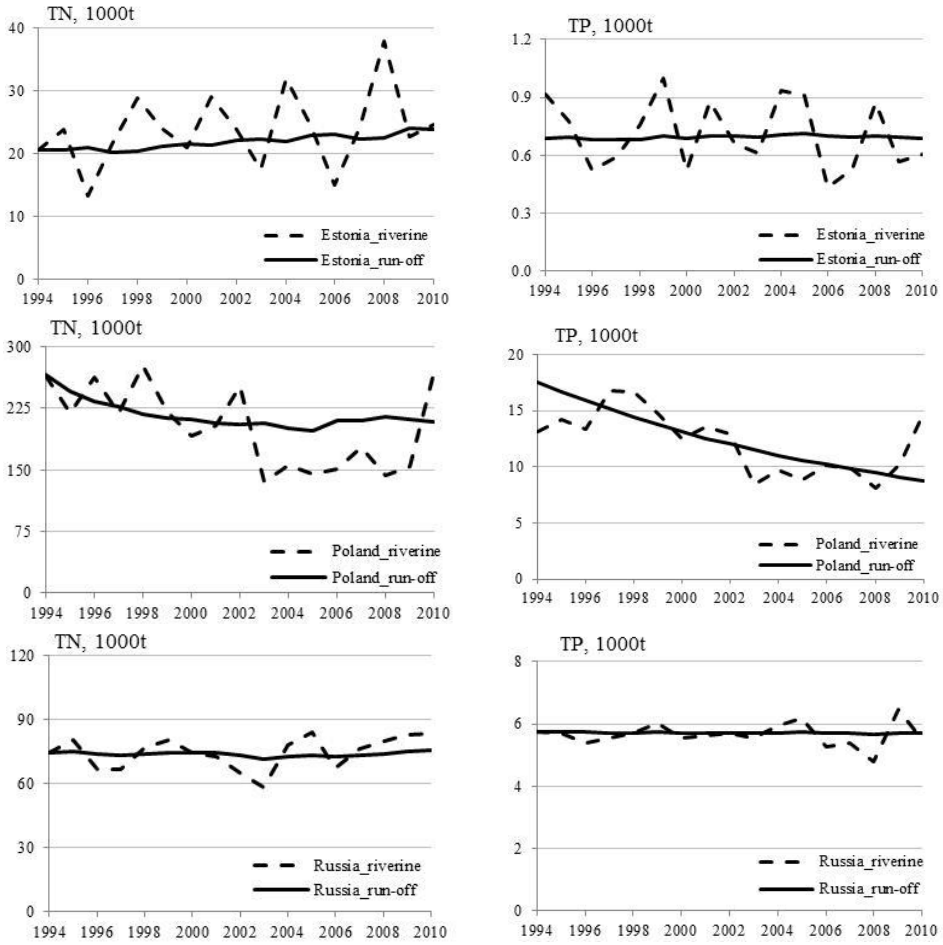
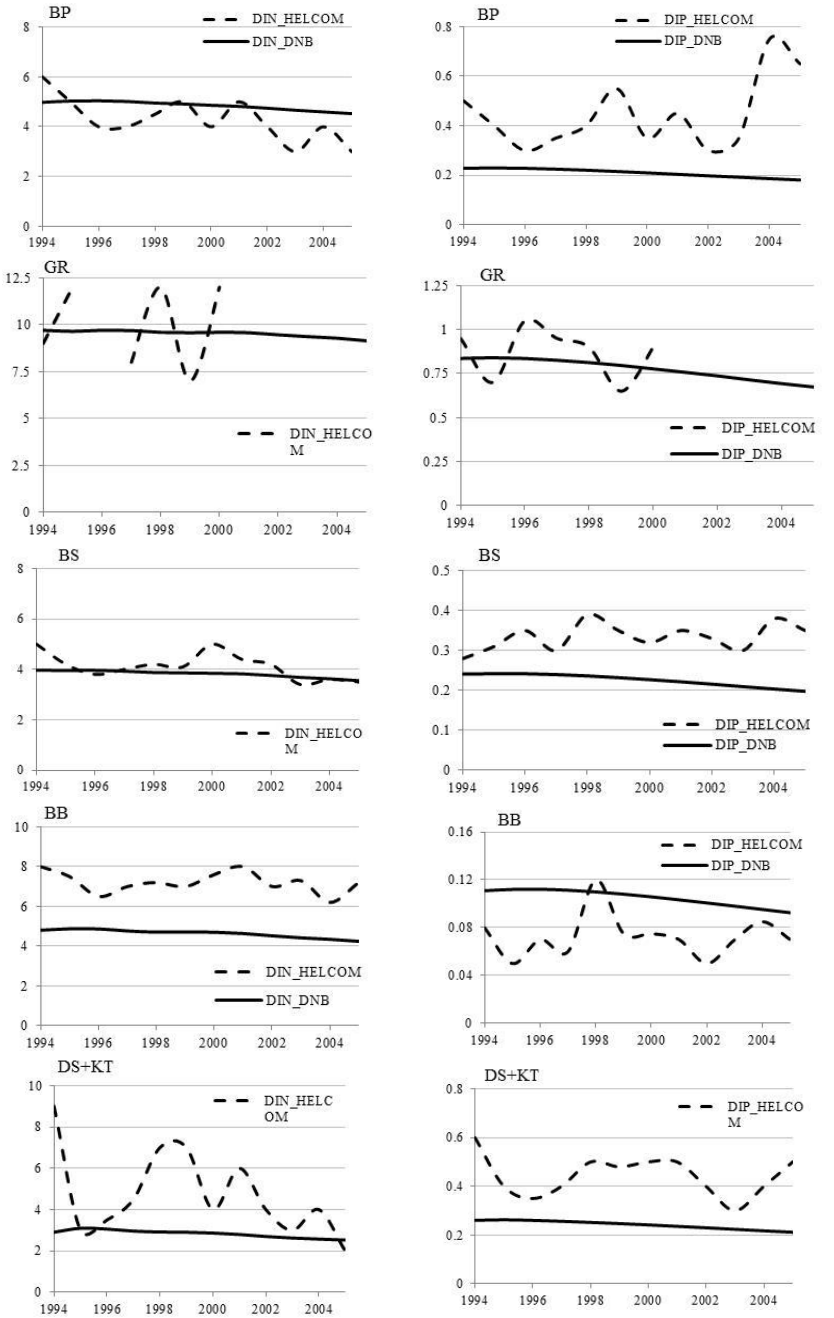


Appendix 2. Development of dissolved inorganic nitrogen (DIN) and dissolved inorganic phosphorus (DIP) concentrations during 1994–2005 according to HELCOM and the DNB method.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DIN_DNB
BP
DIP_HELCOM
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GR
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DIP_HELCOM
DIP_DNB
BS
DIN_HELCOM
BS
DIP_HELCOM
DIP_DNB
BB
DIN_HELCOM
DIN_DNB
BB
DIP_HELCOM
DIP_DNB
DS+KT
DIN_HELCOM
DS+KT
DIP_HELCOM

7. A Responsible Proposal for Italian Seafood Consumers'

Dr. Cristina Giosuè, Dr. Vita Gancitano, Dr. Mario Sprovieri, Dr. Sergio Vitale

ABSTRACT:
Sustainable seafood consumption is a very intricate process, where different factors in diverse ways can influence the consumer's behavior. One of them is the knowledge on aspects related to seafood consumption and resource exploitation. Moreover, the sustainable criteria aren't always "friendly" end opportunely updated for consumers, both under the form of eco-labels and seafood guides. In this context, the aim of the paper was to easily provide buying suggestions based on scientific sustainable criteria, guiding consumers toward to responsible seafood consumption. Data collected during the framework of the study on consumers' perception for eco-labeled Mediterranean anchovy, were adopted as case-study for the most common species sold in fish shop. Each species of the list of seafood preferred by consumers was synoptically related to 4 items, regarding the current healthy status of the marine resource, the legal landing size, as well as biological aspects related to reproductive features. The table obtained was summarized and simplified for consumer use, realizing a friendly picture with figure/graphic, where possible. In general, the data collected, for each species considered, showed lack of information for the selected sustainable criteria. Therefore, more studies are needed, to implement the data helpful to define friendly pictures for consumer use.

Keywords: Sustainable criteria, Seafood, consumers' guide

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1. Introduction

In the last years, several studies investigated worldwide the consumer's awareness and willingness to pay for sustainable seafood (Johnston *et al.*, 2001; Johnston & Roheim, 2006; Erwann, 2009; Goyert *et al.*, 2010; Masahiko, 2010; Roheim *et al.*, 2011; Davidson *et al.*, 2012; Xu et al., 2012; Fernández-Polanco *et al.*, 2013; Sogn-Grundvåg *et al.*, 2013; Uchida *et al.*, 2014; Fonner & Sylvia, 2015; Blomquist *et al.*, 2015; Salladarré *et al.*, 2016, McClenachan *et al.,* 2016; Bronnmann & Asche, 2016; Zhou *et al.*, 2016; Rickertsen *et al.*, 2017; Sun *et al.*, 2017; Vitale *et al.*, 2017), showing as these aspects may not directly translated into sustainable consumer behavior (World Business Council for Sustainable Development, 2008; Clonan *et al.*, 2011; Nguyen *et al.*, 2010; Brécard *et al.*, 2012; Richter *et al.*, 2017). Indeed, the sustainable seafood consumption is a very intricate process, where different factors (intentions, attitudes, social norms, trust, knowledge, habits, situational and socioeconomic conditions) and their interactions can influence the consumer's behavior (fig 1; Richter *et al.*, 2017).

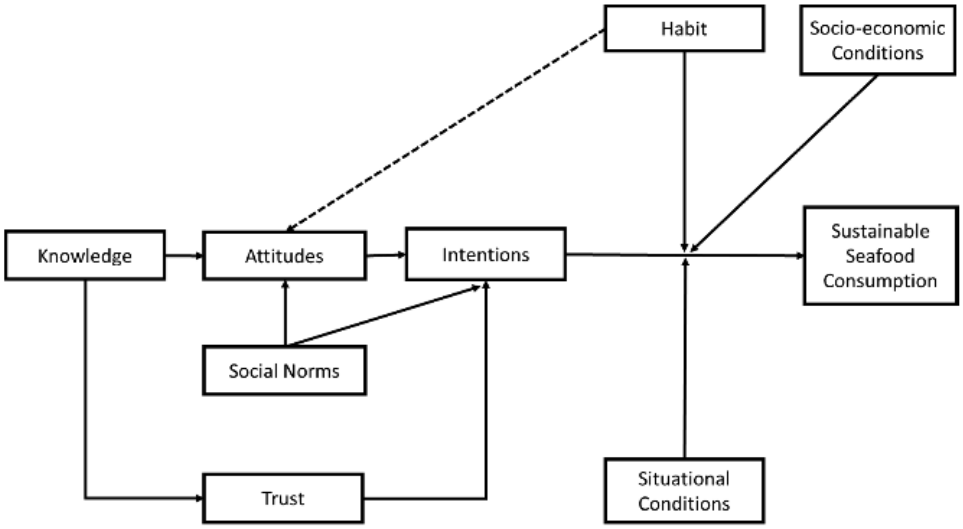


Figure 1. Model of Sustainable Seafood Consumption by Richter et al. 2017

Therefore, all these aspects contribute to make difficult the transfer and assimilation of the concepts on sustainable seafood consumption into consumers. Considering the "knowledge", the criteria for a sustainable consumption are not always clear for consumers. Indeed, among diverse sectors, the sustainable criteria constantly change due to different factors (e.g. seasonal variations, climate change, technical improvements, governmental regulations, and market developments), and the consumers have often limited access to up-dated sustainability criteria during the purchase process (Richter *et al.*, 2017).

Consequently, consumers can only relying on seafood label and seafood guide trying to overtake these gaps on sustainable seafood consumption. Both, seafood label and seafood guide present advantage and disadvantage. The eco-label, in fact, can enclose different attributes based on the sustainability, and it is able to make the product easily recognizable. Consequently, the consumers showed greater awareness and different willingness to pay for eco – labeled seafood in function of the species, the countries, brand, etc. (Vitale *et al.*, 2017). In the same time, some studies showed the eco-label limits, mainly due to the difficulties of the consumers in the understanding the real meaning of eco-label (Brécard *et al.*, 2012; Pérez-Ramìrez *et al.*, 2015), which is often associated to other concepts, such as health and food safety concerns (Nguyen *et al.*, 2010; Brécard *et al.*, 2012; Gutierrez & Thornton, 2014). The seafood guides are referred to particular country or region, and support the consumers offering some information on marine ecosystems, sustainable use of marine resources and consumer responsibility. The guides present the list of seafood categorized on up-date scientific evidence, and the species are often reported following the traffic light system, using green, yellow and red for recommended, critical and avoid species, respectively. In this sense the seafood guides are useful for consumers, but often they require time to be used (Richter *et al.* 2017).

These aspects show how it is necessary to consider the consumer's psychology and the potential levers to be pulled to motivate consumers for sustainable purchase decisions (Richter *et al.*, 2017), including the effort of the scientific community to increase its capacity to transfer the current knowledge on the health status of the marine ecosystems. Moreover, the policy maker, together with the other stakeholders, should assess sustainable policy directed towards consumers, addressing appropriate incentive useful to insure a long-term management of fisheries. In this scenario, the role of fisherman should be fundamental, becoming the main actor and not only the main benefactor, supporting most of the costs, as often happening (Gudmundsson & Wessells, 2000; United Nations Environment Programme, 2005; Roheim *et al.*, 2011; Blomquist *et al.*, 2015). Seems clear that, for a sustainable seafood consumption, all actions should pursue the main goal to determine an appropriate dynamic equilibrium among biological-ecological issues, socio-economic aspects and governance, to insure mainly these commons to the next generations.

In this context, the goal of this contribute is to attempt suggesting on some potential sustainable criteria, that could be useful to guide the consumers toward a responsible seafood consumption in the Mediterranean basin. In this regard, data collected during the framework of the study on consumers' perception for eco-labeled Mediterranean anchovy, were adopted as case-study for the most common species sold in fish shop.

2. Material and methods

A study on the Italian awareness and their willingness to pay for Eco-Labeled Mediterranean anchovy was carried out, interviewing consumers at Auchan fish shop. The sample of respondents was selected in accordance with the main socio-demographic determinants of fish consumption among European consumers (e.g. Pieniak *et al.*, 2007). The survey included, over the usual socio demographic variables, questions on fishing knowledge, factors influencing seafood purchase, awareness for eco-label seafood, etc. (results in publication). Factors, like price, origin of the product, freshness, etc., were considered to define an influencing rank on seafood purchase. Moreover, a list of Mediterranean seafood species according to the Italian consumer's preference was redacted.

The considered sustainable criteria for a responsible seafood consumption were: i) the healthy status of the marine resource (Abella *et al.*, 2011; Cardinale & Osio, 2014; International Commission for the Conservation of Atlantic Tuna, 2016; Simmonds *et al.*, 2017), ii) the minimum sizes of marine organisms (Reg. EC 1967/2006) and iii) the reproductive features by species (Sartor *et al.*, 2017).

In particular, the evaluation of healthy status of the marine resource referred to the current evaluations on *stock assessment* (*SA*) of the investigated species. It is worth to highlight as "*Stock assessment involves the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices*" (Hilborn & Walters, 1992). It tells us if the abundance of a stock is below or above a given target point and by doing so lets us know whether the stock is overexploited or not; it also tells us if a catch level will maintain or change the abundance of the stock. In the present study the following criteria (http://www.fao.org/gfcm/meetings/info/it/c/1040665/) was used to assess the level of overfishing status:

- If $Fc/F0.1$ is below or equal to 1.33 the stock is in Low Overfishing (*OL*);
- If the $Fc/F0.1$ is between 1.33 and 1.66 the stock is in Intermediate Overfishing (*OI*);
- If the $Fc/F0.1$ is equal or above to 1.66 the stock is in High Overfishing (*OH*),

where Fc indicates the current level of fishing mortality and $F0.1$ is a target reference point for the fishing mortality.

The *minimum sizes of marine organisms* (*MS*) is a value of the size assigned to marine organisms to improve their exploitation and to set standards to build management system for fisheries. A marine organism, which is smaller than minimum sizes reported in Annex III of the Reg. EC 1967/2006, shall not be caught, retained on board, transshipped, landed, transferred, stored, sold, displayed or offered for sale.

The reproductive features considered both the $L_{50\%}/W_{50\%}$ and the *reproductive period* (*RP*) by species. The $L_{50\%}/W_{50\%}$ is the length/weight at which 50% of the species of a given sex (normally females) are considered to be mature (Potts & Wootton, 1989). The *RP* indicates the time in which the species spawn. In particular, most of the species exhibit

seasonal cycle in the production of gametes. The expulsion of gametes from the body into the surrounding water is called 'spawning' resulting in fertilization. The spawning depends on the availability of certain crucial environmental factors like temperature, photoperiod, etc.. (Potts & Wootton, 1989).

The available literature was collected for each issue related with the selected criteria. The data collected were used to realize: 1) a synoptic table of the four items (*SA*, $L_{50\%}/W_{50\%}$, *MS* and *RP*) chosen among the criteria and 2) a friendly table summarizing the four items by picture/graphic, using a risk-adverse approach. In particular, the friendly table aggregates the data under the following manner:

$L_{50\%}$-*MS*, comparing the values collected, independently from the sex, only the highest one was reported;

RP, if the information accomplished reproductive peaks, these periods were indicated using red bars at the correspondent months. If the information provides different peaks for different areas, only the common peaks were reported. If the information did not report peaks and the reproductive period was equal or lower than 4 months, only the middle period was assumed likely "peak" and reported using yellow bars. Other cases were not reported.

SA, it was reported a rough average of the level of exploitation, using a green, a yellow and a red smiley from happy to sad looking, to indicate the healthy status of the resources *(happy-green*: low overfishing; *indifferent-yellow*: intermediate overfishing; *sad-red*: high overfishing).

3. Results

A total of 560 consumers were interviewed, equally distributed by sex. The main factors declared to be important during the seafood purchase were the freshness, the origin and the price, while the knowledge about the state of exploitation of the species was the last one (figure 2).

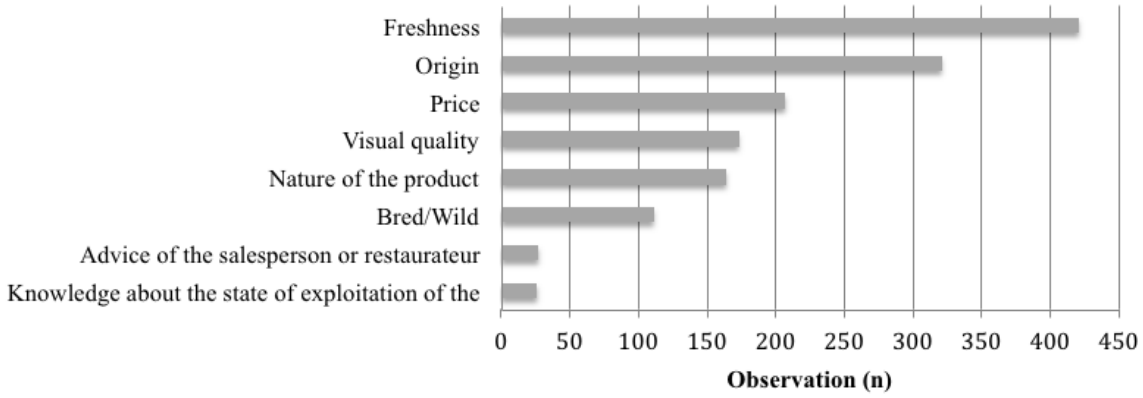


Figure 2. Principal factors considered by consumers during the fish purchase

The survey permitted to define a list of 24 seafood species commonly purchased

among the Italian consumers. The higher preference was recorded for *Sparus auratus* (Gilthead bream) followed by *Dicentrarchus labrax* (European seabass), *Xiphias gladius* (Swordfish) and *Sardina pilchardus* (European pilchard), etc. (figure 3).

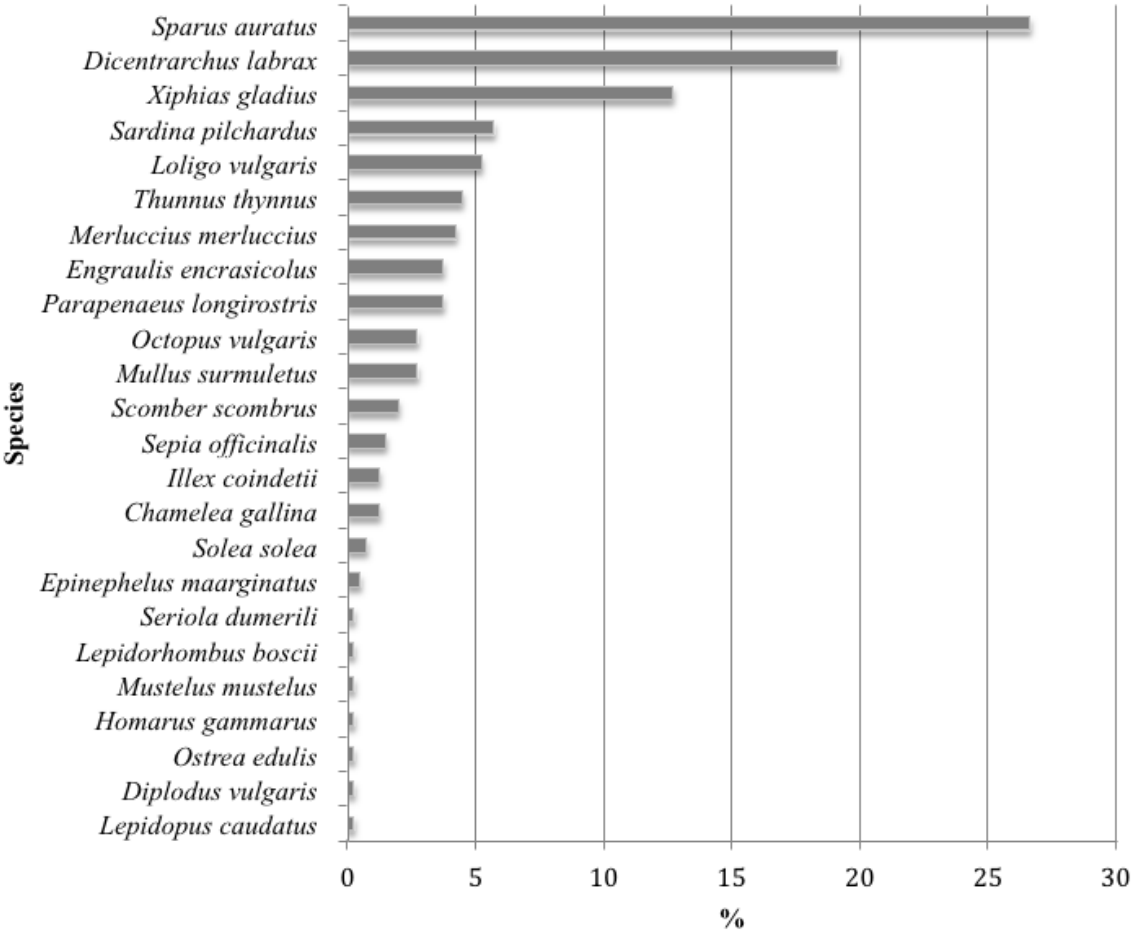


Figure 3. List of seafood species commonly purchased among the Italian consumers

Only 10 of the 24 species above reported are under evaluation by *SA* in the Mediterranean sea. In many cases the same species was assessed (*SA*) in different Geographical Sub Areas (GSAs), consequently more than one evaluation was reported. On the basis of the level of overfishing status (*Fc/F0.1*), 3 species resulted in *OH* (*Sparus auratus, Dicentrarchus labrax* and *Mullus surmuletus*), 2 species in *OH* or *OI* (*Xiphias gladius* and *Merluccius merluccius*), 1 species in *OI* (*Solea solea*), 2 species in *OL* or *OH* (*Sardina pilchardus, Parapenaeus longirostris*), 1 species in *OL* or *OI* (*Engraulis encrasicolus*) and 1 species in *OL* (*Sepia officinalis*) (Appendix).

The $L_{50\%}$ or $W_{50\%}$ was found only for 15 species. Among them, for 8 species the estimated values were reported for sex combined (*Dicentrarchus labrax*, *Xiphias gladius*, *Sardina pilchardus*, *Thunnus thynnus*, *Parapenaeus longirostris*, *Sepia officinalis*, *Solea solea*, *Lepidorhombus*

boscii), while for the others the values were found by sex (*Loligo vulgaris*, *Merluccius merluccius*, *Engraulis encrasicolus*, *Octopus vulgaris*, *Mullus surmuletus*, *Illex coindetii and Lepidopus caudatus*-Appendix).

Among the 24 species preferred by consumers, only 16 species are subjected to a *MS* (*Sparus auratus*, *Dicentrarchus labrax*, *Xiphias gladius*, *Sardina pilchardus*, *Thunnus thynnus*, *Merluccius merluccius*, *Engraulis encrasicolus*, *Parapenaeus longirostris*, *Octopus vulgaris*, *Mullus surmuletus*, *Scomber scombrus*, *Chamelea gallina*, *Epinephelus maarginatus*, *Homarus gammarus*, *Ostrea edulis* and *Diplodus vulgaris*) and for 9 species were found both the $L_{50\%}$ and the *MS* (*Dicentrarchus labrax*, *Xiphias gladius*, *Sardina pilchardus, Thunnus thynnus, Merluccius merluccius*, *Engraulis encrasicolus*, *Parapenaeus longirostris*, *Octopus vulgaris* and *Mullus surmuletus* – Appendix). Comparing the two values, the $L_{50\%}$ was always higher (except for *Thunnus thynnus*) than the *MS*, with differences that ranged from 12% (*Sardina pilchardus*) to 53 % (*Merluccius merluccius*).

Taking into account the *RP*, is possible to empathize the following differences among the species:

during all the year (*Loligo vulgaris*, *Merluccius merluccius*, *Parapenaeus longirostris, Sepia officinalis*, *Illex coindetii*);

during all the year except winter (*Engraulis encrasicolus*, *Lepidopus caudatus*);

during all the year except summer (*Solea solea*);

during all the year with preference in spring-summer (*Octopus vulgaris*, *Chamelea gallina*);

in spring (*Mullus surmuletus, Ostrea edulis*);

in summer (*Thunnus thynnus*, *Epinephelus maarginatus*, *Mustelus mustelus*, *Homarus gammarus*);

in winter (*Scomber scombrus*, *Lepidorhombus boscii*);

late autumn (*Sparus auratus*);

late autumn and winter (*Dicentrarchus labrax*, *Sardina pilchardus*, *Diplodus vulgaris*);

late spring and summer (*Xiphias gladius*) (Appendix).

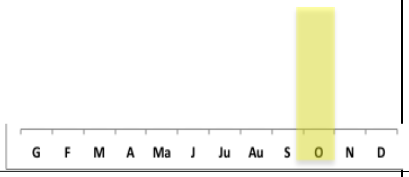
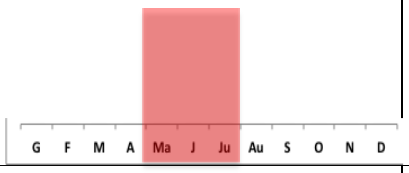
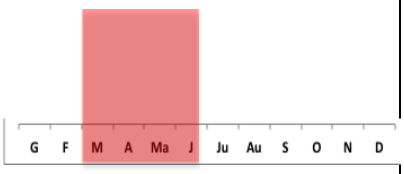
Only for 7 species (*Dicentrarchus labrax*, *Xiphias gladius*, *Sardina pilchardus, Merluccius merluccius*, *Engraulis encrasicolus*, *Parapenaeus longirostris*, *Mullus surmuletus*) it was possible to found complete information on all the criteria considered. No information for all the four items (*SA,* $L_{50\%}$/$W_{50\%}$, *MS and RP*) was found for *Seriola dumerili*.

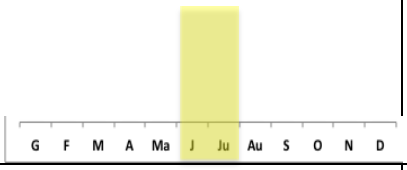
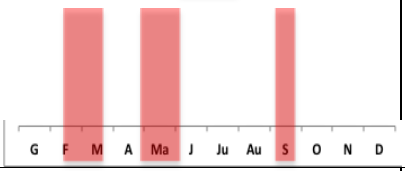
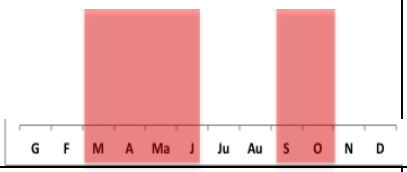
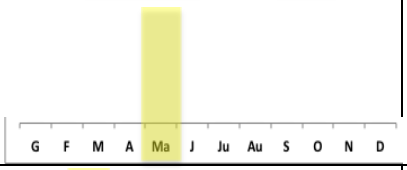
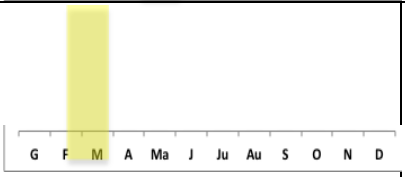
Reporting the higher value between the *MS* and $L_{50\%}$, the "desirable" seafood size for purchase was reported for 22 species (all, except *Seriola dumerili* and *Mustelus mustelus* - table 1).

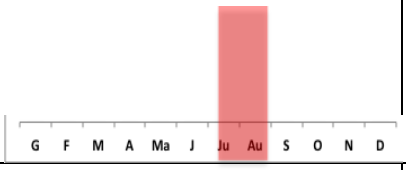
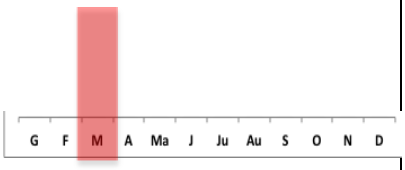
Xiphias gladius, *Loligo vulgaris, Merluccius merluccius*, *Octopus vulgaris*, *Epinephelus maarginatus*, *Lepidorhombus boscii* and *Lepidopus caudatus* were characterized by reproductive peaks, while *Sparus auratus*, *Thunnus thynnus*, *Mullus surmuletus*, *Scomber scombrus*, *Mustelus mustelus*, *Homarus gammarus* and *Ostrea edulis* by middle periods considered as "peaks"; in general, these spawning periods mainly occur in spring and summer (table 1).

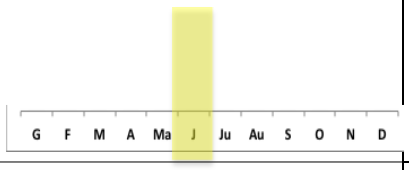
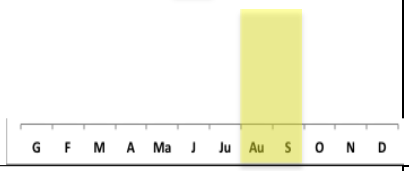
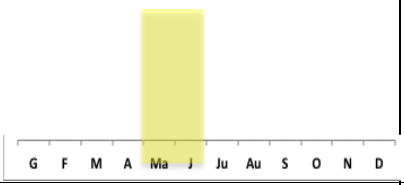
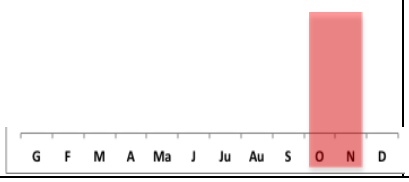
The *current healthy status* for the 10 species with available *SA* information was reported on average for different GSAs, resulting 5 with a sad-red (*Sparus auratus, Dicentrarchus labrax, Xiphias gladius, Merluccius merluccius* and *Mullus surmuletus*), 4 with a indifferent-yellow (*Sardina pilchardus*, *Engraulis encrasicolus*, *Parapenaeus longirostris, Solea solea)* and only 1 species with a *happy-green* (*Sepia officinalis*) smileys (table 1).

Table 1. Friendly table of the seafood species related to the adopted sustainable criteria

Species (*name*)	**It is desirable don't buy seafood below the following size:**	**It is desirable don't buy seafood during the following reproductive periods:**	**Healthy status of the marine resource**
Scientific *Sparus auratus* ***English*** Gilthead bream	< 20.5 cm		
Scientific *Dicentrarchus labrax* ***English*** European seabass	< 38.5 cm		
Scientific *Xiphias gladius* ***English*** Swordfish	< 160.0 cm		
Scientific *Sardina pilchardus* ***English*** European pilchard	< 12.5 cm		
Scientific *Loligo vulgaris* ***English*** European squid	< 25.0 cm		Not known

Species (*name*)	**It is desirable don't buy seafood below the following size:**	**It is desirable don't buy seafood during the following reproductive periods:**	**Healthy status of the marine resource**
Scientific *Thunnus thynnus* ***English*** Northern Atlantic Bluefin tuna	< 115.0 cm < 30.0 kg		Not known
Scientific *Merluccius merluccius* ***English*** European hake	< 42.5 cm		
Scientific *Engraulis encrasicolus* ***English*** European anchovy	< 12.3 cm		
Scientific *Parapenaeus longirostris* ***English*** Deepwater rose shrimp	< 2.8 cm		
Scientific *Octopus vulgaris* ***English*** Common octopus	< 12.0 cm < 520 g (preferred > 750 g)		Not known
Scientific *Mullus surmuletus* ***English*** Striped red mullet	< 12.9 cm		
Scientific *Scomber scombrus* ***English*** Atlantic mackerel	< 18.0 cm		Not known

Species (*name*)	**It is desirable don't buy seafood below the following size:**	**It is desirable don't buy seafood during the following reproductive periods:**	**Healthy status of the marine resource**
Scientific *Sepia officinalis* ***English*** Common cuttlefish	< 10.3 cm		
Scientific *Illex coindetii* ***English*** Broadtail shortfin Squid	< 16.2 cm		Not known
Scientific *Chamelea gallina* ***English*** Striped venus	< 2.5 cm		Not known
Scientific *Solea solea* Common sole	< 26.0 cm		
Scientific *Epinephelus maarginatus* ***English*** Dusky grouper	< 45.0 cm		Not known
Scientific *Seriola dumerili* ***English*** Yellowtail	Not known		Not known
Scientific *Lepidorhombus boscii* ***English*** Fourspotted megrim	< 23.6 cm		Not known

Species (*name*)	It is desirable don't buy seafood below the following size:	It is desirable don't buy seafood during the following reproductive periods:	Healthy status of the marine resource
Scientific *Mustelus mustelus* ***English*** Smooth-hound	Not known		Not known
Scientific *Homarus gammarus* ***English*** European Lobster	< 30.0 cm		Not known
Scientific *Ostrea edulis* ***English*** European flat oysters	< 2.0 cm		Not known
Scientific *Diplodus vulgaris* ***English*** Common two banded seabream	< 23.0 cm		Not known
Scientific *Lepidopus caudatus* ***English*** Silver scabbardfish	< 111.0 cm		Not known

4. Discussions

The survey showed that consumers paid mainly attention to factors related to the quality of the product than to those affecting the exploitation of the marine resources. These results are in line with those observed in studies carried out to investigate the consumers' awareness and willingness to pay for eco-labelled seafood, showing that health and food safety concerns actually motivate the purchase of ecologically friendly food (Nguyen *et al.,* 2010; Brécard *et al.,* 2012; Gutierrez & Thornton, 2014). In this direction, significant connection between the desire for eco-labeling and seafood features, especially fish quality and freshness, geo-origin of fish and wild versus farmed origin were observed (Jaffry *et al.*, 2004; Brécard *et al.*, 2009; Goyert *et al.*, 2010; Xu *et al.*, 2012).

In this study, the price was another important factor influencing the seafood purchase, in accordance with those found by the Istituto di Servizi per il Mercato Agricolo Alimentare

(2011) and the European Market Observatory for Fisheries and Aquaculture Products (2017), in specific studies on the perception and consumption of seafood by Italian and European population, respectively. The seafood, indeed, is considered a category of product with higher price than other protein fonts, such as meat, representing a barrier that limits the purchase (Istituto di Servizi per il Mercato Agricolo Alimentare, 2011; European Market Observatory for Fisheries and Aquaculture Products, 2017).

The considered sustainable criteria for a responsible seafood consumption were i) the current healthy status of the marine resource ii) the minimum sizes of marine organisms and iii) the reproductive features by species, taking into account the *SA*, $L_{50\%}/W_{50\%}$, *MS* and *RP*, respectively. In the specific, the *SA* highlighted that the healthy status of the marine resources is in general not good, with high level of overexploitation. Comparing the $L_{50\%}$ with *MS*, the $L_{50\%}$ was always higher (except for *Thunnus thynnus*) than the *MS* and, reporting the higher value between these 2 items, it was possible to indicate the "desirable" risk adverse seafood size for 22 species. Nevertheless, it is difficult to propose the "best size" considering the multispecies fisheries that characterize the Mediterranean Sea, the difficult to improve the selectivity of the fishing gears insuring, in the meantime, the profit of the fishermen and the sustainability of the marine ecosystem. Regarding the reproductive periods, the spring – summer are the seasons more interested by the spawning for most species and, in the same time, by higher fishing activities and consumption of seafood; consequently, increasing the awareness of the consumer toward a responsible seafood purchase could contribute to improve the health status of the stocks, acting on different aspects that regulate the relationship between supply and demand, affecting the entire productive chain. In conclusion, the implementation of this information needs to systematically consider all the aspects related to the fishery activities, trying to find the good compromise between social, economic and environmental sustainability, consumer's requests and his awareness. In any case, more studies are required to implement information helpful to define friendly pictures, oriented to guide the consumers towards a responsible seafood purchase.

Bibliography

Abella, A., Ratz, H.J., Charef A. (2011). Scientific, Technical and Economic Committee for Fisheries (STECF). Assessment of Mediterranean Sea stocks. Report of the STECF-11-08. Part I. EUR 24902 EN, JRC 66052. Pubblications Office of the EU, Luxembourg: 252 pp.

Blomquist, J., Bartolino, V., Waldo, S. (2015). Price Premiums for Providing Eco-labelled Seafood: Evidence from MSC-certified Cod in Sweden. *Journal of Agricultural Economics*, *66*, 690–704.

Brécard, D., Hlaimi, B., Lucas, S., Perraudeau, Y., Salladarré, F. (2009). Determinants of demand for green products: An application to eco-label demand for fish in Europe. *Ecological Economics, 69*, 115–125.

Brécard, D., Lucas, S., Pichot, N., Salladarré, F. (2012). Consumer Preferences for Eco. Health and Fair Trade Labels. An Application to Seafood Product in France. *Journal of Agricultural & Food Industrial Organization, 10*(1), 1-27.

Bronnmann, J., Asche, F. (2016). The Value of Product Attributes, Brands and Private Labels: An Analysis of Frozen Seafood in Germany. *Journal of Agricultural Economics*, *67,* 231–244.

Cardinale, M., Osio G. C. (2014). Report of the Scientific, Technical and Economic Committee for Fisheries (STECF). 2013 *Assessment of Mediterranean Sea stocks. Part II. STECF-14-08*. EUR 26614 EN, JRC 89860. Pubblications Office of the EU, Luxembourg: 364 pp.

Clonan, A., Holdsworth, M., Swift, J.A., Leibovici, D., Wilson, P. (2011). The dilemma of healthy eating and environmental sustainability: the case of fish. *Public Health Nutrition, 15*(2), 277–284.

Council Regulation (EC) No 850/98 of 30 March 1998 for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms.

Council Regulation (EC) No 27/2005 of 22 December 2004 fixing for 2005 the fishing opportunities and associated conditions for certain fish stocks and groups of fish stocks, applicable in Community waters and, for Community vessels, in waters where catch limitations are required.

Council Regulation (EC) No 51/2006 of 22 December 2005 fixing for 2006 the fishing opportunities and associated conditions for certain fish stocks and groups of fish stocks applicable in Community waters and for Community vessels, in waters where catch limitations are required, lays down quotas for 2006.

Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.

Council Regulation (EC) No 41/2007 of 21 December 2006 fixing for 2007 the fishing opportunities and associated conditions for certain fish stocks and groups of fish stocks, applicable in Community waters and, for Community vessels, in waters where catch limitations are required.

Council Regulation (EC) No 1559/2007 of 17 December 2007 establishing a multi-annual recovery plan for bluefin tuna in the Eastern Atlantic and Mediterranean and amending Regulation (EC) No 520/2007.

Davidson, K., Pan, M., Hu, W., Poerwanto, D. (2012). Consumers' willingness to pay for aquaculture fish products vs. wild-caughtseafood - a case study in hawaii. *Aquaculture Economics & Management, 16*(2).

D.P.R. 1639/68. Regolamento per l'esecuzione della Legge 14 luglio 1965, n. 963, concernente la disciplina della pesca marittima.

European Market Observatory for Fisheries and Aquaculture Products (2017). EU consumer habits regarding fishery and aquaculture products.

Erwann, C. (2009). Eco-labelling: A new deal for a more durable fishery management? *Ocean & Coastal Management, 52,* (5), 2009, 250-257.

Fernández-Polanco, J., Mueller Loose, S., Luna, L. (2013). Are retailers' preferences for seafood attributes predictive for consumer wants? Results from a choice experiment for seabream (Sparus aurata). *Aquaculture Economics & Management, 17*(2).

Fonner, R., Sylvia, G. (2015). Willingness to Pay for Multiple Seafood Labels in a Niche Market. Marine Resource Economics, 30(1), 51-70.

Goyert, W., Sagarin, R., Annala, J. (2010). The promise and pitfalls of Marine Stewardship Council certification: Maine lobster as a case study. *Marine Policy*, 2010, 34, 1103–1109.

Gudmundsson, E., Wessells, C. (2000). Eco-labelling seafood for sustainable production: implications for fisheries management. *Marine Resource Economics, 15*, 97–113.

Gutierrez, A., Thornton, T.F. (2014). Can Consumers Understand Sustainability through Seafood Eco-Labels? A U.S. and UK Case Study. *Sustainability, 6*, 8195-8217.

http://www.fao.org/gfcm/meetings/info/it/c/1040665/

http://www.fao.org/gfcm/reports/technicalmeetings/detail/en/c/1105308/

Hilborn, R. and C.J. Walters. 1992. Quantitative Fisheries Stock Assessment: Choice, Dynamics, and Uncertainty. Chapman Hall. New York.

International Commission for the Conservation of Atlantic Tunas (2016). Report of the 2016 Mediterranean swordfish stock assessment meeting. Casablanca, Morocco, 11-16 July 2016

Istituto di Servizi per il Mercato Agricolo Alimentare Istituto di Servizi per il Mercato Agricolo Alimentare (2011). Il pesce a tavola: percezioni e stili di consumo degli italiani.

Jaffry, S., Pickering, H., Ghulam, Y., Whitmarsh, D., Wattage, P. (2004). Consumer choices for quality and sustainability labeled seafood products in the UK. *Food Policy, 29*, 215–228.

Johnston, R.J., Wessells, C.R., Donath, H., Asche, F. (2001). Measuring Consumer Preferences for Ecolabeled Seafood: An International Comparison. *Journal of agricultural and resource economics*, *26*(1), 20-39.

Johnston, R.J., Roheim, C.A. (2006). A battle of taste and environmental convictions for ecolabeled seafood: a contingent ranking experiment. *Journal of agricultural and resource economics, 31*(2), 283-300.

Masahiko Ariji. (2010). Conjoint analysis of consumer preference for bluefin tuna. *Fisheries Science, 76*(6), 1023–1028.

McClenachan, L., Dissanayake, S.T.M., Chen, X. (2016). Fair trade fish: consumer support for broader seafood sustainability. *Fish and Fisheries, 17*, 825–838.

Musick, J. & Bonfil, R (2004). *Management Techniques for Elasmobranch Fisheries*. FAO Fisheries Technical Pape 474, Chapter: 2, pp.6-14.

Nguyen, L.Q., Du, Q., Friedrichs, Y.V. (2010). Effectiveness of Eco-label? A study of Swedish University Students' Choice on Ecological Food (Master Thesis, Umeå School of Business, Umeå, Sweden). Retrieved from http://www.diva-portal.org/smash/get/diva2:327644/FULLTEXT01.pdf

Pérez-Ramírez, M., Almendarez-Hernández, M., Avilés-Polanco, G., Beltrán-Morales, L.F. (2015). Consumer Acceptance of Eco-Labeled Fish: A Mexican Case Study. *Sustainability, 7,* 4625-4642.

Pieniak, Z. Verbeke, W., Scholderer, J., Brunsø, K., Olsen, S.O. (2007). European Consumers' Use of and Trust in Information Sources About Fish. *Food Qual. Prefer.* 2007, 18, 1050–1063.

Potts, G.W. and Wootton, R.J. (1989). Fish reproduction: Strategies and tactics. Academic press, London. Pp 405

Relini, G., Bertand, J., Zamboni, A. (1999). Sintesi delle conoscenze sulle risorse da pesca dei fondi del Mediterraneo centrale (Italia e Corsica). *Biologia Marina Mediterranea,* published by SIBM, volume 6 (suppl. 1).

Richter, I. G. M. & Klöckner, C.A. (2017). The Psychology of Sustainable Seafood Consumption: A Comprehensive Approach. Foods, 6, 86.

Rickertsen, K., Alfnes, F., Combris, P., Enderli, G., Issanchou, S., Shogren, J.F. (2017). French Consumers' Attitudes and Preferences toward Wild and Farmed Fish. *Marine Resource Economics 32*(1), 59-81.

Roheim, C.A., Asche, F., Santos, J.I. (2011). The elusive price premium for ecolabeled products: Evidence from seafood in the UK market. *Journal of Agricultural Economics*, *62*, 655–668.

Salladarré, F., Brécard, D., Lucas, S. and Ollivier, P. (2016). Are French consumers ready to pay a premium for eco-labeled seafood products? A contingent valuation estimation with heterogeneous anchoring. *Agricultural Economics*, *47*, 247–258.

Sartor, P., Mannini, A., Carlucci, R., Massaro, E., Queirolo, S., Sabatini, A., Scarcella, G., Simoni, R. (2017). *Sintesi delle conoscenze di biologia, ecologia e pesca delle specie ittiche dei mari italiani*. Biologia Marina Mediterranea, published by SIBM, volume 24, suppl 1.

Sciagura, C.V. (2017). Biologia e dinamica di popolazione della triglia di scoglio (Mullus surmuletus, L., 1758) nello Stretto di Sicilia. Thesis of ecobiology. Facoltà di Scienze Matematiche, Fisiche e Naturali. Corso di Laurea in Ecobiologia (Univer. La Sapienza), Academic year 2016/2017, pp. 136.

Simmonds, J., Osio, G. C., Mannini, A. (2017). Scientific, Technical and Economic Committee for Fisheries (STECF). Mediterranean assessments 2016-part 2. Report of the STECF 17-06. Part II. EUR 28359 EN, JRC 106582. Pubblications Office of the EU, Luxembourg.

Sogn-Grundvåg, G., Larsen, T. A., Young, J. A. (2014). Product Differentiation with Credence Attributes and Private Labels: The Case of Whitefish in UK Supermarkets. J*ournal of Agricultural Economics, 65,* 368–382.

Sun, C-H.J., Chiang, F-S., Owens, M., Squires, D. (2017). Will American consumers pay more for eco-friendly labeled canned tuna? Estimating US consumer demand for canned tuna varieties using scanner data. *Marine Policy, 79*, 62-69.

Uchida, H., Onozaka, Y., Morita, T., Managi, S. (2014). Demand for ecolabeled seafood in the Japanese market: A conjoint analysis of the impact of information and interaction with other labels. *Food Policy, 44*, 68-76.

United Nations Environment Programme. (2005). *The Trade and Environmental Effects of Ecolabels: Assessment and Response.* Geneva, Switzerland: Tom Rotherham

Vitale, S., Giosuè, C., Biondo, F., Bono, G., Boscaino, G., Sprovieri, M., Attanasio, M. (2017). Are People Willing to Pay for Eco-Labeled Wild Seafood? An Overview. *European Journal of Sustainable Development*, 6, 3, 20-28.

World Business Council for Sustainable Development. (2008). *WBCSD, Sustainable Consumption: Facts and Trends.* Geneva, Washington DC, Brussels.

Xu, P., Zeng, Y., Fong, Q., Lone, T., Liu, Y. (2012). Chinese consumers' willingness to pay for green- and eco-labeled seafood. *Food Control, 28*, 74-82.

Zhou, G., Hu, W., Huang, W. (2016). Are consumers willing to pay more for sustainable products? A study of eco-labeled tuna steak. *Sustainability, 8*(5), 494.

8. The New Role of Private Sector in Community Development: A Case Study in Artisanal Fishery Communities in Thailand

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ABSTRACT:
Private sector's role in community development is often seen as a supporting organization with its own interests. Generally, a company chooses to support a particular community according to the company's strategic topic. This top-down approach benefits the company in many ways including effective operations and communications. However, its effectiveness on sustainable development of communities is questionable. As each strategic topic is heavily influenced by the company's reasoning, this approach often lacks in dimensions, has narrow focus, and therefore disconnects with the community real needs. This results in little contributions to the sustainability of the community. This proposal proposes a different approach through a case study with two artisanal fishery communities. With this new approach, the company acted as a bridging organization working closely with the communities together with other stakeholders to truly understand their needs and facilitated them in designing and implementing its own sustainable solutions. This requires changes in the company operations as well as acquiring new knowledge for its outreach team. The findings show a successful case of community development towards self-sustainable resource management. The analysis of these findings helps the company to strike a balance between "company-centric" and "community-centric" approach in the future.

Keywords: Community, Private Sector, CSR, Artisanal Fishery, Sustainable Development

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1. Introduction

The private sector role in operating its business in a way that is ethical, as well as, contributing to social, economic and environmental development at the same time is typically known as Corporate Social Responsibility (CSR). It is often viewed by the public as well as the private sector themselves as an unsuccessful and unsustainable approach of developing local communities and creating financial l benefits to the firms.

Over three decades, alarm about climate change, health pandemics, economic crisis and income inequality is increasing apace with global temperatures. The private sector, nowadays, realized that CSR has become more importance than being voluntary and

philanthropy annual activities. On the contrary, firm must embrace the benefits of integrating sustainability into their business models, budgets, practices and value chains through the concept of Creating Shared Value. This dynamic role can be defined by recognition and collaboration between multiple stakeholders i.e. employees, suppliers, national laws, international guidelines, customers, and public (local or international). These dynamic and various definitions and expectations are one of the key challenges for business with all sizes and all industries.

In the recent years, the United Nations (UN) released the Sustainable Development Goals (SDGs) which are signposts to illustrate the link between economic, social and environmental issues. To achieve the SDGs, it is well recognized that social and environment issues cannot be solved by the public sector itself. The private sector is considered as another important player in this field as it remarkably plays a role in driving national economy. In terms of involving in sustainable development, the private sector can contribute (1) sustainable production processes and technologies, (2) sustainable economic growth, (3) decent job creation and many more.

Community Development (CD) is one of the topics that has been described as one of the areas where private sector can contribute in terms of business and CSR activities inevitably interact with communities including its own employees, local community or community at a larger scale. In a broad sense, CD is an effort made by an institution or more in order to solve community problems. It is important to note that by UN definition (Mayo, 1999), CD must be carried by the community itself and with minimal help from external organizations.

This proposal examines an alternative role in which a company could take part in community development. The company's efforts are based on the UN definition where the ultimate goal of company's intervention is community's empowerment. Thai artisanal fishing communities were chosen in this study because they are one of the vulnerable groups of people whose livelihoods have been impacted by the declination of marine resources.

2. Methodology

2.1 Proposed Role

Private sector's role in rural community development is often seen as an external funding or supporting organization with its own interests. Generally speaking, a company chooses to support a particular community under a particular issue according to its strategic CSR goal and activity. For example, a company establishes its strategic topic to be improving the well-being of rural communities by focusing in providing access to medical services. When such company chooses which community to work with, it evaluates many aspects this includes locations, their needs in health care service, relationships with the company, relationships with NGO and governments, cultural difference, social and political structure, etc. Nevertheless, the chosen communities, finally, need to align with the company's strategy i.e. medical services.

On the other hand, social workers in general do not have such strict constraint. Inarguably, those from civil society organizations or academics have their own interests according to their organizations' purpose and therefore must also work towards these goals. However when comparing to a company's CSR effort, these organizations is able

to work with more freedom and flexibility. This allow them to work under variety of topics that address community's true needs.

2.1.1 Characteristics

In the light of aforementioned difference and the company's own interest in focusing on sustainable community development, a more flexible approach was initiated since the past year in several places in Thailand. Specifically speaking, the new approach of a private sector towards community development described in this paper follows similar path with those social workers and pay full attention to the community needs rather than company's own constraint. The four characteristics of such approach is depicted in Figure 2.

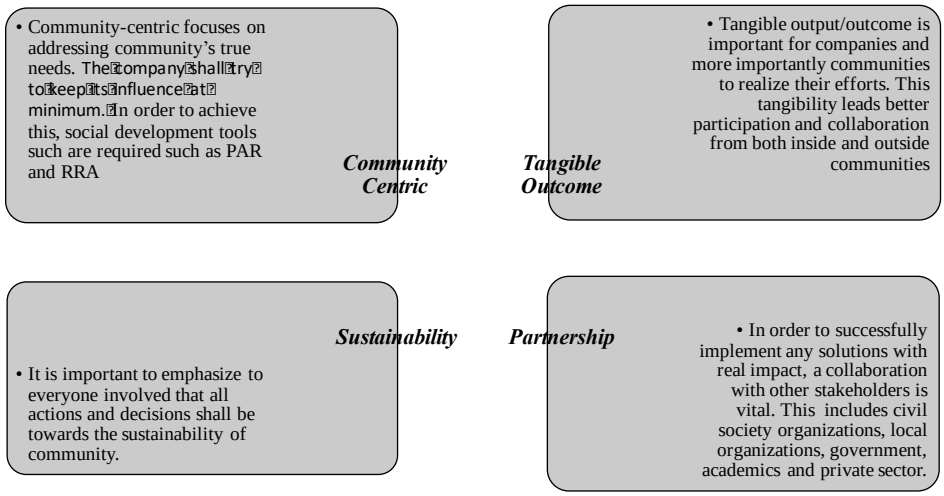

Figure 2 New Approach's Characteristics

2.1.2 Supporting Drivers

To support the four characteristics, there are a number of enabling drivers in which the company has adopted. This includes:

2.1.2.1 Dedicated Field Team

A dedicated team is essential in carrying out all engagement activities with the communities. Moreover, they are the core factor to a successful project. The composition of the team was diverse in personal competency and demography. This includes people who have background in laws, social science, and natural resource management. The aim of this is to have an interdisciplinary team as suggested in Rapid Rural Appraisal (RRA) which is one of the popular set of tools for analyzing a rural community. The field team's engagement with the community is based on the Participatory Action Research (PAR) as this type of research allows the field team to fully understand the community while at the same time was able to draw tangible outputs. This simply supports all characteristics described earlier.

2.1.2.2 Flexible Management and Operation

To effectively support the field team, a well-balanced top-down and bottom-up

management approach was required. The new community-centric approach requires that the management and operations to be adaptive and responsive. This is because each community has its own problems within its own context. An activity or a solution in one place cannot be entirely duplicate to other communities. Therefore, the management and operations must be resilience to this diverse environment.

2.1.2.3 Knowledge

Field team as well as the central management must equip themselves with extra set of skills and knowledge which are essential to meet all above mentioned requirements. These are community development, regulatory, marine resources and soft skills as summarized in

Table 1 below.

Table 1: Knowledge and Skills

Discipline	Topics
Community Development	Sustainable Livelihood Framework Community-led Resource Management or co-management Engagement and development tools such as Snowball Sampling, RRA, PRA and PAR
Marine Resource Management	Ecosystem Approach Fisheries Management (EAFM) Marine science and technology
Related Regulatory and Laws	Department of Fisheries, Ministry of Agriculture and Cooperatives Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment Marine Department, Ministry of Transportation
Management and Communication Skills	Public speaking Negotiation Conflict management Project management

2.2 Participatory Action Research

As mentioned earlier, Participatory Action Research was used as a tool for field team to approach, engage and work with the communities. The research was carried out with a close collaboration with local academics to ensuring credible results. The analysis of research is based on the following three principles: 1) Strategic Roles of Field Team 2) Sustainable Livelihood Framework and 3) Bridging Organization

2.2.1 Strategic Role of Field Team

Strategic role of the field team was defined prior any engagement work was carried out and it is essential for everyone in the team to understand their roles. It is important to stress out that their role is not typical CSR activities that concentrate on pre-identified company's interests i.e. company-centric approach. The field team is also not social a development officer from government, NGOs nor fulltime researchers. Their role is therefore unique in balancing the two ends and can be summarized as follows:

1) The field team shall work together with the communities. They shall understand the communities from inside out and able to facilitate, encourage and empower the communities.

2) The field team understand company's strategic goals and policy. They shall embed these goals into all activities and communications with the communities.
3) The field team acts as a Bridging Organization and must exploit company's strength as much as possible.

2.2.2 Sustainable Livelihood Framework

Sustainable Livelihood approaches as stated (Krantz, 2001) were considered. These include three approaches from UNDP, CARE and DFID. The DFID approach (Ashley, 1999) was selected as the basis framework for the field team's community development work. This is because unlike the other two, DFID principle emphasizes more on the analysis of the community rather than proposing steps or procedure for projects. This means it leaves room for flexibility for the implementers. Furthermore, DFID not only provides community-level analysis it also offers the analysis at a bigger picture such as policies and institutional factors.
At its core, DFID provide the following principles: People-centered, Participatory, Dynamic environment, Macro-micro links, Partnership and Sustainable. It is important to note that the four characters of the proposed approach discussed earlier and DFID principles are well aligned. Five types of livelihood assets or capitals that must be captured in order to effectively analyze the community's situation and draw out meaningful livelihood strategies that can help elevate their livelihood. These five assets are human capital, social capital, natural capital, financial capital and physical capital. These assets were captured during the research and its analysis were done with full participation with communities.

2.2.3 Bridging Organization

To aid the above strategic role of the field team, the concept of Bridging Organization (Berkes, 2009) was used to explain "how" should those strategic roles can be achieved. Bridging Organization is a crucial part in the co-management of local marine resources. Since the co-management requires effective co-production of knowledge so that power and responsibility are appropriately distributed among all stakeholders, this requires an intermediary who is the catalyst as well as a facilitator that build healthy linkages between different parties who possess different governance, knowledge and resources.

3. Results

An interdisciplinary team (i.e. the field team) was formed specifically for engaging closely with artisanal fishing communities. The team composed of people from different backgrounds including coastal resource management, business administration, and sales. A dedicated manager was assigned to manage this particular team and help link up the company's strategy and policy with the field team.

3.1 Thai Artisanal Fishing Communities

Marine fisheries contribute significantly on Thailand's economy ensuring its food security and self-sufficiency as indicated in the Marine Fisheries Management Plan of Thailand (Department of Fisheries, 2015). Thousands of lives are dependent on marine

fisheries including fisherman, and those who work in various value chains that are involved with marine fisheries. The national plan further suggests, based on a survey in 2015, that the number of artisanal fishing vessels[4] were about 78% of all fishing vessels in Thailand while their catch only contribute to only 11% of the total catch in 2014. According to the data from the National Statistical Office Thailand, there are 53,343 households who live along the 23 coastal provinces in Thailand.

The current status of Thailand's fishery resources is worrisome. According to the national trawl surveys that are carried out annually by the Department of Fisheries (DOF). The CPUE (catch per unit effort) values, that are used to represent the amount of fishing resources, have dramatically declined since 1961. Precisely speaking, the CPUE value that represents catch in the Gulf of Thailand in 2014 was only 9% of CPUE value that was measured back in 1961. Moreover, Thailand is currently harvesting more than it should i.e. beyond its maximum sustainable yield (MSY).

From aforementioned facts, the declining of marine resources in Thailand is enormous and it has been impacting the livelihood of artisanal fisher folks as they are heavily relying on marine resources. Together with the fact that artisanal fisher folks often lack in livelihood security for example there are issues such as land rights, fishers' legal status, and financial accessibility, it is therefore not an overstatement to say that artisanal fisher folks in Thailand are considered as one of the vulnerable groups. Many of their communities are now facing severe social and economic problems. Some are even facing the collapse of its identity and traditional culture.

There were two artisanal fishing communities in Songkhla province, the southern coast of Thailand, where the team worked closely with. First community was located in Rawa Sub-District and the second one was located in Sanamchai Sub-District. Both of these communities are rather small in terms of vessels and households. They were struggling with the decline of coastal resources. For example, the artisanal fishermen in Rawa community were able to catch blue swimming crabs at the rate of 30-40 kilograms per catch effort in 2007 but the number has dropped to 5-6 kilograms in 2017. Even though, the market price of these blue swimming crabs has indeed gone up, this does not compensate the loss of quantity and hence the overall income declined along with the marine resources. This insecure income inevitably impacts their traditional pride and culture as less pupils were going to continue their fishing legacy and moved in to towns or worked at factories, conventional stores and worse became involved with illegal activities.

It is important to mention that these two communities did not abandoned their values and cultures altogether. They initiated marine resource improvement programs with the help from external sources particularly from local NGOs and local government bodies such as the Southern Gulf Fisheries Research and Development Center (SMDEC) which is under the Department of Fisheries and the local branch of Office of the Non-formal and Informal Education which is under the Ministry of Education. These programs were particularly involved with the concept based on local-run burry crab hatchery system i.e. Crab Bank (Jöhl, 2013) that aims at enhancing the stocks of blue swimming crabs in the coastal areas. However, up until 2017, these initiatives were not successfully implemented

[4] Artisanal fishing vessels are grouped into two groups: (1) Small artisanal fishing vessels are those with engine power less than 180 horsepower and less than 5 gross tonnages; and (2) Large artisanal fishing vessels are those with engine power between 180-220 horsepower and capacity between 5 to 10 gross tonnages.

nor self-sufficient in the sense that the two communities are relying heavily on external funding.

3.2 Community Engagement

The field team started to engage Sanamchai since November 2016 and Rawa since January 2017. Over the range of one year, engagement activities can be summarized into four phases as shown in the

Table 2.

Table 2: Research Phase

Phase	Main activities	Output/Outcome
1. Preliminary data collection	Approach communities Short-term CSR activities Gathering general information about the communities through semi-structure interview and observations.	Team increase their understanding about the communities Building trust and relationship Workable data for next steps
2. Acquiring knowledge	Link to experts from academics and government through meetings and small workshops Visit other success communities and learn from case studies Research methodology and participatory approach	Communities and team learn more about development methodology Communities understand about PAR and teams' objectives
3. Livelihood strategy	Five assets and SWOT analysis Research topic identification Designing approach and plan out activities Roles and responsibilities	Analysis of community's assets Research question and approach identification Implementation plan
4. Implementation and Evaluation	Carry out activities as plan Monitoring and analyze for continuous improvement i.e. modify plan if needed Project assessment	Data collection system Success factors and challenges Future plan

3.3 Community Empowerment

Though Sanamchai and Rawa artisanal fishing communities are rather close in proximity (about 20 kilometers distance), their contexts especially in terms of social capital were different.

Artisanal fishing community in Sanamchai sub-district is no stranger to the idea of "People Organization". Its leader shown his understanding in the importance of a strong community's organization. In 2010, he was one of the pioneer who helped organizing the cooperative for artisanal fishermen in Songkhla province. In the same year, the community also initiated a community-based saving group that aimed at helping fellow fishermen particularly in household's financial access and saving discipline. From 2011, onwards they have been actively engaged in coastal resources enhancement activities including fish enhancing devices (FED), beach cleanup and berried crab hatchery system that aims at enhancing blue swimming crab population (Crab Bank). However, the crab hatchery system was not successful.

Artisanal fishing community in Rawa sub-district have been experiencing the declination

of marine and coastal resources for the past ten years. This declination became prominent in the last five years. This community has no experience in any community-based activities nor setting up formal community-based organization.
With different backgrounds and contexts, activities and livelihood strategies are different as shown in
Table 3.

Table 3: Livelihood Strategy

	Local Context	Analysis	Livelihood Strategy
Sanamchai	Existing community-based organization Strong linkage with local CSOs Marine resources severely damaged Experienced with unsuccessful initiatives	Strength: Experienced personnel (human capital) with strong networks Weakness: doubtful members and severe resources that prevent community-based Crabs Bank (or any other marine animals) opportunities	Conservation Areas with community rules that govern how local resources can be used. The aims at 1) conserving marine resources 2) strengthen co-management efforts
Rawa	No experience with community-based organization Marine resources declined but not as severe as Sanamchai	Strength: Open minded and willing to accept new knowledge Weakness: Lack of experience and require participation	Crab Bank that aims at increasing community's participation, community's awareness on resource management and crabs population

3.3.1 Sanamchai Community

As mentioned earlier that Sanamchai initiated a "crab bank" that aims at enhancing crabs stock in 2011. The crab bank model adopted in Sanamchai was based on Donation model (described in the Crab Banks: a Literature Review (Jöhl, 2013)) such that the gravid female crabs were donated to the bank where they were carefully put into small rearing tanks. The zoeas of these newly spawn crabs were released back to the sea. The female crabs were then return to the owners.
When the field team engaged with the community in 2016, it was found that there was lack of participation from fellow community's members. It was reported that very little to none gravid female crabs were donated to the bank. It was speculated by the communities that the high price of crabs has put negative incentives to their members who were more likely to sell their crabs to the market instead of donating them to the bank. Furthermore, as the model of their crab bank does not incorporate any income to support their operation and maintenance. It was extremely difficult to maintain crab bank. Their crab bank was basically finally abandoned and left with only empty house and tanks.
During the initial phase of engagement, the field team facilitated the learning process (i.e. capacity building) of the community in a number of areas that were within community's interests. These were community's saving group, coastal conservation area and community's rules, and crab bank management and operation. They visited a number of artisanal fishing communities who have experience and successful in those areas. The field team then organized a number of meetings where the community members analyzed and drew conclusions on what have they learnt from each of the visit and how would

these case studies be applied to their own.

After several meetings and workshops, the team facilitated the livelihood strategy designing process with the community based on the Five assets and SWOT analysis. The community agreed that designated coastal conservation areas where agreeable local rules are used to govern marine resources within the area. This was due to the fact that, the result from analysis showed that the very reason that bank crab and other conservation activities did not success was because there was no supportive mechanism. That is, any efforts in enhancing marine resources such as increasing crab stocks (releasing baby crabs) or introducing environmental friendly fish enhancing devices (FED) were not effective as once crabs were releasing back to the sea they have little chance surviving and reproducing. Similarly, as FEDs were installed in area that were not governed by any rules and participation from fishermen in the area, they were used as fishing tools instead of conserving them.

Therefore, a supportive mechanism for effective conservation is required. That is a proper designated conservation area should be established. The process of this establishment shall encourage full participation from local fishermen and stakeholders in the area. These participations will enable a recognition by all stakeholders especially those government bodies who have authority over such coastal area. Furthermore, they should agree on "how" the conservation area should be governed as well. This include rules and enforcement.

3.3.2 Rawa Community

On the other hand, while artisanal fishermen in Rawa is experiencing similar declination of coastal resources, they were very new in organizing any conservation activities and efforts.

The team engaged the community early January 2017 and learnt that the community's leader was interested in implementing crab bank within the community based on the introduction of the concept by the local branch of Office of the Non-formal and Informal Education. At the time they were particularly interested in financial support from private sector rather any other kind of support. The company was introduced to this community by an officer the Non-formal and Informal Education which is under the Ministry of Education.

During the capacity building phase, since the community members had shown particular interest in implementing crab banks, they were therefore exposed to the management of crab bank and related conservation area. They visited several successful communities. Followed by a number of meetings and workshops, the field team facilitated the livelihood strategy designing process with the community based on the Five assets and SWOT analysis. The crab bank model, implementation plan, management, data collection and assessment was designed by the community with the help of field team.

The funding from the company together with the funding from the Southern Gulf Fisheries Research and Development Center (SMDEC) enabled the crab bank project to move forward. The crab bank was a hybrid model in which the participated fishermen have the choice to either donate or sell the gravid female crabs to the bank. This allow crab bank to have flexibility in gaining participation and have income to support the operation of crab bank at the same time. Later in July 2017, the community's efforts received an official recognition by the DOF by winning an award for being the best

community (within the area of five provinces) for their initiative in community-based fisheries management.
Furthermore, the community has initiated the process towards their conservation zone together with local rules. However, this is still in its early stage as no official recognition from authority was received and that not all stakeholders were included in the designing process.

4. Discussion and Analysis

4.1 Field Team Empowerment

After one-year engagement with the two artisanal fishing communities, field team as well as central management learnt three crucial facts that are required for community development work:
(1) Earning trust is vital and as a company this may be more difficult than CSOs, academics or even government staff. This is especially true if community has negative view about the company.
(2) Each community is unique. We cannot and shall not copy-and-paste solutions nor assumptions.
(3) Community organizations and community engagement principles and tools are important and should be learnt very quickly.

4.2 Bridging Organization

As a bridging organization, the company helped link "scientific knowledge" with "local wisdom" and "local institutes" with "government bodies". The factor that encourages the very existence of bridging organization in artisanal fishing community development in Thailand is the known fact that there is an immediate need to establish the co-ownership on marine and coastal resource. This is fundamental for inclusive development and co-management towards sustainable livelihoods and marine resources.
The above factor clearly identifies the role of a bridging organization i.e. gathering of different stakeholders, creating the environment that encourage a single set of shared visions and goals by building trust and respects that are based on equality and justice, and finally stakeholders' harmony roles and responsibilities must be clearly identified and executed.
Base on the field team's experience, its role as a bridging organization has been successful this was due to the fact that all stakeholders had common realization and goal towards coastal and marine resources. They all (including government bodies) realized that marine resources were heavily degraded to the point that they all must do something to rectify this. More importantly, they all realized that in order to address this issue they all need to work together but there was no appropriate stage nor opportunities for them to work together. The team effort as a bridging organization filled in this gap and therefore experienced good participations from all parties.

4.3 The New Role

As suggested in the journal on CSR roles in community development (ISMAIL, 2009), common roles of CSR in community development involve transferring knowledge, strengthening relationship, and gathering data. It is clear that the proposed approach in

the paper is unique in its own way. On surface, the proposed approach shares several aspects with other previous approaches such as they involved building healthy relationship with communities and transferring own knowledge and technology. However, for the proposed approach, these overlap subjects are simply a tool (or a means) and not the goal (or an end).

The main difference is the perspective of which the company took or choose to tackle social issues in community development. The new role suggests that while the company should exploit its knowledge and leverage its strength as much as possible, this exploitation shall not burden the community's sustainable livelihood strategy and the company shall facilitate such livelihood strategy as much as possible through the role of bridging organization.

This new role of private sector requires new type of investments and as a result the company who adopted this role needs to innovatively create how to benefit from this. These new investments do not only cover social development activities, they also cover investments for human capitals, organizational changes, new processes and network development. In order to benefit from the new role, the company must understand and measure the success or return on investment in a total different view. For example, with traditional CSR role in community development, it is easy to monitor progress, measure success, and most importantly to communicate and advertise to public. However, the new role will leave a company with various topics and social issues that are dependent on communities' sustainable livelihood strategies. The same thinking that the company used to do to monitoring progress, measuring output/outcome, and communication is no longer apply.

Conclusion

The new role of private sector in rural community development is proposed in this paper. The approach was experimented in two artisanal fishing communities in Thailand and shown promising results. The role is based on the concept of Bridging Organization and Participatory Action Research. That is the company facilitated the two communities by means of linking them with other organizations, external knowledge as well as extending their networks that are essential for achieving their sustainable livelihood strategies. The company also helped in the process of developing livelihood strategies based on the DFID livelihood framework and its five assets. Furthermore, PAR provided the team with community engagement tools, collection tools and analysis. It also supports the inexperienced field team with proven research methodology and principle. Results shown promising community development cases in which one of the two communities had in fact received a community-based fisheries management from the department of fisheries. Finally, this new role introduces new investments especially in social and human capitals and therefore require innovative ways that the company must consider in order to fully benefit from their efforts.

References

Adam A. Kowalski, L. D. (2015). The role of bridging organizations in environmental management: examining social networks in working groups. *Ecology and Society, 20*(2), Art. 6.

Ashley, C. a. (1999). *Sustainable livelihoods: Lessons from early experience*. London: DFID.

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management , 90*(5), 1692-1702.

Department of Fisheries. (2015). *Marine fisheries management plan of Thailand: a national policy for marine fisheries management (2015–2019)*. Bangkok: Ministry of Agriculture and Cooperatives.

Ismail, M. (2009). Corporate Social Responsibility and Its Roles in Community Development: An International Perspective. *The Journal of International Social Research, 2/9*, 199-209.

Jöhl, A. (2013). *Crab Banks: a Literature Review*. International union for conservation of nature. Bangkok: IUCN Southeast Asia Group.

Krantz, L. (2001). *The Sustainable Livelihood Approach to Poverty Reduction: Introduction*. Swedish International Development Cooperation Agency, Division for Policy and Socio-Economic Analysis. Stockholm: Swedish International Development Cooperation Agency.

Mayo, S. B. (1999). Culture, community development and representation. *Oxford University Press And Community Development Journal*, 191-204.

9. Carbon Footprint of the Coffee Roasting Process based on Two Technologies with Different Sources of Energy in Peru

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ABSTRACT:
The objective of this study was to determine and to compare the Carbon Footprint (CF) of the coffee roasting process carried out by using two technologies with different energy sources. To this aim two coffee roasting companies were selected in the rainforest of Peru. These companies apply concentrated solar and photovoltaic energy, and electricity from the local grid as source of energy during the coffee roasting process. For this determination, primary data was collected from the two companies located in the province of Junin. The information obtained was analyzed according to the procedures and requirements of ISO 14040 (Life Cycle Analysis) to obtain the carbon footprint, and then processed with the software "SimaPro" to evaluate the environmental impacts due to the effect of climate change. The results indicated a CF of the solar energy roasting process of 0.318 and a CF of the local electricity grid production of 0.744 kg CO2 -eq per kg of roasted coffee. This represents a difference in greenhouse gasses (GHG) emissions of 134%. Within the factory activities, the stage with the greatest environmental impact or "hotspot" was the roasting stage, where the most sophisticated machines are used and generate higher emissions from the combustion of fossil fuels. From this, proposals and recommendations to improve the strategies include an approach to clean energy technologies for a sustainable development in the sector, among others.

Keywords: LCA, carbon footprint, roasted coffee, renewable energy, Concentrated Solar Power, photovoltaics, solar energy

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Keywords: LCA, Carbon Footprint, Roasted Coffee, Renewable Energy, Photovoltaics, Concentrated Solar Energy

1. Introduction

Coffee is the main agricultural export product in Peru. It accounts 85% of the total crop exports and it is already delivered to 48 countries (Huerta- Mercado, 2012). Also, coffee has a very important role in the national economy. This commodity is the main livelihood of about 223,000 families from small producers in 425,000 hectares distributed in 17 regions (Agencia Andina, 2016).
Junin coffee production represents roughly 27% of the national production and it is now considered the most important coffee producing region of the country (The World Bank, 2016). In Satipo, a province in the region of Junin, coffee production accounts roughly 90% of its GDP. In this region, Chanchamayo and Satipo provinces perform this activity

at a massive level, where 50% of its arable land is coffee (CRS, 2005). Also, national production shares from Satipo and Chanchamayo account 10% and 17%, respectively (The World Bank, 2016).

From the other side, there is enough scientific based evidence that shows climate sensitivity on coffee in terms of coffee suitability, yield, pests, diseases and farmers livelihood (Laderach, P. et al, 2017). For instance, a minimum variation in temperature of half a degree can make a big difference in coffee yield, flavor and aroma. This will turn into negative effects at the level of development in the coffee producing countries, and it will make difficult to respond to the global demand for this product (Watts, C.; 2016).

In Peru, the increase of temperatures and unpredictable weather patterns are changing historic trends in coffee growing areas. Crops lifespan is becoming shorter and farmers are reporting that the current typical behavior and maturing of coffee trees are tending to be at high-altitude than their low land counterparts. Also, floods, landslides and stronger winds are constantly damaging infrastructure and coffee plantations (ITC, 2016).

This decay of the coffee production is often addressed due to climate change events. For instance, considering that water is the most important input in coffee cultivation, rains are no longer predictable and these often appear when these are not required. Also, coffee productivity is not consistent (Gestión, 2012).

In response to this situation, the coffee sector is promoting solutions based on the transition to a sustainable low-carbon economy. For example, companies in the sector are implementing mitigation and adaptation strategies, which include the compliance with sustainability standards and certifications, the use of clean technologies and renewable energy, among others (Dominguez, S.; 2016). Within this path, mitigation strategies involving such as the implementation of clean technologies in the sector will contribute to the reduction of environmental impacts and will provide services to the habitants of the area (UNDP, 2012; Powermundo, 2016).

The present study aims to estimate and to compare the Carbon Footprint of the Coffee Roasting process that is performed with two technologies with different sources of energy following the Life Cycle Assessment (LCA) methodology. One company that is located in a rural rain forest area uses solar energy and solar concentrated energy, and the other company that is located in an urban area performs its activities with energy that comes from the local grid. Even though the company with clean energy based technology is one of the very few examples in the Peruvian coffee sector, insights and recommendations are brought in the behalf of the sector within a low-carbon economy.

2. Methodology

For this determination, primary data was collected from the two companies located in the province of Satipo, Junin, Peru. The information obtained was analyzed according to the procedures and requirements of ISO 14040 (Life Cycle Analysis) (see Figure 1).

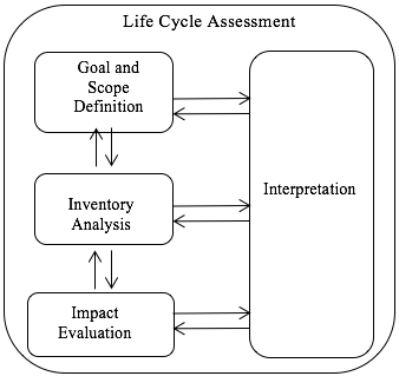

Figure 1.- Life Cycle Assessment Framework. (Source: own construction).

This management tool, which will be used in this study for environmental purposes, has the objective to identify the opportunities within the life cycle of a product or service, to reduce the consumption of non-renewable resources, the emissions and environmental impacts, to improve the performance of the processes involved, among others (Dantes, 2016; Tree). Later, the information gathered is processed with the software "SimaPro" to evaluate the environmental impacts due to the effect of climate change that will turn into the Carbon Footprint (CF).

The use of the LCA includes four main phases that will be develop in the present study: Definition of the Goal and Scope, where the limits of the study system are defined and the functional unit is determined. The inventory analysis, which consists of the collection and quantification of inputs and outputs of the product or service throughout its life cycle.

Then, the impact evaluation, which assess and quantifies the magnitude and significance of the impacts that occur in the water, in the soil, and/or in the air. Also, the impact categories to be analyzed are chosen (eutrophication, acidification, toxicity, etc.) here. Finally, the interpretation phase, where the conclusions and recommendations are generated for a further improvement within the systems analyzed (PRé Sustainability).

2.1 Scope

The scope of the current study is gate to gate. The activity assessed is the Coffee Roasting process that includes three stages: Selection, Hulling and Roasting. The following diagram corresponds to the Process of roasted coffee production based on two different roasted technologies that use different energy source (see Figure 2).

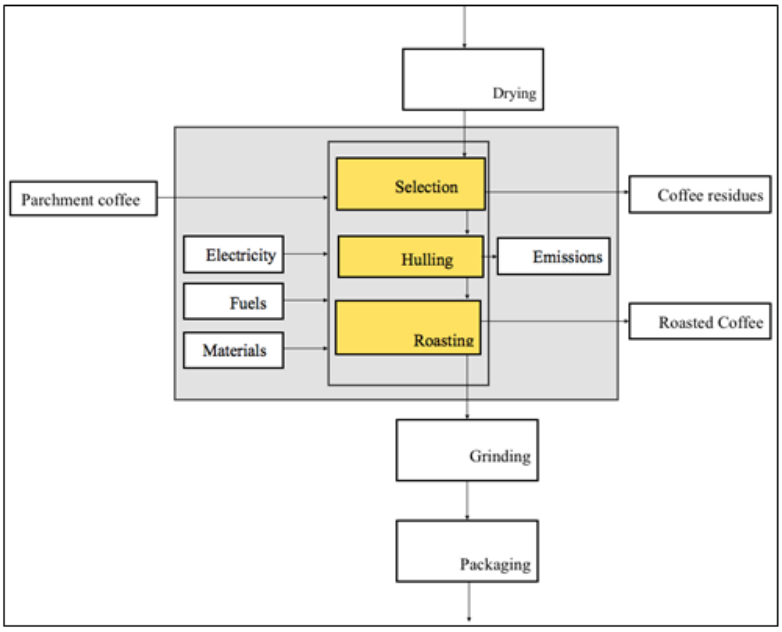

Figure 2.- The scope of the study is presented within the grey rectangle. It includes the inputs and outputs already mentioned. Also, the yellow rectangles are the stages assessed in the current study (Source: own construction).

The functional unit defined for this study was one kilogram of roasted coffee medium degree. Therefore, the results of the carbon footprint are presented as kilograms of carbon dioxide (CO2-eq) per one kilogram of roasted coffee (kg CO2-eq/kg roasted coffee).

Data collection was performed during the month of July 2017 in a visit field to the companies based in Satipo, Junin. Also, phone calls were made. Data corresponds to the frame time of June 2016 to June 2017. Some important inputs are located into chart 1.

Chart 1.- Main information of the two companies assessed *(Source: own construction).*

Company	Solar Energy based	Local Electricity Grid based
Location	Rural area, rain forest	Urban area
Energy source	Photovoltaic, Concentrating Solar	Electricity, LPG
Annual production of roasted coffee (kg)	705.4	1772.1
Roasted coffee medium degree production (%)	100	70
Material based stages	Hulling, Roasting	Selection, Hulling, Roasting

2.2 Inventory

Inputs are electricity, fuels and materials for the equipment and facility. Outputs are coffee residues (e.g.: coffee defects) and emissions from the fuels used. Also,

production of this materials and electricity generation are included based on a Peruvian average (see Figure 2).
For the Carbon Footprint calculation, SimaPro and Eco Invent database was used. Within this library, some assets that came out into the current study were not identified. To provide a solution, technologies were disaggregated into the most representative parts (steel, aluminum, mirror, as photovoltaic panels, batteries, LPG, among others). Within this process, inputs were modeled depending on the lifetime of the technology that are part and of the quantity of raw coffee that pass through these assets.
Moreover, only the main material of the technologies that were modeled is considered in the current study. The lifetime required for the calculation of the material flow corresponds to the whole technology. Also, to estimate the carbon contribution of the fuels used within this study, carbon dioxide emissions coefficients were identified following literature about the calculation of GHG emissions (Oficina Catalana del 'Camvi Climàtic, 2011).

3. Results

1. Carbon Footprint of the Coffee Roasting Process
The results indicated a CF of the solar energy roasting process of 0.318 and a CF of the local electricity grid production of 0.744 kg CO2-eq per kg of roasted coffee. This represents a difference in greenhouse gases (GHG) emissions of 134%.

Also, Energy Generation inputs are the most intensive contributors in both processes. From a Solar Energy based production, the production and distribution of main materials of the Solar Concentrator and the PV System accounts 0.252 kg CO2-eq/kg roasted coffee and represents 79% of the total CF (see Figure 3).

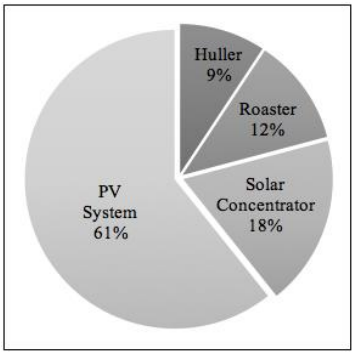

Figure 3.- Carbon Contribution in Solar Energy Roasted Coffee Production (Source: own construction).

From the other side, Energy Generation inputs from the Local Hydropower Electricity Grid accounts 0.724 kg CO2-eq/kg roasted coffee and represents 97% of the total carbon contribution of this process. An LPG fuel emissions input, which only accounts in this second local grid energy process, accounts 0.586 kg CO2-eq and represents 79% of the CF. This is due to the combustion of LPG fuel during the roasting stage for heating the drum.
Production of main materials for technologies in the all the process does not impact

significantly (less than 3% in total). There, the Energy Generation input based on hydropower energy accounts 18% of the total carbon contribution. This includes electricity production and distribution from the local grid, and LPG production. Therefore, the largest contribution within this process is due to the emissions generated within the LPG combustion for the thermal energy production used in the roasting stage (see Figure 4).

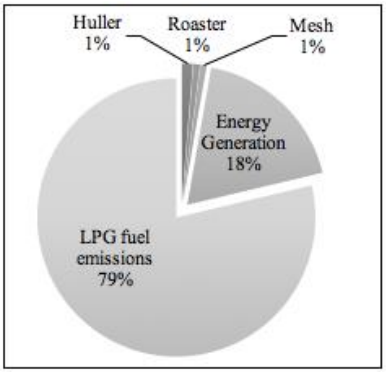

Figure 4.- Carbon Contribution shares of Local Hydropower Electricity Grid based Production (Source: own construction).

2. Carbon Contribution in Electricity Grid Roasted Coffee Production

Energy production in Junin is almost 100% hydropower source. There exists a negligible participation of thermal energy production that will not be considered in this assumption (INEI, 2014).

However, "peak hours", which means a large amount of energy consumption in the region in specific periods of time during the day, promote thermal energy production to fulfill this demand. This variation between energy shares is unknown. Due to this context, the system mentioned before will be assessed within two different scenarios: energy input as 100% Hydropower source and Peruvian Electricity Mix source.

The exchange of Local Hydropower Electricity Grid to the Peruvian Electricity Grid within the coffee roasted production varies from 0.744 to 0.801 kg CO2-eq and represents a 7% increase in the total carbon contribution (see Figure 5).

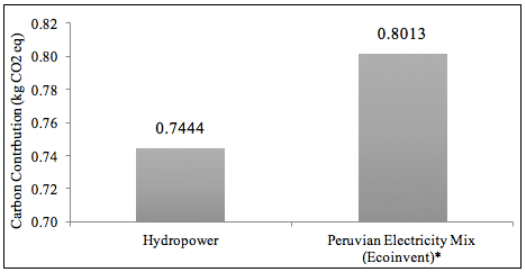

Figure 5.- Carbon Contribution in Electricity Grid Roasted Coffee Production with different Energy Matrix (Source: own construction).

From the other side, the energy consumption assessment was performed with the

EcoInvent database. There, the Peruvian electricity matrix available was from the year 2008 and had the following electricity generation (Caceres, A., 2016) (see Figure 6).

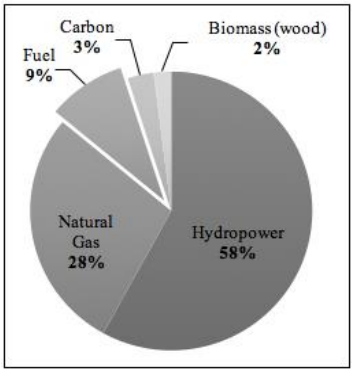

Figure 6.- Peruvian Energy Matrix in 2008. (Source: Cáceres, A.; 2016)

Between 2008 and 2016, the reduction of energy generation from fossil fuels was about 9%. The Peruvian energy matrix has kept the contribution of hydropower and thermal energy as main sources of electricity in the country (95.5% by June 2016). This points to an advantage in environmental terms due to the country's natural geographical conditions (IBD, 2010).

Into this perspective, investment for electricity generation based on clean energy sources such as Eolic, Solar, Geothermal, Biomass and others are being promoted along the country. By June 2016, the contribution of this clean energy sources accounted roughly 4% of the total energy generation. This is a very important point of start considering that clean energy participation by December 2011 was less than 1% (PCR, 2016) (see Figure 7).

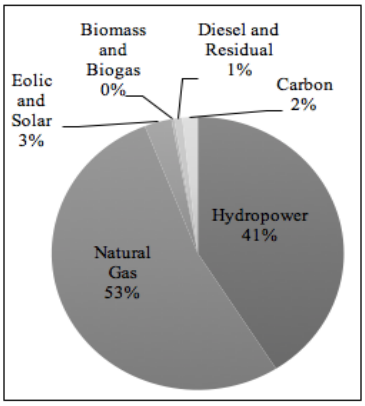

Figure 7.- Peruvian Energy Matrix in November 2016 (Source: Delta Volt, 2017).

3. Carbon Contribution in Roasted Coffee Production Facilities

The facilities of the production of roasted coffee by Solar Energy are of material of way, whereas the installations of the process by Electricity coming from the Local Network are of concrete.

The facility input in the Solar Energy based production represents 30% of the carbon contribution of this process stated in figure 18. This accounts 0.135 kg CO2-eq and is the second largest contribution after the PV system with 0.193 kg CO2-eq and a share of

43% within the whole process.
From the other side, the facility input in the local grid electricity generation roasted coffee production accounts just 5% of the carbon contribution of this process stated in Chart 2.

Chart 2. Carbon Contribution in Roasted Coffee Production (Source: own construction).

Type of Production	Carbon Contribution (kg CO_2-eq)	Carbon Contribution + Facility (kg CO_2-eq)
Solar Energy based	0.3178	0.4529
Local Hydropower Electricity Grid	0.7444	0.7857

4. Conclusions

1. The current study showed that the Local Hydropower Electricity Grid Roasted Coffee Production accounts the most intensive production process with 0.744 kg of roasted coffee versus 0.453 kg CO2-eq emitted in the Solar Energy based Roasted Coffee Production. This 139% difference is mainly because the use of LPG fossil fuel that contributes to a 79% of the carbon contribution.
Across the coffee roasting process, the highest volumes of greenhouse gases are produced during the roasting stage due to the combustion of fuel for heating purposes. As a result, the main focus of the companies involved should be to improve their environmental performance in this stage. Then, different solutions can be considered, such as a change of energy matrix, a shift to more sustainable fuels, an improvement in efficiency in the process, as well as a shift to more sustainable technologies.
2. The material based facility can increase the carbon contribution from 5 to 30%. Even though facilities have a considerable impact, these are not linked to roasting technology. Thus, facilities should not be included when comparing roasting technologies.
3. The selection of Peruvian Energy Matrix for Electricity Generation does not have a major effect on the results. This is due to the important contribution of the hydropower energy source within the Peruvian energy matrix (Catholic Relief Services, 2005).

5. Discussions

1. Carbon Footprint, one of the indicators of the Life Cycle Assessment methodology helps us to make decisions on how to improve our environmental performance. Moreover, the the facility of communication and the understanding by the public is the main advantage of this impact category compared to a full LCA. Thus, the Carbon Footprint tool is also considered a marketing tool for manufacturing industries not only to show their commitment to reduce the environmental impact, but also to highlight the sustainability of their products (UNESCO, 2012).
2. Research on LCA and Carbon Footprint at a roasting level is often less likely to be developed since the cultivation stage accounts about 70% of the carbon contribution in the whole life cycle coffee production process. That stage includes agricultural inputs and emissions that affect directly biodiversity, water bodies and land erosion. However, there are other examples that provide results where inputs such as electricity consumption and fossil fuel are considered. Within this path, roasting stage accounts from a negligible value up to 6% of the total carbon contribution in its whole life cycle (BALAS, 2012; Pilotprojekt Deutschland, 2008; ITC, 2012 and Salomone, R.; 2003). Nevertheless, studies

like the present research allow the recognition of these initiatives towards the reduction of environmental impacts in the sector as a mitigation strategy to tackle climate change.

References

Agencia Andina (2016). *Al servicio de tu Economía: La producción de café y su aporte al PIB agrario.* [Audio file]. Retrieved from https://soundcloud.com/agenciandina/cafe-pbi-peru.

BALAS (2012). *Carbon Footprint Across the Coffee Supply Chain: The Case of Costa Rican Coffee*. Retrieved from http://www.balas.org/BALAS_2013_proceedings_data/data/documents/p639212.pdf.

Banco Interamericano de Desarrollo (BID) and Consorcio de Investigación Económica y Social (CIES) (2010). Las Barreras del Crecimiento Económico en el Perú. Lima, Perú: Ediciones Nova Print S.A.C.

Banco Mundial. (2016). Análisis Integral de Logística en Perú. Parte 2b: Resultados por productos: Café. Retrieved from https://www.mincetur.gob.pe/wp-content/uploads/documentos/comercio_exterior/facilitacion_comercio_exterior/Anexo2_Producto_Cafe_Final.pdf

Cáceres, A. (2016). *Análisis de Ciclo de Vida Comparativo de Edificaciones Multifamiliares en Lima*. (Bachelor Dissertation). Pontificia Universidad Católica del Perú. Lima, Perú.

CEPAL (2016). *Nota Técnica 1: Calcular los Índices de Desarrollo Humano*. Retrieved from https://dds.cepal.org/infancia/guia-para-estimar-la-pobreza-infantil/bibliografia/capitulo-III/Calculo%20IDH.pdf

Dantes (2016). *More About LCA.* [blog post]. Retrieved from http://www.dantes.info/Tools&Methods/Environmentalassessment/enviro_asse_lca_detail.html

Delta Volt (2017). *Energía Hidroeléctrica, Energía Tradicional del Perú*. [blog post]. Retrieved from http://deltavolt.pe/energia-renovable/renovable-peru

Dominguez, S. (2016). *Grano de Oro: Café nuestro de cada día.* Retrieved from http://www.elperuano.com.pe/noticia-cafe-nuestro-cada-dia-41523.aspx

Gestión (2012). *La producción de café caerá un 25% este año*. Retrieved from http://gestion.pe/noticia/323656/produccion-cafe-caeria-25-este-ano

Huaro, V. (2008). *Plan de Desarrollo Regional Concertado Junín 2008- 2015*. Retrieved from http://www.regionJunín.gob.pe/ver_documento/id/GRJ-144750a3caba5d02ac914b7144f171cb00a875.pdf/

Huerta- Mercado Herrera, E. (2012). *Café, el primer producto agrícola de exportación del Perú.* [blog post]. Retrieved from http://innovasupplychain.pe/articulos/4638-cafe-primer-producto-agricola-de-exportacion-del-peru

Catholic Relief Services (2005). *Diagnóstico de la Cadena de Valor del Café de Satipo y Chanchamayo.* Retrieved from http://www.corladlima.org.pe/index.php/services/category-list?download=24:centro-dedocumentacion-virtual&start=20

Instituto Nacional de Estadística e Informática (2014). Electricidad y Agua. In INEI (Ed.), *Compendio Estadístico Perú 2014* (pp. 1133- 1150) Lima, Perú: Instituto Nacional de Estadística e Informática. Retrieved from https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1173/cap16/cap16.pdf

International Trade Center (2010). *Climate Change and The Coffee Industry*. Geneva, Switzerland: International Trade Center.

Laderach, P., J. Ramirez Villegas, C. Navarro-Racines, C. Zelaya, A. Martinez Valle & A. Jarvis. (2017). Climate change adaptation of coffee production in the space and time. Climatic Change. 141 (1), 47- 62. doi: 10.1007/s10584-016-1788-9

Oficina Catalana del 'Camvi Climàtic (2011). *Guía Práctica para el Cálculo de Emisiones de Efecto Invernadero (GEI).* Retrieved from http://www.caib.es/sacmicrofront/archivopub.do?ctrl=MCRST234ZI97531&id=97531

Pilotprojekt Deutschland (2008*). Case Study Tchibo Privat Kaffee Rarity Machare by Tchibo GmbH*. Retrieved from http://www.pcf-projekt.de/files/1232962944/pcf_tchibo_coffee.pdf

Powermundo (2016). *Accesso a la Energía en el Perú.* [blog post]. Retrieved from http://www.powermundo.com/es/el-reto/acceso-a-la-energia-en-el-peru/

PRé Sustainability. Retrieved from https://www.pre-sustainability.com

Programa de las Naciones Unidas para el Desarrollo (PNUD) (2012). *Tres millones de peruanos de la zona rural no tienen acceso a energía eléctrica.* [blog post]. Retrieved from http://www.pe.undp.org/content/peru/es/home/presscenter/articles/2012/09/06/tresmillones-de-peruanos-de-la-zona-rural-no-tienen-acceso-a-energ-a-el-ctrica.html

Salomone, R. (2003). Life Cycle Assessment Applied to Coffee Production: Investigating Environmental Impacts to Aid Decision for Improvements at Company Level. Food, Agriculture & Environment, 1(2), pp. 295-300.

The World Bank Data. *Access to Electricity (% of population)*. Retrieved from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

Tree (s/f). *LCA (Life Cycle Assessment) and Carbon Footprint*. Retrieved from http://treeng.com/en/environment/lca-life-cycle-assessment-and-carbon-footprint

UNESCO (2012). *Carbon and Water Footprints: Concepts, Methodologies and Policy Responses*. Retrieved from http://www.unesco.org/new/en/naturalsciences/environment/water/wwap/publications/side-publications/carbon-and-waterfootprints-concepts-methodologies-and-policy-responses/

Watts, C. (2016). The Climate Institute. Sydney, Australia: The Climate Institute.

10. An Analysis of the Western Balkans Power Market Prices within the ENTSO-E framework.

Dr. Aranit Shkurti

ABSTRACT:
This paper analysis the Western Balkan power market, taking in consideration 4 countries from the Area: Albania, Croatia, Bosnia and Herzegovina, and Montenegro. All these countries are members of the European Network of Transmission System Operators, an association of 43 electricity transmission system operators (TSOs) from 36 countries across Europe. Quarterly panel data for this 4 Balkan Countries are used. These variables are used to generate VCM models that estimate their relationships in the energy market and the integration level of these markets. The Western Balkan countries have difference composition of their electricity supply mainly based on hydropower generation or thermo power generation. Currentlty this systems face market inefficiencies and power outages. The aim of these models is to show how the hydroelectric generators of some countries can use their water storage capacities strategically to mainly affect off-peak prices, while heat generators of other countries can manage their capacity strategically to influence peak prices. The potential of regional coordination has been highlighted also by the European Commission within the recent legislative proposal, "Clean Energy Package for All Europeans". The aim of this paper, is to raise awareness on the need to have more regulatory alignment in the Western Balkan region to remove the economic and political barriers between these countries.

Keywords: electricity market, energy planning, EU integration, power outage, barriers.

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1. Introduction

The region of the Western Balkans, a term coined by the European Union in the late 1990s, includes Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro and Serbia. All of the countries of the region with the exception of Albania are successor states of the former Socialist Federal Republic of Yugoslavia, and all seven are ex-Communist states. This legacy has important implications for the state of the present-day energy systems of the Western Balkans.
Electricity trading across borders is a key element of EU energy policy. Three regulatory packages have opened up formerly isolated EU markets and introduced cross-border trading through liquid spot markets, with a view to removing the barriers to an internal electricity market covering the entire EU. As Contracting Parties to the Energy Community Treaty, the Western Balkan six countries ('WB6 countries') have followed this development, including full implementation of the Third Energy Package by 1 January 2015. WB6 countries committed in Vienna in 2015 to implement a list of energy legal and regulatory measures, which are necessary to establish market-based electricity trading. These commitments remain valid. They include developing spot trading and regional market coupling, regional balancing and regional capacity allocation. They also

include the removal of existing legal and regulatory barriers by, inter alia, full implementation of the Third Energy Package and additional market reforms.
The recently signed Memorandum of Understanding of the WB6 on regional electricity market development ("MoU") constitutes the basis for further regional market integration; it is a positive signal in the right direction. A central element is now how to continue national reform and regional market integration efforts, and to allow integration of the SEE markets into the pan-European electricity market.

Figure 1. Map of the Western Balkans Countries

However, the majority of the WB6 countries are still lagging behind in establishing organized market places as a precondition for efficient electricity trading. Cross-border electricity trade is below the region's potential, reflecting the high level of market fragmentation. The potential benefits of liquid spot markets for the WB6 countries are significant. Many of the WB6 countries do not have the critical size to develop liquid markets in isolation. Liquid cross-border markets will lead to important cost savings for SEE energy consumers through more competition and more effective use of existing generation and transmission infrastructure in the region. This would also attract more investments. Regional power trading is also a pre-condition to organise electricity markets in a more environmentally-friendly manner. Aggregating generation and demand over larger trading regions will become a key condition for integrating energy from water, wind and sun. Expanding renewables in small isolated markets would require considerable investment into backup generation, which would further increase costs for customers. All of this market integration will also enhance security of supply.
Unbundled and certified transmission system operators and a regionally coordinated capacity calculator are part of a functioning regional trading system. Not all countries have implemented the necessary institutional changes yet.
Since the WB6 region is physically closely linked with neighbouring EU Member States, it

is crucial to develop an integrated SEE trading region, including WB6 and EU countries in order to overcome the limits of the small size of isolated national markets. The WB6 countries will support integration with the neighbouring EU Member States which should take place in parallel to the implementation of the present Roadmap but not replacing it. In this respect, they take note of and will participate in the emerging "SEE Coupling Initiative". National market reforms will also have to be executed in EU MSs neighbouring the WB6 countries to allow for successful implementation of market coupling in the SEE Region (to be followed up by EC). This roadmap clarifies content, addressees and implementation steps for implementing the soft measures relating to the development of spot trading and market coupling in the WB6 countries. It is an additional tool to enable implementation of those soft measures which are particularly important to prepare WB6 countries for integration with the EU markets. This roadmap neither replaces nor extends the Vienna Summit conclusions, which remain as commitments. The clearer description in this roadmap of the conditions to be fulfilled by WB6 countries may reduce the risk of further delays to access EU funds for energy infrastructure.
By the signing up to this Roadmap, the WB6 countries reiterate their commitments made under the Energy Community Treaty and at the WB6 Summit in Vienna last year and ask the Secretariat of the Energy Community to help them coordinating and implementing the reform measures to be taken for that purpose and to monitor the implementation.

Agreement on Day-Ahead Market Integration and Cross-Border Balancing Targets
In April 2016 representatives of transmission system operators, national regulatory authorities, and ministries of energy and power exchanges of the Western Balkans 6 countries committed to implementing a memorandum of understanding (MoU) setting out general principles of cooperation as well as concrete actions to develop the regional electricity market. The memorandum of understanding was signed at the premises of the Energy Community Secretariat in Vienna.[5]

2. The MoU's signatories agreed to implement:

Day-ahead market integration between the six countries of the WB6 region with the aim of achieving market coupling of national organised day-ahead markets with at least one neighbouring WB6 or EU country by July 2018; and
Cross-border balancing cooperation between the WB6 countries by December 2018.
The MoU also commits its signatories to follow up with legally binding agreements between the concerned parties. It will facilitate the implementation of the regional electricity market objectives agreed upon by the Energy Ministers in August 2015 and will improve the coordination between Western Balkans 6 in order to create a competitive, efficient and integrated European energy market.
"Integrating power markets in the region and with the rest of Europe is an important step in delivering more social and economic welfare to all customers", commented Konstantin Staschus, ENTSO-E Secretary-General. "Transmission system operators will continue working hard towards the goal of creating a regional electricity market in the Western Balkans in a consistent and coordinated manner with the work already undertaken within

[5] https://www.entsoe.eu/

the European Union, and of integrating it with the overall European Internal Electricity Market. As in many other processes, TSOs support policy-makers and regulators, and in this instance the Energy Community, in building 'power bridges' between countries".

The signature of the Memorandum of Understanding by Kosovo representatives is pending the entry into force of the Connection Agreement between KOSTT and the relevant ENTSO-E members.
This MoU is open for signature by additional WB6 and EU neighbouring stakeholders which are willing and expected to assume a role in the market integration projects.

The Memorandum of Understanding was signed on 27 April by:
For the WB6 Transmission System Operators (TSOs):
Operatori i Sistemit të Transmetimit (OST)
Nezavisni operator sistema u Bosni i Hercegovini (NOS BiH)
Transmission System Operator of Macedonia – Joint Stock Company for Electricity Transmission and Power System Control of Macedonia (AD MEPSO)
Electric Transmission System of Montenegro (Crnogorski Elektroprenosni Sistem AD - CGES)
JP Elektromreža Srbije (EMS)
For the WB6 National Regulatory Authorities (NRA):
Albanian Energy Regulatory Authority (ERE)
State Electricity Regulatory Commission (DERK)
Energy Regulatory Commission (ERC)
Energy Regulatory Agency (REGAGEN)
Energy Agency of the Republic of Serbia (AERS)
For the Power Exchanges (PX) and parties expected to assume responsibilities for market organisation:
SEEPEX a.d. Beograd (SEEPEX)
COTEE Montenegro
For the WB6 Ministries of:
Ministry of Energy and Industry of Albania
Ministry of Economy of Macedonia
Ministry of Economy of Montenegro
Ministry of Mining and Energy of Serbia

3. Power Exchange

Western Balkan Countries have monopolised power markets, dominated by state owned companies. Hence the envisaged market liberalisation would mean breaking up these monopolies into smaller companies in charge of individual market segments. For instance separating electricity production and distribution in two separate legal entities etc. This would also mean enabling consumers to choose between multiple electricity providers. Most importantly it would entail having electricity markets, which in the Western Balkan case would be bundled and connected to rest of Europe. Lastly these countries are obliged to adopt the Third Package, which is a set of legislative measures aimed at creating a single EU gas and electricity market.

The Transmission System Operators, regulators and energy ministers of the WB6 have signed in 2016 in Vienna a Memorandum of Understanding, where they have agreed on joint targets for regional market integration and these include:

Day-ahead market integration between the six countries of the WB6 region with the aim of achieving market coupling of national organised day-ahead markets with at least one neighbouring WB6 or EU country by July 2018 Cross-border balancing cooperation between the WB6 countries by December 2018.

Until now progress has been made and in this Energy Community Secretariat report you can read in more detail about individual countries. However apart from CROPEX, which joined the memorandum additionally in 2017, the SEE Power Exchange (SEEPEX) in Serbia is the only other operational power exchange in the Western Balkan region.

The SEEPEX is a licensed Market operator for an organized electricity market/power exchange established in the form of partnership between A.D. EMS and EPEX SPOT as a joint stock company. It provides a market place where exchange members send their orders to buy or sell electricity in determined delivery areas. Its role consists in matching these orders in a transparent manner, according to the public market rules which among others describe the priorities and algorithms used for the matching of the orders.

Croatian Power Exchange Ltd. (CROPEX) was established in May 2014 and is equally owned by the Croatian Energy Market Operator Ltd. and the Croatian Transmission System Operator Ltd

SEEPEX has until now traded much more than CROPEX, while the prices on these two markets have remained more or less the same, and on average around 40 EUR/MWh. This is still higher than in Western European markets. For instance in Germany the power prices have dropped to about 30 EUR/MWh, and this has mainly been caused by an increase in zero-marginal-cost renewable electricity. A snapshot of CROPEX and SEEPEX in the period 2016-2017 is shown in Figure 1.

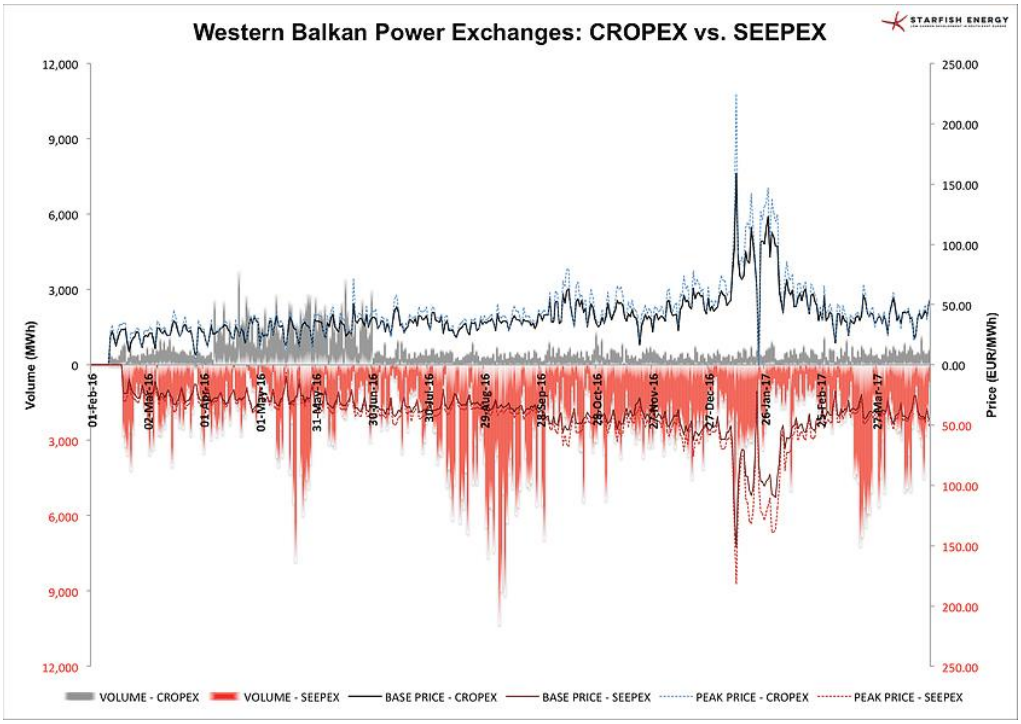

Figure 1 Western Power Exchanges: CROPEX VS. SEEPEX
Source: starfishenergy.org

4. Conclusion

The Western Balkans region has significant potential over the long term to decarbonise its electricity system by increasing its share of renewables and improving cross-border market integration. Yet despite the enormous potential to expand renewables and improve energy efficiency, significant fossil fuel investment is currently being planned, particularly for coal generation. If the Western Balkan countries are to decarbonise their electricity systems, power markets and greater competition among providers are a necessity. All countries of the Western Balkans have committed to increase the share of renewable sources in electricity production by 2020 and reach targets between 25% and 75% of their energy mix as part of broader commitments taken from the Energy Community Treaty. This is close to be achieved when the investment plans for new production capacities are being reviewed and the entire region is well on track to accomplish its goals. The numbers sound optimistic and the actual increase is above 10% in most of the countries when compared to base 2011 year. However, it is necessary to note that this is a thorny and complicated path. The Western Balkan countries, however, have not been able so far to capitalise on this key location and draw benefits as transit countries. Most of them suffer from chronic electricity and energy imbalances due to their backward power facilities and grids as well as the influence of external factors: on the one hand, the consistent strategy of Russia, the main supplier of energy carriers to the region, to retain its monopoly position and use it as leverage in the political sphere; and on the other, the slowness of the EU, which all Western Balkan countries aspire to join, in countering the Russian influence in the region through viable and effective

diversification strategies and rules. The EU, however, has already made firm and irreversible steps towards integrating the Western Balkans in its energy market, a process affirmed with the 2005 Energy Community Treaty.

References

Analytica (2008), "Renewable energy in Macedonia. Focus on 'green' electricity production", December, www.analyticamk.org

Approach in the Accommodation Sector of the Balkan Region. European Journal of Sustainable Development, 5(4), 431-442.

Assenova, M., Georgiev, Z., & Dunjic, B. (2016). Application of Resource Efficient and Cleaner Production

Bigerna S. and P. Polinori (2012), Households' willingness to pay for renewable energy sources in Italy: a bidding game approach, in Uvalic M. (ed), this volume.

Bollino C.A. and Polinori P. (2012), Market strategies and market structures in the Italian wholesale electricity market, in Uvalic M. (ed), this volume.

Bollino C.A., Ciferri D. and Polinori P. (2012), Contagion in electricity markets: empirical evidence from Italian markets, in Uvalic M. (ed), this volume.

Cerovic B. and Uvalic M.(eds) (2010), Western Balkans' Accession to the European Union: Political and Economic Challenges, Belgrade: Faculty of Economics Publishing Centre.

Deitz L., Lindsay S. and Wright K. (2009), "South East Europe's electricity sector: Attractions, obstacles and challenges of Europeanisation", Utilities Policy 17: 4–12.

European Bank for Reconstruction and Development (2001), Transition Report 2001, London.

European Bank for Reconstruction and Development (2011), Transition Report 2011. Crisis and Transition: The People's Perspective, London: EBRD.

European Commission. Energy in South East Europe. Available at: http://ec.europa.eu/enlargement/archives/seerecon/infrastructure/sectors/energy/

Ferrara C. (2010), "Il calore della terra", available at http://www.balcanicaucaso.org/ita/Temi/Cooperazione/Il-calore-della-terra,

http://www.ebrdrenewables.com http://www.energy-community.org http://www.entsoe.eu http://www.westbalkan.um.dk (Ministry of Foreign Affair, Trade Council, Denmark). http://www.worldbank.org.

International Energy Agency. Energy in the Western Balkans: The Path to Reform and Reconstruction. Paris (2008). Available at: http://www.iea.org/w/bookshop/add.aspx?id=332.

Kaminski B, de la Rocha M (2003b) Policy-induced integration in the Balkans: policy options and their assessment. In: World Bank report no. 24460, Trade policies and institutions in the countries of South Eastern Europe in the EU stabilization and association process: regional report, pp 23–72.

Karova R. (2010), The Energy Community - the Eight Regional Electricity Market in Europe, in Cerovic B. and Uvalic M. (eds), Western Balkans' Accession to the European Union: Political and Economic Challenges, Belgrade, Faculty of Economics of the University of Belgrade Publishing Centre, pp. 313-342.

Karova R. (2011), "Regional electricity markets in Europe: Focus on the Energy Community", Utilities Policy, 19: 80-86.

March. Hooper E. and Medvedev A. (2008), "Electrifying integration: Electricity production and the South-East Europe Regional Energy Market", Electricity Policy Research Group Working Paper 0803, Cambridge Working Paper in Economics 0804, Cambridge.

Micheli S. (2012), Learning curve and wind power, in Uvalic M. (ed), this volume.

Muco M, Frasheri A (2003) Does economic cooperation in the Balkans follow ethnic lines? In: Franičević V, Kimura H (eds) Globalization, democratization and development: European and Japanese views of change in South East Europe. Massmedia, Zagreb, pp 325–348.

Nicolini, M., Tavoni, M., Are renewable energy subsidies effective? Evidence from Europe, Renewable and Sustainable Energy Reviews, 74 (2017), pp. 412-423.

Shasivari, J., & Zejneli, I. (2013). The Legal and Political System of the Republic of Macedonia between the Rule of Ethnos and Demos. Mediterranean Journal of Social Sciences, 4(10), 598.

Shkurti, A. (2018). Energy Consumption Modeling in the Western Balkan Countries Using a Top-Down Approach, Academic Journal of Interdisciplinary Studies, 7(3), 35-41. doi: https://doi.org/10.2478/ajis-2018-0056.

Stambolis, Costis. Redefining Se Europe's Energy Map – Policy Implications [Presntation at WEC Central and Eastern Europe Energy Forum, 17-21 June 2012]. Institute of Energy for SE Europe (IENE).

11. A Sustainable Approach for a Smart Human Resource Management in Healthcare

Prof. Dr. Hubertus Franke, Prof. Dr. Martina Hasseler, M.Sc. Denise Dick, M.Sc. Stephanie Krebs

ABSTRACT:
Sustainable healthcare only works with sufficient and high performance employees for all specialized areas. Especially in nursing care more and more employees are needed because of the demographic factor. Furthermore, it needs to account that there are nurses who are still willing to work in this job but have requirements to the working conditions, e.g. working without night shift or only to special times (perhaps for a single parent). Also job-hopper in nursery could help to optimize the situation. One possibility to optimize this scenario is founding a regional hospital network. Different clinics, which are located in the same area, are able to establish a joint venture. This joint venture could use smart IT-support to hire nurses on various and specific requirements. The challenge is to manage all constraints of the corresponding hospitals, e.g. the different processes and the different data-structures. The new established pooling-company bases on a smart software so the hospital can request more staff to fill in the gaps of working schedule. The publication focused on describing the hospital-network, the processes and the required software.

Keywords: Hospital-network, human resource management, pooling solution, information technology

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1. Introduction - The Problem of Vacant Jobs in Healthcare

A very important area of environmental sustainability can be observed in healthcare and nursing care. As often discussed in media, there is a big problem finding qualified employees for healthcare in Germany. Sustainable healthcare only works with sufficient and high performance employees for all specialized areas. Especially the nursing care needs more and more employees because of the demographic factor and the shortage of nurses. On the one hand a lot of older nurses will retire while on the other hand there are only a few younger people left to work in the healthcare sector (Nanninga, 2014). Furthermore, the number of patients increases (Grieß, 2015), (Nowossadeck, 2013). Consequentially, a decreasing number of employees will take care of an increasing number of patients for 365 days a year in shift work. But hospitals have to be staffed with sufficient qualified personnel to guarantee high quality care for patients (Aiken et al., 2011), (Butler, 2011), (Aiken et al., 2014). According to this, it is inevitable discussing the shortage of nursing staff causes strategic assurances as well as effectively and efficient coordination of employees in hospitals (Damart & Kletz , 2016). Therefore, there are many small regional hospitals experiencing big problems to fulfil all requirements of patients already (Deller, 2009).

In addition, in compliance with statutory regulations it is very difficult to fill up gaps in personnel time scheduling with employees of own ranks (Weskamm, 2016). Also, hospitals use job-hoppers to optimize the situation, it do not led to any relief caused by a poor coordinating structure (Benedix & Medjedovic´, 2014). Furthermore, the pool-concept, which is known in Germany and hospitals of other countries for example as "Bank Nurse-Concept" to solve staff shortages, is very time-consuming so far. Staff members of the personnel department or head nurses have to take many calls until they get a suitable replacement (Damart & Kletz , 2016). Moreover, different software tools for time planning support exist. However, these planning tools are not able to fix the problem of staff shortage either (Benedix & Medjedovic´, 2014). Facing the increasing complexity, this cannot be handled by manual methods anymore.

The shortage of specialist and nurses in healthcare will grow on during the next years. As per

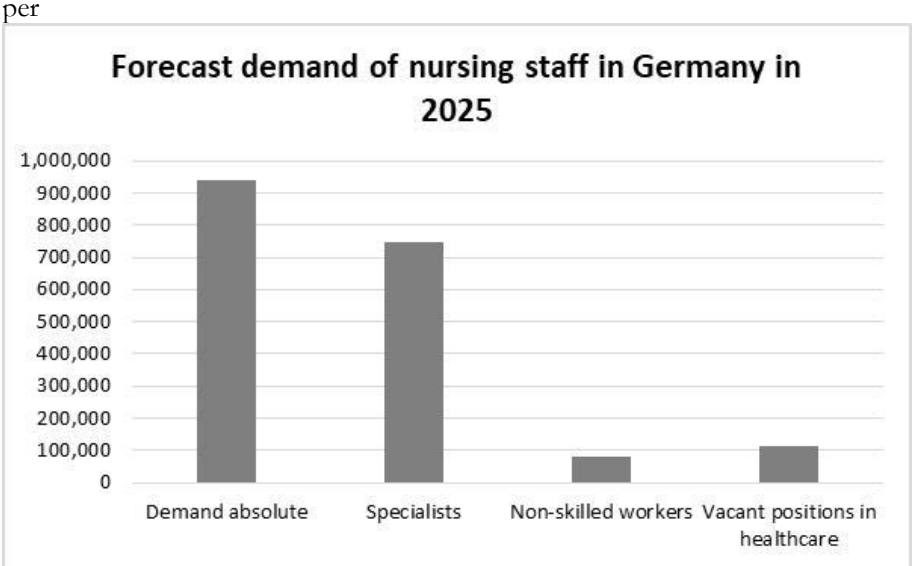

Figure 3, a forecasted demand in healthcare forced nearly 1 million employees until 2025.

In detail, up to 747,000 specialists in healthcare will be needed. In spite of the possibility deploying 81,000 employees without any professional training, there will be a difference about 112,000 vacant positions left (Becker, 2017), (hu Versicherungen, 2018).

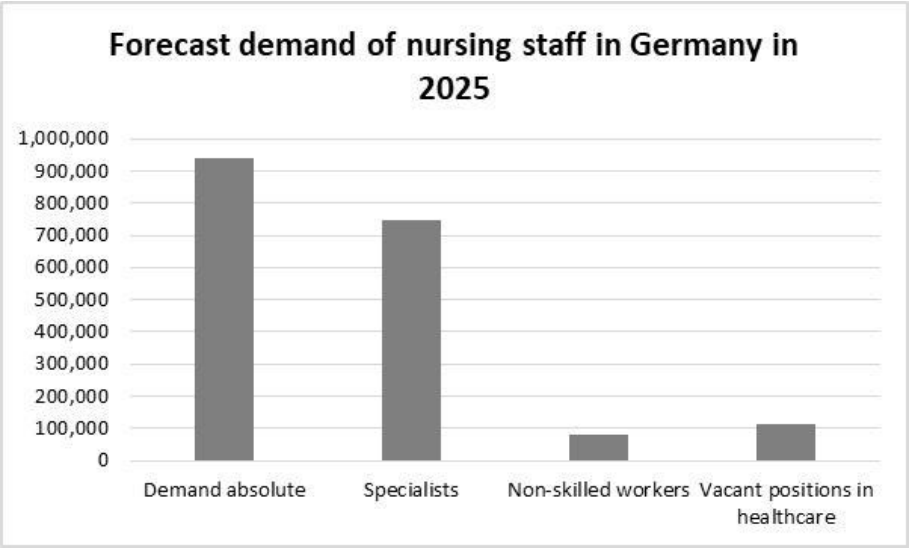

Figure 3: Demand of specialist in healthcare in Germany in 2025 (SZ. (n.d.)., 2018)

In addition, an actual survey related of "tagesschau September 21, 2017" indicates a gap of 350,000 specialists in healthcare in 2030 (Deutscher Pflegerat, 2017). Furthermore publications, media and 66% of coordinators of intern hopper-programs, who were interviewed in this project, point out that there are nurses who are still willing to work in their job but have special requirements to the working conditions, e.g. working without night shift or working only to special times, firmly scheduled working hours (prosoft-Team, 2017) . To find a new, flexible and structured solution for the described problem, it is necessary to analyse the Human Resource Management, especially the process of staff acquisition and distribution in healthcare, in more detail (Butler, 2011).

2. Basics of Staff Acquisition in Healthcare

The staff acquisition in healthcare can be considered from two different points of view. The first one is, hiring nurses generally for one hospital or nursing home. Hospitals handle this in conventional way so far. Candidates apply for a special position in a hospital or in nursing homes via internet or in paper based manner. At the best an applicant fulfils the requirements and the hospital hire him or her immediately. Because of a small number of applications this approach is in current situation rarely successful. Hence, some hospitals pay very high provisions to find new employees (Straßmann, 2014). Especially employment agencies use this for making big profit (Thelen, 2018).
The other requirement of acquisition manpower in healthcare is filling in gaps in personnel time schedules. Caused by illness or other short-term absences of staff members, head nurses or employees of the personnel department have to take several calls until they get suitable replacements. In many cases this process is very time-

consuming so far. Furthermore, it is discontentedness for the person calling as well as for the nurses being called. Very often nurses, who have some days off or are on holiday, have to come in (Damart & Kletz , 2016). Beyond that, not all nurses in time off have the right skills or may help filling in the time schedule gap. Moreover, there are lots of laws and rules regulating the work in the healthcare sector in Germany. For example it is not allowed to work one day in night shift and the day after in a morning or afternoon shift. It is also mandatory having at least 15 free Sundays within a year (Bundesministerium für Arbeit und Soziales, 2017).

Depending on these problems, some smaller hospitals in countryside enter into a cooperation agreement with some other hospitals in the surrounding area to share staff members (Deller, 2009). Based on this, it is a promising approach founding a synergetic cooperation between existing institutions in healthcare. The idea of the project, which will be described in the following, is to establish a joint venture based on a smart IT-tool between three different hospitals located in the same geographic area. This joint venture will work like a "temporary employment agency" for the specific kind of hospital network and will be capable to react quickly and flexibly on demand.

The described idea, with high innovation potential through process and organizational innovation, is comparable to the industrial resource management, where numerous studies and developments have created advantages for Industry and Logistic already. Applied logistic is using IT-tools and further IT-based support to handle very big packages of data (Franke & Matteoschat, 2009), (Franke, 2013), (Franke, 2014). The idea is, to transfer this approach to the Human Resource Management in hospitals.

But for using the IT-tool in a hospital network of three hospitals in competition with each other, the idea of the described project is assuming an organization development as well. One big challenge is to manage all constraints of the corresponding hospitals, e.g. the different processes and the different data-structures. Another challenge is to get them working together on this project by sharing and discussing their demand (Deller, 2009).

3. Basics of Hospital Networks

In a hospital network every hospital works along their own processes, rules and standards. Nevertheless, there are lot of standards given by the government; the amount of individual processes is enormous. To build up a hospital network, respectively a joint venture as an economical supply chain, standardization in processes, standards in the pay scale (the rate) and especially in IT-infrastructure are needed. Thus, a staff time scheduling must have the same data structure in every corresponding hospital in the network. Furthermore, it is indispensable that the employee and executives of every hospital go along with the new idea and implementation of new processes and rules (Deller, 2009).

4. A Regional Hospital Network for a Synergetic Exchange of Employees in Healthcare

Especially for the lack of specialists in the social economy in Germany this research approach designs a concept with quick respond. Due to strategic assurance and a more adapted catalogue of measures this project works together with three different hospitals, which are integrated in a regional network of politics, economic and sciences

already to activate regional available recourses, potentials and manpower. Therefore, one economic partner of the regional network is integrated. The project is subsidized by Funds from the European Regional Development Fund (according to the directive about grants for innovation networks).

Figure 4 and Figure 5 show that the project is divided into two phases with twelve different working packages (WP), six in each project phase. In the first project phase, the researchers analyse framework, processes and requirements for an IT-based Human Resource Management tool. To find out more about the attitudes and perspectives from hospital staff and management, the researchers use group interviews of nurses to ask them about the ideal conditions and requirements of the smart IT-tool and hospital network in WP 1. To ask about ideas and suggestions for the smart IT-tool of hospital management as well, they do lead guided expert interviews with decision-makers of the three hospitals in WP 4. In addition, they use the qualitative content analyses of Mayring to accumulate the group and expert interviews to a specification sheet (Mayring, 2010).

Subsequently, in WP 2 is developed the legal prerequisites, to secure that the software will be allowed to insert in different hospitals on employment law and data protection. Therefor the law department of Ostfalia University of applied sciences and the experts about law of the three hospitals do a literature search and analysis.

In WP 3 the scientists carry out a modelling and state analysing of the current processes of filling in gaps in time scheduling. In addition, they closely monitor weak points of all current processes. To simplify, the weak points are evaluated and priorities varies focused on distribution of Human Resources. Based on this, they design a target process by using Petri-nets modelling.

In WP 5 the academics starts the software modelling by an initial prototyping of the smart software to get to know some challenges from this perspective as well. The first project phase ends in WP 6 by a workshop of all involved to discuss the results of this phase.

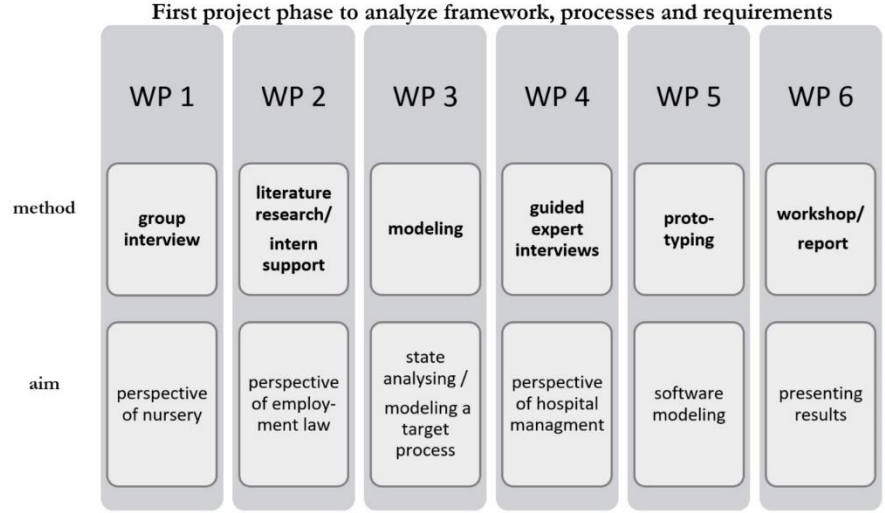

Figure 4. First project phase - HNET 1

After researching the framework for a joint venture of a hospital network bases on a smart IT-tool in the first project phase, it is possible to install the software prototype in

each of the cooperating hospitals in a scenario, which is close to reality and examined in feasibility and effectiveness, in the second project phase.
In WP 1 of the second project phase the researchers define criteria like workability of the program, understanding of the instrument, fulfilment of the requirements of responsible person's view, efficient use of personnel, effective use of personnel, satisfaction of the involved nursing directorates, satisfaction of the head nurse and many more as evaluation criteria.
Based on these, they specify data collection tools for example guidelines for interviews, online questionnaires or guidelines for joining observations in WP 2 to get feedback of the employed nursing staff, responsible personnel manager, nursing directorate or nursing management about using the prototype software.
In WP 3 the results of the different WP's from project phase one are used to enforce a "second" software prototyping. It portrays the feasibility of the actual real implementation and suggests an optimized distribution of hospital staff, based on all important data. Modifications of the prototype are always possible and requested because a "Rapid Prototype" is used. The researchers use a tool-supported approach, because numerous software components from the large area of IT-based project management are already available.
Against the background, training leads to motivated using and testing, the scholars design workshops and seminars to instruct all responsible persons (personnel managers, nursing service management and personnel manager) of the three hospitals to use the smart software tool effectively during their working day in WP 4.

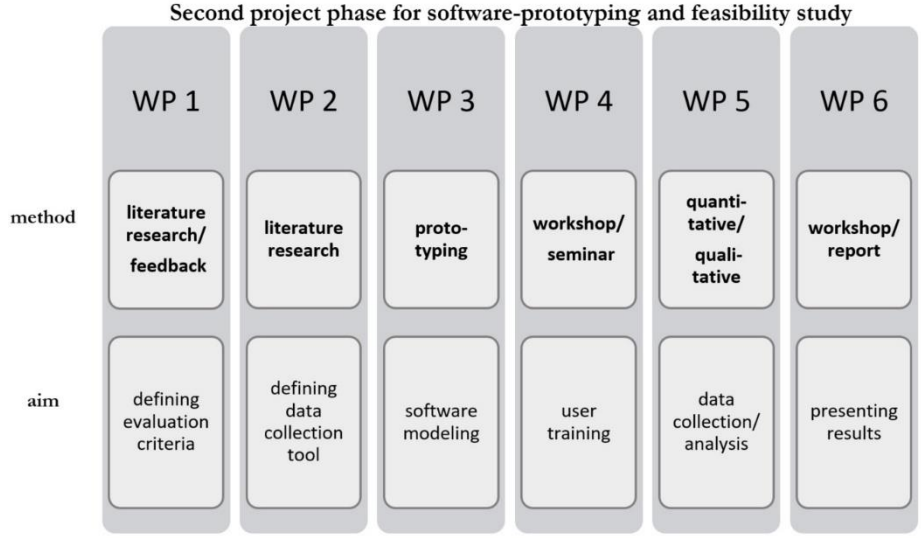

Figure 5: Second project phase – HNET 2

In case of this, it is possible to collect various data about using and handling the software along the designed data collection tools of WP 1+2 in WP 5. Beside of this, the researchers analyse these results and adapt them to the prototype, whenever it is required. Also they tests prototypical created software for special parts of different hospitals. Though, they check the created prototype for all necessary requirements. In case of this the prototype must bases on up-to-date programming language, commonly available on

the free market (e.g. Java or similar object-oriented programming languages).
At the end of the second project phase all results are presented in a workshop to the involved partners in WP 6 as well. Furthermore, a foundation of the pooling company is needed. Thereby it is necessary, that the new joint venture is only responsible for hiring pool employees to fill in gaps in time schedules. This should be done parallel to the conventional way for hiring new employees for special vacant positions in one clinic of the hospital network.

5. IT Framework

As described above the IT framework is one of the main factors to create a flexible and quick solution to find suitable replacements in gaps within time schedules. In case of this, the idea of modeling smart software will be described in more detail in this chapter.
The first step, filling in a time schedule gap, consists primarily on generating a list with all eligible nurses. And exactly this is the biggest challenge. Beside the laws and rules regulating a working day, there is no standard procedure to generate the list and the algorithm behind this process may change according to the problem (short or long-term gap, special skills need, gap on a working day or weekend, etc.). Anyhow, there is a way to reproduce these procedures in software.
Although the process finding a substitute nurse may differ among the hospitals, they all aim the same goal: reallocating nurses as efficient as possible to fill in the gaps in a running time schedule.

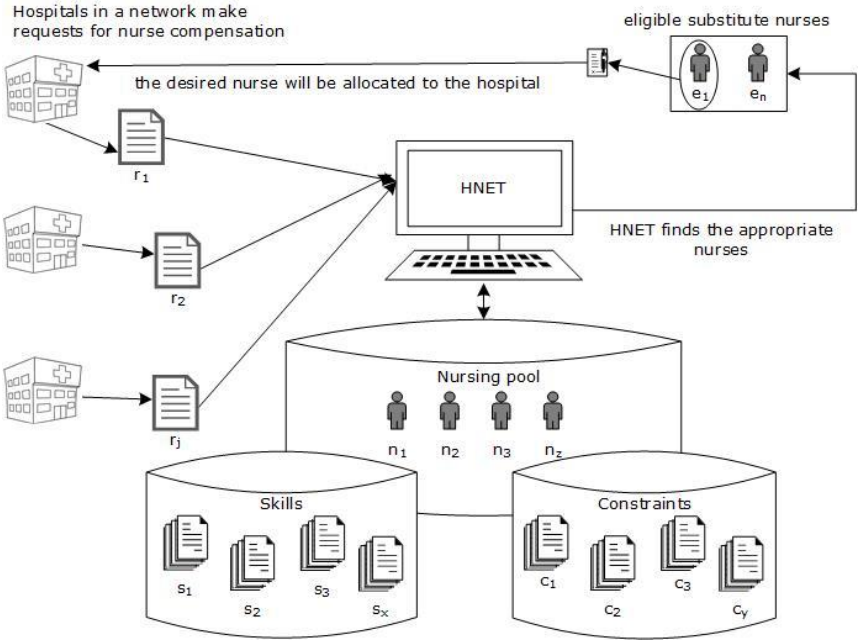

Figure 6: HNET Software

The Hospital Network (HNET) Project aims supporting the hospitals filling in the gaps as efficient and effective as possible. Therefore, a web based software prototype will be

developed. In this, hospitals in a regional network will be able to make requests for nursing compensation. At least each request contains the skills and the period the substitute will be needed for. Based on this information, a list with all eligible substitute nurses will be generated and provided to the specific hospital, which decides who they want to recruit. Against the actual process, this person will automatically contacted by a short message. In case of a positive answer, the nurse will be allocated to the hospital and blocked for all other requests within the booked period (Figure 6).

Anew against the actual system, the nurses being contacted are not in time off. When they register for the nursing pool, they are able to set their constraints (e.g. the cities, the days and time they are capable to work). The HNET-Software is just going to match requests that attend these restrictions.

The HNET-Software consists of a database with nurse information (e.g. skills and constraints) as well as a database with the requests and all information related to them (Figure 6). For each request, nurse's and request's information will be matched generating a list with the eligible substitute nurses. Therefore:

Let $\boldsymbol{N}$ be a set of nurses in the nursing pool, where $N = \{n_1, n_2, \dots, n_z\} \wedge |N| = z$

Let $\boldsymbol{S}$ be a set of nurses' skills, where $S = \{s_1, s_2, \dots, s_x\} \wedge |S| = x$

Let $\boldsymbol{C}$ be a set of nurses' constraints about labour, where $C = \{c_1, c_2, \dots, c_y\} \wedge |C| = y$

Let $\boldsymbol{R}$ be a set of requests for a substitute nurse, where $R = \{r_1, r_2, \dots, r_j\} \wedge |R| = j$

Let $\boldsymbol{E}$ be a set of eligible nurses, where $E = \{e_1, e_2, \dots, e_n\} \wedge |E| = n$

After all matches were found and weighted, the list with the eligible nurses is generated and offered to the hospital for further evaluation. The requests themselves are divided in three possible categories: proactive, reactive recommendation and reactive request.

Proactive: the easiest way for the hospitals to find substitute nurses is uploading a time schedule to the HNET web application. The software will automatically interpret it. Once vacant positions are recognized, the software will be able to match the requirements to the skills and constraints of the nurses in the nursing pool generating a list with eligible substitutes. The list will be delivered to the hospital, which hires one or more of the suggested nurses in case of demand

Reactive recommendation: like the "proactive" solution, the hospitals are able to upload time schedules to the HNET web application. In this case the time schedules will only be interpreted and the list with the eligible substitutes will only be generated after the application has been triggered to do it.

Reactive request: this solution offers the most interaction with the user, a hospital in this case. A list with eligible substitute nurses can only be generated after the user has filled in a web based form, providing all essentially information (e.g. the exact days, shifts and skills needed for the open position).

The first two categories implicate the interaction between HNET-Software and the time schedule software of the hospitals. Various hospitals may use different software, so an extra inter layer will be needed interpreting the time schedule and deleting all non-relevant and individual-related information.

Independent of the request model used by the hospital, all them helps improving the efficiency – labour as well as organizational – and helps managing the difficult and time-consuming problem of finding a substitute nurse for a free time-slot. Furthermore, it also helps solving the dissatisfaction of the employees because the regular staff will not be

called, while being in time off.

6. Implications

The described project approach shows that cross-sectoral cooperation and networks are very useful to meet challenges in effective operations. Synergy effects, for example knowledge, financial aspects and manpower, lead to very effective solutions for every project partner. Mainly caused by increasing competitive pressure and absence of specialization, there are rare hospital networks in Germany yet (Deller, 2009). Therefore, the described project demonstrate that ideas transferred from industry can be used in social institutes and healthcare in very good manner. Analysing and optimizing a big data process, by developing an IT-based tool for support, will lead to more effectiveness and efficiency in social area as well. This is very important to reduce the pressure of the employees in hospitals. Moreover, simple and transparent processes raise motivation and employee satisfaction. These are two main facts to make employees stay for work in healthcare.

7. Summary

The publication focuses the description of a project approach to analyse requirements, processes, modelling and usability of IT-based Human Resource Management software in healthcare. A hospital network of three hospitals, plus support of a smart IT-tool, is one possibility to counteract the effects of the growing shortage of nurses by coordinating the available resources targeted on demand to time and place. On the one hand, this is needed in case of a shortage of nurses based on demographic factors. On the other hand, working conditions and salary are not attractive enough for employees working in hospitals anymore. Hence, many nurses do occupational changes to temporary employment agencies or other jobs. This has negative impact to the quality of patient care in hospitals. Therefore, hospitals search several ways of getting nurses back, working as hospital nurses. The described project bases on Funds from the European Regional Development Fund and operates on an innovative idea to sensitize hospitals for positive effects of a hospital network and the employment of modern IT systems. Rest on this, the idea led to an intern temporary employment agency bases on IT support. This joint venture of hospitals may hire employees, who will only work for these special hospitals of the specific network. In case of this, the hopper-nurses will get to know the processes and characteristics of the special hospitals very quick. After a training they will be able to work flexible but on high quality in each of these hospitals. Caused on recurring cooperation, the hopper-nurse of the joint venture and the hospital nurses will get to know each other and learn to work in an efficient team without any extern-intern barriers. The joint venture should be seen as a parallel solution to hire nurses in one hospital of the network.

References

Aiken et al., L. (2011). Effects of Nursing Staffing and Nurses Education on Patient Deaths in Hospitals With Different Nurse Work Environments. *Medical Care 49*.

Aiken et al., L. (2014). Nurse staffing and education and hospital mortality in nine European Countries: a retrospective observation study. *The Lancet*.

Becker, K. B. (2017, 04 21). Pflege in Deutschland -Wie die Digitalisierung dem Fachkräftemangel begegnet. *Süddeutsche Zeitung*, München Seit 16, Bayer Seite 16.

Benedix, U., & Medjedovic , R. (2014). *Gute Arbeit und Strukturwandel in der Pflege: Gestaltungsoptionen aus Sicht der Beschäftigten* (Vol. Reihe Arbeit und Wirtschaft in Bremen). (I. A. (IAW), Ed.) Bremen: Institut Arbeit und Wirtschaft (IAW) .

Bundesministerium für Arbeit und Soziales. (2017). *Arbeitszeitgesetz*. Retrieved from http://www.bmas.de

Butler, M. (2011). Hospital nurse staffing models and staff-related outcomes. *Cochrane Database Syst Rev 6*.

Damart, S., & Kletz , S. (2016, 01). When the management of nurse absenteeism becomes a cause of absenteeism: a study based on a comparison of two health care facilities. *Journal of Nursing Management*, pp. 24:4-11.

Deller, U. (2009). *Kooperationsmanagment. Ein Lehr- und Arbeitsbuch für Sozial- und Gesundheitsdienste*. Opladen & Farmington Hills: Verlag Barbara Budrich.

Deutscher Pflegerat. (2017, 01). *deutscher-pflegerat.de*. (D. P.-u. Hebammenwesen, Ed.) Retrieved 06 18, 2018, from deutscher-pflegerat.de: https://deutscher-pflegerat.de/aktuelles/newsletter/DPR_-Newsletter_01_-Januar_2017.pdf?m=1483968541&

Franke, H. (2013). Multiagentensimulation in komplexen Logistiksystemen am Beispiel der der Baustellenlogistik. *ASIM Fachtagung Simulation in Produktion und Logistik*. Fürstenalle 11, 33103 Paderborn.

Franke, H. (2014). Agent based environments using Petri-Net-Profiles in constructing sites. *2rd Annual International Conference on Industrial, Systems and Design Engineering*. Athens, Greece.

Franke, H., & Matteoschat, S. (2009). Dezentrale Produktionsablaufplanung mittels Agentensimulation. *11. Paderborner Frühjahrstagung – Nachhaltiggkeit im flexiblen Produktions- und Liefernetzwerken*. Fürstenallee 11, 33103 Paderborn.

Grieß, A. (2015, 09 17). *Spiegel ONLINE*. Retrieved 06 12, 2018, from Spiegel ONLINE: http://www.spiegel.de/gesundheit/diagnose/krankenhaus-statistik-weniger-kliniken-mehr-patienten-a-1053286.html

hu Versicherungen. (2018, 06 18). *Pflegeversicherung-direkt.de*. Retrieved from Pflegeversicherung-direkt.de: https://www.pflegeversicherung-direkt.de/service/pflege-in-zahlen.html

König, J., & Raiß, M. (2015). *Dienstplangestaltung – was Pflegekräfte wissen müssen. Ein Ratgeber für die tägliche Praxis*. Hannover: Schlütersche (Pfllege-Kolleg).

Mayring, P. (2010). Qualitative Inhaltsanalyse. In G. Mey, & K. Mruck, *Handbuch Qualitative Forschung in der Psychologie*. Verlag für Sozialwissenschaften.

Nanninga, J. (2014). *Fachkräftemangel in der Pflege. Darstellung eines Imagekonzepts, Personalbindungsstrategien und Maßnahmen zur Nachwuchsrekrutieruntg*. Hamburg: Diplomica Verlag.

Nowossadeck, S. (2013, 08). Demographic change, people needing long-term care, and the future need for carers. An overview. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*.

prosoft-Team. (2017, 10 18). *hr-blog.prosoft.net*. Retrieved 06 18, 2018, from hr-blog.prosoft.net: https://hr-blog.prosoft.net/zeitarbeit-fuer-pflegekraefte/

Straßmann, B. (2014, 03 13). Pflegekräfte: Schluss mit Schwester! *Die Zeit* (12).

SZ. (n.d.). (2018, 06 20). *Prognostizierter Bedarf an Pflegekräften* in Deutschland im Jahr 2025*. Retrieved from Statista: https://de.statista.com/statistik/daten/studie/172651/umfrage/bedarf-an-pflegekraeften-2025/

Thelen, P. (2018, 04 03). Konkurrenz im Altenheim. Wie Leiharbeitsfirmen den Markt für Pflegekräfte aufmischen. *Handelsblatt*, https://www.zeit.de/2014/12/kopfgeld-pflegepersonal-klinik.

Weskamm, A. (2016). Dienstplanung im Krankenhaus. (D. B. (DBfK), Ed.) *Mein Recht auf Frei!, Sammelband zur DBfK-Aktion*, 6.

12. Estimation of Radioactivity Caused by Chemical Fertilizers on Trakya Sub-Region Soils and Its Potential Risk on Ecosystem

Dr. Gökçen Bayrak, Emine Keles, Dr. Damla Atik

ABSTRACT:
Exposure to terrestrial radioactivity depends primarily on geological conditions and soil types. Phosphate, nitrogen and potassium fertilizers, which are used predominantly in order to increase crops in agriculture, provide basic nutrients to plants. Radionuclides in phosphate fertilizer belonging to 232Th and 238U from phosphate rocks series as well as radioisotope of potassium (40K) are the major contributors of outdoor terrestrial natural radiation. The plants take some fractions of radioactivity and radionuclides enter the food chain in this way. Trakya sub-region, located in northwestern Turkey, constitutes one of the significant agricultural centers, 65% of this area is used for agricultural purposes. This is the region which uses the most fertilizer per unit area, with an average of 145 kg per hectare and approximately 20% of the fertilizer consumed in Turkey is used in the region. The main objective of this study is to evaluate Trakya Sub-region from the point of potential environmental effects of radionuclides which may be caused by phosphate fertilizers used in agricultural areas. For this purpose, it is aimed to determine the priority areas for the monitoring studies by analyzing the results of the use of temporal and spatial fertilizers by creating maps and the studies performed in the region.

Keywords: Radioactivity, chemical fertilizers, Trakya Sub-region, soil, GIS

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1. Introduction

During the four decades agricultural activities have expanded widely, resulting in an increase in the applications of the different chemical fertilizers. Fertilization increases efficiency and obtains better quality of product recovery in agricultural activities. More than 30 million tons of phosphate fertilizers are annually consumed worldwide, which increase crop production and land reclamation. Chemical fertilizers are chemical compounds that provide necessary chemical elements and nutrients to the plants and mainly contain phosphate, nitrate, ammonium and potassium salts. Phosphate rocks together with potassium ores and nitrogenous compounds are the main raw materials used for fertilizers in industrial production. Agro-chemical-based intensive agriculture has contributed substantially to the emission of the very powerful greenhouse gases CH_4 and N_2O, and the entry of pollutants (excessive nitrogen and phosphorus, pesticide, heavy metals and radioactive materials) into water bodies and soils (Jankovic, et al., 2013)

(Uosif, Mostafa, Elsaman, & Moustafa, 2014) (Bayrak Yılmaz, Atik, & Sivri, 2017). These pollutants have adverse effects on environmental quality and public health.

1.1 Natural Radioactivity

Radioactivity is the emission of alpha ~~(a)~~ and beta ~~(b)~~ particles as well as gamma ~~(c)~~ radiation from the unstable isotopes. Long-live radioactive elements such as uranium (^{238}U), thorium (^{232}Th) and potassium (^{40}K) and any of their decay products, such as radium and radon are examples of naturally occurring radioactive materials (NORM) (Gaafar, El-Shershaby, Zeidan, & ayed El-Ahll, 2016) (Hassan, Mansour, Fayez-Hassan, & Sedqy, 2016) (Zaim. & Atlas, 2016). Natural radioactivity is wide spread in the Earth's environment and it exists in various geological formations like soils, rocks, plants, sand, water, air and building materials. Hence, humans should beware of their natural environment with regard to the radiation health effects (chronic lung diseases, cancers etc.) (Mir & Rather, 2015).

Radioactivity is a normal constituent of the earth's crust. Natural radioactive nuclei are found in high concentrations in volcanic, phosphate, granite and salt rocks. The natural radionuclides which are very long half-life and have been on the earth for billions of years such as ^{238}U, ^{232}Th, ^{40}K which are involved in the soil due to the disintegration of these rocks cause the soil to be radioactive. Main primordial nuclides and mean occurence in earth crust is shown in Table 1.

Table 1. Main primordial nuclides and mean occurence in earth crust (Scholten & Timmermans, 1996)

Nuclide	Half-life in billions of years	Mean concentration in earth crust (Bq/kg)
^{238}U	4.47	25
^{232}Th	12.4	25
^{40}K	1.28	370

The natural radioactivity in phosphate rock depends on its origin. In sedimentary rock it is much higher than in volcanic rock. Granite rocks contain thorium in significant quantities. The main producers of phosphate rock are China, Morocco, Russia and the United States. The radionuclide activity values differed among the districts, depending upon the geographic structures, rainfall amounts, and elevations of the districts. Some typical values of activity concentrations in phosphate rock is shown in Table 2. One reason for the increase in natural radiation is the chemical fertilizers used in agriculture (Scholten & Timmermans, 1996) (Alam, ve diğerleri, 1997) (Saleh, Hafez, Elanany, Motaweh, & Naim, 2007) (Ghosh, Deb, Bera, Sengupta, & Patra, 2008) (Hussain & Hussain, 2011) (Gönen, 2012) (Thabayneh & Jazzar, 2012) (Jankovic, et al., 2013) (Mir & Rather, 2015) (Durusoy & Yildirim, 2017). Variation of uranium contents in different rocks is attributed mainly to different rock types depending on its geographical and geological origin, age of the rocks, and uranium mobility (Ghosh, Deb, Bera, Sengupta, & Patra, 2008).

Table 2. Some typical values of activity concentrations (Bq/kg) in phosphate rock (Sahu, Ajmal, Bhangare, Tiwari, & Pandit, 2014)

Location	^{226}Ra	^{238}U	^{232}Th	^{40}K
Morocco	1600	1700	10	20
Togo	1100	1300	30	4
Western Sahara	900	900	7	30
Syria	300	1000	2	-
Usa	1600	1500	20	-
Tunisia	800	1000	20	30
India	1290	1340	90	10

1.2 Radioactivity in Fertilizers

In order to reach high agricultural productivity, the present practice of replacing nutrients in soils is by supplying substances and this is done by the application of chemical fertilizers. More than 100 different combinations of fertilizers are available in the market with varying concentrations of nitrogen, phosphorus, and potassium (NPK), mostly compounds commercially named MAP (Mono Ammonium Phosphate) and Urea (46% Urea Nitrogen) (Bramki, Ramdhane, & Benrachi, 2018). In NPK fertilizers, gamma activity shows a wide variation because of the difference in the factories of manufactured fertilizers and the difference in the places from which the raw minerals for manufacturing the fertilizers were taken (Hussain & Hussain, 2011).

Phosphate rocks are largely used for the production of phosphoric acid, fertilizers and gypsum (Alam, ve diğerleri, 1997) (Jankovic, et al., 2013) (Sahu, Ajmal, Bhangare, Tiwari, & Pandit, 2014). Phosphate ores typically contain about 1500 Bq/kg of uranium and radium, although some phosphates contain up to 20000 Bq/kg of U_3O_8. In general, phosphate ores of sedimentary origin have higher concentrations of radionuclides of the uranium family. In 90% of cases, the ore is treated with sulfuric acid. The fertilizers become somewhat enriched in uranium (up to150% relative to the ore), while 80% of the ^{226}Ra, 30% of ^{232}Th and 5% of uranium are left in phosphogypsum (Alam, ve diğerleri, 1997) (Gaafar, El-Shershaby, Zeidan, & ayed El-Ahll, 2016). Phosphoric acid is the starting material for TSP and ammonium phosphate fertilizers. Some typical values of activity concentrations in fertilizers is shown in Table 3.

Table 3. Some typical values of activity concentrations (Bq/kg) in fertilizers in the World

Location	Reference	^{226}Ra	^{238}U	^{232}Th	^{40}K
Bangladesh	(Alam, ve diğerleri, 1997)	5-329		3-22	8-12628
Iraq	(Hussain & Hussain, 2011)		13-89	1-27	12-2276
Saudi Arabia	(Alharbi, 2013)	64		17	2453
India	(Shahul Hameed, Sankaran Pillai, & Mathiyarasu, 2014)		2-396	5-39	33-93
Egypt	(Uosif, Mostafa, Elsaman, & Moustafa, 2014)	12-244		3-99	109-670
Serbia	(Jankovic, et al., 2013)	87	220		4860
Croatia	(Barišić, Lulić, & Miletić, 1992)	75	120		
Egypt	(Ghosh, Deb, Bera, Sengupta, & Patra, 2008)	301		24	3
Egypt				125–239	446–882
Egypt		366		67	4

Phosphogypsum is a waste by-product from the processing of phosphate rock by the "wet acid method" of fertilizer production, which currently accounts for over 90% of

phosphoric acid production. The wet process is economic but generates a large amount of phosphogypsum (5 tons of phosphogypsum per ton of phosphoric acid produced). World phosphogypsum production is variously estimated to be around 100-280 mega tonnes per year. The nature and characteristics of the resulting phosphogypsum are strongly influenced by the phosphate ore composition and quality. Wet processing causes the selective separation and concentration of naturally occurring radium, uranium and thorium: about 80-90% of ^{226}Ra is concentrated in phosphogypsum while nearly 86% of U and 70% of Th end up in the phosphoric acid. The discharge of phosphogypsum on earth surface deposits is a potential source of enhanced natural radiation and heavy metals, and the resulting environmental impact should be considered carefully to ensure safety and compliance with environmental regulations. The radionuclide ^{226}Ra produces radon gas (^{222}Rn), which has a short half-life of 3.8 days, an intense radiation capacity, and causes significant damage to internal organs. For this reason the United States Environmental Protection Agency (USEPA) has classified phosphogypsum and rock phosphate as "Technologically Enhanced Naturally Occurring Radioactive Materials" (TENORM) and phosphogypsum exceeding 370 Bq/kg of radioactivity has been banned from all uses by the EPA since 1992. Depending on the quality of the rock source, phosphogypsum can contain as much as 60 times the levels normally found prior to processing (Alam, ve diğerleri, 1997) (Sahu, Ajmal, Bhangare, Tiwari, & Pandit, 2014). It is estimated that approximately 9–22 million tons of uranium could be recovered from the total phosphate rock deposits which may control substantially the price of the uranium in the market. However, conventional technology is not economical to recover uranium from the phosphate rock sources (Gupta, Chatterjee, Datta, Veer, & Walther, 2014).

As a nonrenewable resource, phosphorus is the second most important macronutrient for plant growth and nutrition. Demand of phosphorus application in the agricultural production is increasing fast throughout the globe. The bioavailability of phosphorus is distinctively low due to its slow diffusion and high fixation in soils which make phosphorus a key limiting factor for crop production. Applications of phosphorus-based fertilizers improve the soil fertility and agriculture yield but at the same time concerns over a number of factors that lead to environmental damage need to be addressed properly (Gupta, Chatterjee, Datta, Veer, & Walther, 2014). Phosphate fertilizer also contains various stable elements~~. These stable elements~~ that are macronutrients (N, P, K, Ca, Mg, and S), micronutrients (B, Cl, Co, Cu, Fe, Mn, Mo, Ni, Se, Si and Zn), and fluorine and toxic elements (As, Al, Cd, Pb, and Hg) (Ghosh, Deb, Bera, Sengupta, & Patra, 2008).

Reallocation of naturally occurring radionuclides takes place through the use of fertilizers at trace levels throughout the environment and becomes a source of radioactivity, which may lead to radiological hazards due to the exposure during resident time in the soil and intake of foodstuff grown on such fertilizer amended soils. Moreover, during handling, packing and transportation of fertilizers, an additional external exposure is also evident. Since phosphate contains some natural radionuclides like ^{238}U, ^{232}Th and ^{40}K, fertilizers become the major contributor for outdoor terrestrial natural radiations. Among the constituents of agricultural phosphate fertilizers are potassium ores (potassium sulphate, potassium chloride) (Hussain & Hussain, 2011) (Uosif, Mostafa, Elsaman, & Moustafa, 2014). Potassium is of concern rather in K-fertilizers, however the long lived primordial

radionuclide ^{40}K with half-life of 1.28-109 years and an isotopic abundance of 0.0118%, can contribute to the external radiation exposure of workers (Alharbi, 2013) (Gupta, Chatterjee, Datta, Veer, & Walther, 2014).

1.3 Potential Environmental Effects of Radioactivity of Fertilizers

Radioactivity of phosphate rocks leading to health problems from radiation at the level of the industrial processes which involves mining and transportation of phosphate ores and production of fertilizers. Relatively large concentrations of natural radionuclides present in phosphate fertilizers contaminate the environment and agricultural lands during cultivation. At the usage level, when fertilizers dispersed into the geo and biospheres, have a potential to transfer to living beings. Leaching of the minerals and wastes is another potential source of radioactivity dissemination which may contribute to enhanced exposure of workers, public and the environment to these radionuclides (Jankovic, et al., 2013) (Sahu, Ajmal, Bhangare, Tiwari, & Pandit, 2014). The uptake and distribution of radionuclides in soil depends on several factors such as soil pH, type and amount of clay, exchangeable Ca and K and organic matter contents, physicochemical properties of the radionuclide, type of crop (crop species and variety, and cultural practices), fertilizer application, irrigation, plowing, liming and climate conditions (Bramki, Ramdhane, & Benrachi, 2018).

The environmental impact of chemical fertilizer production depends on the raw materials, production processes and the status of the pollution control equipment (Hussain & Hussain, 2011). Proper management of phosphorus along with its fertilizers is required that may help the maximum utilization by plants and minimum run-off and wastage. Phosphorus solubilizing bacteria along with the root rhizosphere of plant integrated with root morphological and physiological adaptive strategies need to be explored further for utilization of this extremely valuable nonrenewable resource judiciously (Gupta, Chatterjee, Datta, Veer, & Walther, 2014).

A possible negative effect of chemical fertilizers is contaminating the cultivated hands by trace metals and some naturally occurring radioactive materials. The large concentration of natural radionuclides in the fertilizers contaminates the environment and agricultural field. Direct inhalation of dust of phosphate fertilizers could affect the farmers on agricultural land. From the viewpoint of biological effect of radiation, the urea fertilizers did not cause any effect on human health. The main reason for the high radioactivity in the leafy fertilizers was ^{40}K. Chemical fertilizers caused increase in annual exposure dose by no more than 0.15% which should be taken into account at the continuing use of chemical fertilizers (Hussain & Hussain, 2011). The fertilizers which are all water soluble substances dissolve instantly in water. These dissolved radionuclides, taken up by aquatic foods and fishes, enter into the human body through vegetables, food grains, fruits, aquatic food and fishes, and through the meat and milk of pastured animals (Alam, ve diğerleri, 1997) (Uosif, Mostafa, Elsaman, & Moustafa, 2014).

The transfer of natural radionuclides to vegetation is low. Therefore the risk to the public from consumption of crops with enhanced natural activity derived from the use of fertilizer is negligible. Extended use of phosphate fertilizer raises the dose rate in air above the ground by about 0.8 nGy/h. This may give rise to an additional exposure of man at continuous residence on such previously contaminated farm land of 0.007 mSv/y. If phosphogypsum is used as a soil amendment, the doses may be no longer insignificant,

mainly due to the exhalation of radon (Scholten & Timmermans, 1996).
Soil not only acts as a source of continuous radiation exposure to humans but also as a medium of migration for transfer of radionuclides to biological systems, which can cause harmful biological effects such as DNA damage and cancer. Despite a well-known effect of cancer, scientists have long known that ionizing radiations with high doses may also cause mental retardations in the children of mothers exposed to radiations during the pregnancy period. All types of food including wheat and apples contain a detectable amount of radioactivity which successively relocates into the human body via the ingestion pathway. The activity of food is strictly linked to the activity of the soil where the food was grown. Knowledge of the concentration and the distribution of the radionuclides in these materials is very important because they provide useful information for the monitoring of environmental contamination by natural radioactivity (Bramki, Ramdhane, & Benrachi, 2018). Radionuclides enter the human body in ways of direct inhalation of airborne particulates, ingestion through the mouth, and entry through the skin. The ultimate state of the radionuclides depends upon their chemical and physical form. After uniform distribution, some radionuclides irradiate the entire body at the same rate (Ghosh, Deb, Bera, Sengupta, & Patra, 2008).

2. Materials and Methods

2.1 Study Area

Trakya Sub-region remains between Northern Marmara Basin, Meriç Basin and Greek and Bulgarian border; North Egean Sea, Marmara Sea and Black Sea (northwestern Turkey, 40°45', 42°10' North latitude and 26°15', 28°15' East longitude) are shown in Figure 1.

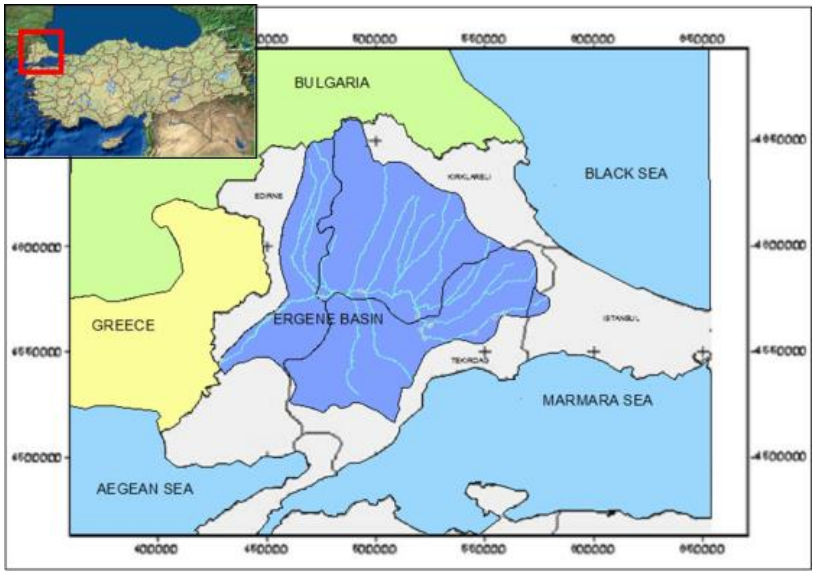

Figure. 1. Geographical Location of Trakya Sub-region

Trakya Sub-region and Ergene Basin constitute one of the most important agricultural

centers of our country. Sub-region has a total land area of 2376400 hectares, of which about 65% are cultivated. Excluding the parts of Istanbul and Canakkale which are located in sub-region, Tekirdağ, Edirne and Kırklareli have total agricultural land of 1239102 ha constitutes 73.8% of the total area I., II. and III. in the Land Use Capability Class, fertile and well-qualified agricultural land, which should be carefully protected. Despite the fact that the surface area of the three provinces forming the sub-region constitutes approximately 2.32% of the total surface area of Turkey, the absolute protected agricultural land located in the sub-region constitutes 8.23% of the total agricultural land protected by Republic of Turkey. The agricultural land in sub-region is seen to be between 10% and 70% more than the productivity capacities of many cultivated plants grown compared to the agricultural land in the country. If it is thought that the land on different marine, terrestrial and alluvial sediments in the high plain system forming an integral part in the sub-region is deep and rich in plant nutrients; it appears that the region is an agricultural sanctuary. 109512 ha of meadow-pasture; 512380 ha in the forest; the remaining 43425 ha are other land and water surfaces used for non-agricultural purposes (TU, 2007).

This is the region which uses the most fertilizer per unit area, with an average of 145 kg per hectare (TU, 2007). The fertilizer is used intensively in the region and the chemical fertilizers used are mostly nitrogen content. The most widely used fertilizer types are 20-20 (NP), 15-15-15 (NPK), Ammonium Nitrate and Urea varieties. In the wheat cultivation, 20-20 (NP) and 15-15-15 (NPK) are used as base fertilizer. Urea and Ammonium nitrate are used as upper end fertilizer. In the sunflower, the same base fertilizer is used, but top fertilizer application is not very common. In the rice cultivation, 20-20 (NP) and 15-15-15 (NPK) are used as lower fertilizer, and the nitrate and urea are used besides fertilizers containing sulfate as upper fertilizer. Sulphate-containing fertilizers are mostly used in Edirne province and they are mostly used in paddy farming. In Tekirdag province, the unit area is the fertilizer which uses the most fertilizer (Inan, 2012).

Three geological rock groups in Trakya Sub-region are observed in different sizes. Trakya is located on the Alpine Himalaya belt. Pontian located north of Turkey is located at the northwest end of the tectonic units. Rhodoplas that are surfacing on the Greek borders to the west, Rhodope intermediate masses to the north and silent strandja tectonic units of the Balkan fold system. In the north of Trakya, there is the Istranca massif consisting of Palaeozoic and Mesozoic aged magmatic and metamorphic rocks. The Ergene basin, located in the middle of the lower section, is a growth zone between the Istranca Massif and the Biga Massif in the south and constitutes one of the existing 13 sedimentary basin. In the basin, volcanic rocks belonging to young volcanism are available. The Miocene and Oligocene series are overlain by Pliocene aged series composed of basalt gravel. In the eastern part of the basin there are lakeshops with a thickness of 30 m. The thickness of the Pliocene series in the basin center is 600 m. In the central and southern parts of the basin there are young volcanic outcrops of augite-olivine basalt in the Pliocene series (TU, 2007).

After the Chernobyl accident in Turkey in ~~Thrace~~ Trakya region, the activity concentration of ^{137}Cs in the soil was determined as 324 Bq/kg in Edirne and 45 Bq/kg in Saray town of Tekirdağ province. ^{137}Cs is a product of fission, it is not found naturally in nature, nuclear tests or reactor accidents are the result. ^{137}Cs half-life is 30.2 years

(Gönen, 2012).

2.2 Experimental Procedure

The fertilizer usage data of Edirne, Kırklareli and Tekirdağ provinces which constitute the Trakya sub-region were obtained from the Provincial Directorates of Environment and Urbanism according to years. ^{226}Ra, ^{238}U, ^{232}Th and ^{40}K activity concentrations in phosphate rocks, fertilizers and soil were set from various studies conducted in our country and in the world, compared with limit values of UNSCEAR (2000).

3. Results and Discussion

Trakya sub-region is an important agricultural region where the fertilization is 2-fold that of fertilizer consumption in Turkey. Agricultural activities have decreased in the basin. However, agriculture sector is still among the most important factors that shape socio-economic structure of the basin.

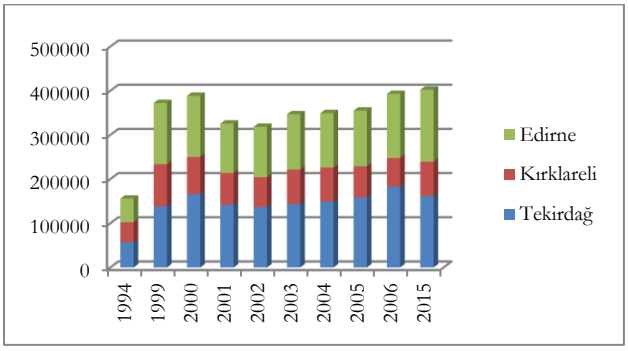

Figure 2. Chemical fertilizer consumption in Trakya Sub-region by years (tons)

When we look at the fertilizer usage according to the provinces that constitute the region (Figure 2); fertilizer consumption has increased in the last 15 years, mostly in Tekirdağ and Edirne provinces and fertilizer consumption in Kırklareli province is considerably lower than the others. Furthermore, it is estimated that fertilizer usage will continue at significant rates. When we consider the fact that the global climate change affects the hydrological cycle and nutrient transport, it seems that the fertilizer usage control is vital for agricultural production.

The fertilizer is used intensively in the region and the chemical fertilizers used are mostly nitrogen content. The most widely used fertilizer types are 20-20 (NP), 15-15-15 (NPK), Ammonium Nitrate and Urea varieties. Sulphate-containing fertilizers are mostly used in Edirne province and they are mostly used in paddy farming (Inan, 2012). Demand of phosphorus application in the agricultural production is increasing fast throughout the globe. The bioavailability of phosphorus is distinctively low due to its slow diffusion and high fixation in soils which make phosphorus a key limiting factor for crop production. Applications of phosphorus-based fertilizers improve the soil fertility and agriculture yield but at the same time concerns over a number of factors that lead to environmental damage need to be addressed properly (Gupta, Chatterjee, Datta, Veer, & Walther, 2014). Phosphate fertilizer also contains ~~various stable elements. These stable elements are~~

macronutrients (N, P, K, Ca, Mg, and S), micronutrients (B, Cl, Co, Cu, Fe, Mn, Mo, Ni, Se, Si and Zn), and fluorine and toxic elements (As, Al, Cd, Pb, and Hg) (Ghosh, Deb, Bera, Sengupta, & Patra, 2008). The amount of phosphorus is also considerable as we can see in Figure 3.

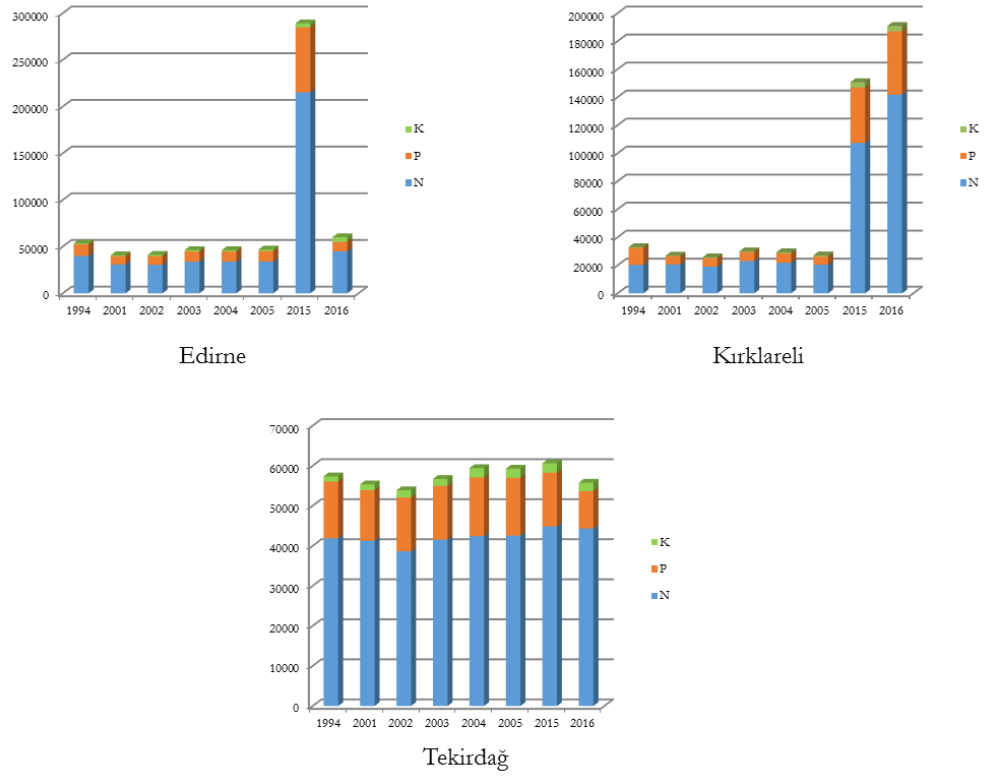

Figure 3. Chemical fertilizer consumption based on plant nutrient in provinces in the sub-region by years (tons)

Heavy metals such as Co, Cu, Fe, Mn, Mo, Ni, Zn, As, Al, Cd, Pb, and Hg which can be caused by phosphorous and potassium fertilizers used in the sub-region may cause contamination of soil and water resources and accumulation in the food chain. Nucleid contents and environmental effects of different chemical fertilizers (as shown in Table 3) and soil (as shown in Table 4) can be different from those of different phosphate rocks with different production technologies. The use of fertilizers produced in our country or imported, in sub-region with high agricultural value, can cause radioactive contamination in soil and water resources and in produced vegetables.

When we examine Table 4, in studies conducted by Edirne (Gönen, 2012) (Zaim. & Atlas, 2016), it is seen that the average activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K are generally above the UNSCEAR limit values. According to Zaim and Atlas (2016), while the average activity concentrations for ^{226}Ra in the soil samples of the study area excluding Havsa and İpsala are between 1.04 and 1.47 times higher than the worldwide figures, average value of Edirne province is 1.14 times higher than the same figures. All activities of ^{232}Th in the studied regions are higher than the world average and average value of Edirne province is 1.86 times of the world average. The highest amount of ^{232}Th

was found at Lalapaşa, is about two times of the world average value. The result may be due to the geological structure. The activity concentrations of ^{232}Th in Edirne soil samples were higher than the activity concentrations of ^{226}Ra. Among the ^{40}K concentrations, while values are lower than the world average except Lalapaşa, Süloğlu, Edirne (center) and Enez, average value of Edirne is similar to the world average. The ^{137}Cs was also determined in the soil samples in six districts of Edirne (Lalapaşa, Edirne-center, Meriç, İpsala, Enez and Keşan). 137Cs does not exist in soil naturally, this result may be due to Chernobyl nuclear power accident in 1986 or nuclear weapon testes. The concentrations of ^{137}Cs are consistent with the world average (Zaim. & Atlas, 2016). A similar work has not been reached for Kırklareli and Tekirdağ.

Table 4. Some typical values of activity concentrations (Bq/kg) in soils in the World

		Soil			
Location	**Reference**	**^{226}Ra**	**^{238}U**	**^{232}Th**	**^{40}K**
World Wide	(UNSCEAR, 2000)	35	35	30	400
Edirne, Turkey	(Gönen, 2012)	11-38		18-56	294-822
Edirne, Turkey	(Zaim. & Atlas, 2016)	40		56	407
İstanbul, Turkey		28		33	388
Zonguldak, Turkey		23		20	245
Kayseri, Turkey		36		37	430
Rize, Turkey		50		42	643
Rize, Turkey	(Durusoy & Yildirim, 2017)		7-80	10-171	36-924
Bangladesh	(Alam, ve diğerleri, 1997)		36	46	351
Palestine	(Thabayneh & Jazzar, 2012)		34.5	23.8	120
Iran	(Asgharizadeh, ve diğerleri, 2013)	31-45		27-57	328-769
India	(Shahul Hameed, Sankaran Pillai, & Mathiyarasu, 2014)		8	98	436
India	(Sahu, Ajmal, Bhangare, Tiwari, & Pandit, 2014)	22-683	21-674	11-44	51-295
Bosnia and Herzegovina	(Kasumović, Adrović, Kasić, & Hankić, 2015)	32	41	32	331
Albania			34	18.3	348
Bulgaria		45	40	30	400
Montenegro		29		23.7	246
Czech		44		41	613
Greece		29	45	28	383
Croatia		43	53	37	423
Hungary		33	29	28	370
Macedonia		23	37	25	456
Poland		25	25	25	410
Romania		32	32	38	490
Slovenia		41		35	374
India		24		55	549
Iran		39		43	555
Mexico		203		22	252
Nigeria		55		91	287
Italy		72		48	617
Spain		46		49	650
India	(Bangotra, Mehra, Kaur, & Jakhu, 2016)	18-98		46-248	53-756
Algeria	(Bramki, Ramdhane, & Benrachi, 2018)	24-66		26-27	221-261
Algeria		53.2		50	311
Egypt		14		12	1233
India				49	1147
Jordan		58		18	138
Nigeria		41		30	413
Spain		39		41	578
Iran		19		18	338
Saudi Arabia		5		3	71

Conclusions

In order to decrease environmental effects from natural and chemical fertilizers in agricultural areas and water sources, farmers should be informed; good agriculture practices and organic agriculture should become widespread, incentives for the recycling of organic manure should be improved; fertilizer management system should be used to prevent excessive fertilizing for plants and tighten the regulations and national standards on organic waste disposal and pesticides use. Sustainable agriculture covers all these applications. The key principles for sustainability are to integrate biological and ecological processes such as nutrient cycling, nitrogen fixation, soil regeneration, allelopathy, competition, predation and parasitism into food production processes; minimize the use of those non-renewable inputs that cause harm to the environment or to the health of farmers and consumers; make productive use of the knowledge and skills of farmers, thus improving their self-reliance and substituting human capital for costly external inputs (Pretty, 2008). Also it will minimize specific soil threats such as soil erosion by wind, water, and tillage, and soil compaction and physical deterioration and the loss of biodiversity from the soil.

To protect the soil and water sources in the sub-region, long-term monitoring is essential; which should include baseline, extreme, and representative sites. A well-distributed network of monitoring stations across all land uses, topographic conditions, and sub-catchments of the larger catchment would assist in model evaluation and verification when estimating at smaller scales. Legislation to ensure the continuity of long-term monitoring, cross-media monitoring (water, soil, air) at different scales such as field, farm catchment, sub-basin and basin and detailed information on soil and farm management are needed for all provinces in the sub-region. Studies should also be done to determine the radioactivity caused by fertilizers in Kırklareli and Edirne province soils.

References

Alam, M. N., Chowdhury, M. I., Kamal, M., Chose, S., Banu, H., & Chakraborty, D. (1997). Radioactivity in Chemical Fertilizers Used in Bangladesh. *Appl. Radiat. Isot., 48*(8), 1165-1168.

Alharbi, W. R. (2013). Natural Radioactivity and Dose Assessment for Brands of Chemical and Organic Fertilizers Used in Saudi Arabia. *Journal of Modern Physics*(4), 344-348.

Asgharizadeh, F., Ghannadi, M., Samani, A. B., Meftahi, M., Shalibayk, M., Sahafipour, S. A., & Gooya, E. S. (2013). Natural Radioactivity in Surface Soil Samples from Dwelling Areas in Tehran City, Iran. *Radiation Protection Dosimetry, 156*(3), 376–382.

Bakkal, S. (2012). Master Thesis, Kilis 7 Aralık University Institute of Science. *Kilis İli Toprak Örneklerinde 238U, 232Th, 40K ve 137Cs Radyoaktivite Konsantrasyonlarinin Belirlenmesi.*

Bangotra, P., Mehra, R., Kaur, K., & Jakhu, R. (2016). Study of Natural Radioactivity (226Ra, 232Th and 40K) in Soil Samples for the Assessment of Average Effective Dose and Radiation Hazards. *Radiation Protection Dosimetry*, 1-5.

Barišić, D., Lulić, S., & Miletić, P. (1992). Radium and uranium in phosphate fertilizers and their impact on the radioactivity of waters. *Water Research, 26*(5), 607-611.

Bayrak Yılmaz, G. (2011). PhD Thesis, İstanbul University Institute of Science. *Determination of the Impact of Long Term Nutrient Loads on Surface Water: A Case Study of Ergene Basin*.

Bayrak Yılmaz, G., Atik, D., & Sivri, N. (2017). Agricultural Diffuse Pollution and Sustainability in Ergene Basin. *European Journal of Sustainable Development Research, 2*(1), 127-134.

Bramki, A., Ramdhane, M., & Benrachi, F. (2018). Natural radioelement concentrations in fertilizers and the soil of the Mila region of Algeria. *Journal of Radiation Research and Applied Sciences*(11), 49-55.

Durusoy, A., & Yildirim, M. (2017). Determination of radioactivity concentrations in soil samples and dose assessment for Rize Province, Turkey. *Journal of Radiation Research and Applied Sciences*(10), 348-352.

Gaafar, I., El-Shershaby, A., Zeidan, I., & ayed El-Ahll, L. (2016). Natural radioactivity and radiation hazard assessment of phosphate mining, Quseir-Safaga area, Central Eastern Desert, Egypt. *NRIAG Journal of Astronomy and Geophysics*(5), 160–172.

Ghosh, D., Deb, A., Bera, S., Sengupta, R., & Patra, K. (2008). Measurement of natural radioactivity in chemical fertilizer and agricultural soil: evidence of high alpha activity. *Environ Geochem Health*(30), 79–86.

Gönen, E. (2012). Master Thesis, Namık Kemal University Institute of Science. *Edirne İlinin Çevresel Radyoaktivitesinin Belirlenmesi.*

Gupta, D., Chatterjee, S., Datta, S., Veer, V., & Walther, C. (2014). Role of phosphate fertilizers in heavy metal uptake and detoxification of toxic metals. *Chemosphere*(108), 134–144.

Hassan, N., Mansour, N., Fayez-Hassan, M., & Sedqy, E. (2016). Assessment of natural radioactivity in fertilizers and phosphate oresin Egypt. *Journal of Taibah University for Science*(10), 296–306.

Hussain, R., & Hussain, H. (2011). Investigation the Natural Radioactivity in Local and Imported Chemical Fertilizers. *Brazilian Archives of Biology and Technology, 54*(4), 777-782.

Inan, I. (2012). Trakya Bölgesinde Tarım ve Hayvancılığın Durumu. *Turkish Economic Association*(16), .

Jankovic, M., Nikolic, J., Pantelic, G., Rajacic, M., Sarap, N., & Todorovic, D. (2013). Radioactivity in Chemical Fertilizers. *Proceedings of 9th Symposium of the Croatian Radiation Protection Association*, 578.

Kasumović, A., Adrović, F., Kasić, A., & Hankić, E. (2015). Natural radioactivity and radiation hazards assessment of soil samples from the area of Tuzla and Lukavac, Bosnia and Herzegovina. *Isotopes in Environmental and Health Studies, 51*(3), 469-477.

Mir, F., & Rather, S. (2015). Measurement of radioactive nuclides present in soil samples of district Ganderbal of Kashmir Province for radiation safety purposes. *Journal of Radiation Research and Applied Sciences*(8), 155-159.

Pretty, J. (2008). Agricultural sustainability: concepts, principles and evidence. *Phil. Trans. R. Soc. B.*(363), 447-465.

Sahu, S., Ajmal, P., Bhangare, R., Tiwari, M., & Pandit, G. (2014). Natural radioactivity assessment of a phosphate fertilizer plant area. *Journal of Radiation Research and Applied Sciences*(7), 123-128.

Saleh, I., Hafez, A., Elanany, N., Motaweh, H., & Naim, M. (2007). Radiological Study on Soils, Foodstuff and Fertilizers in the Alexandria Region, Egypt. *Turkish J. Eng. Env. Sci.*(31), 9–17.

Scholten, L., & Timmermans, C. (1996). Natural radioactivity in phosphate fertilizers. *Fertilizer Research*(413), 103-107.

Shahul Hameed, P., Sankaran Pillai, G., & Mathiyarasu, R. (2014). A study on the impact of phosphate fertilizers on the radioactivity profile of cultivated soils in Srirangam (Tamil Nadu, India). *Journal of Radiation Research and Applied Sciences*(7), 463-471.

Thabayneh, K., & Jazzar, M. (2012). Natural Radioactivity Levels and Estimation of Radiation Exposure in Environmental Soil Samples from Tulkarem Province-Palestine. *Open Journal of Soil Science*(2), 7-16.

TU. (2007). *Ergene River Basin Environmental Master Plan* (Cilt 1-2-3). Edirne: Trakya University Rectorate Publications.

UNSCEAR. (2000). *Report Of The United Nations Scientific Committee On The Effects Of Atomic Radiation To The General Assembly. ANNEX B Exposures From Natural Radiation Sources.*

Uosif, M., Mostafa, A., Elsaman, R., & Moustafa, E. (2014). Natural radioactivity levels and radiological hazards indices of chemical fertilizers commonly used in Upper Egypt. *Journal of Radiation Research and Applied Sciences*(7), 430-437.

Zaim, N. T., Atlas, H., Buyuk, B., Demir, E., N., B., & N., A. (2016). Investigation of Natural Radioactivity of Surface Soil Samplesin the Vicinity of Edirne-Turkey. *Acta Physica Polonica, 130*(1).

Zaim., N., & Atlas, H. (2016). Assessment of radioactivity levels and radiation hazards using gamma spectrometry in soil samples of Edirne. *Turkey. J Radioanal Nucl Chem.* doi:DOI 10.1007/s10967-016-4908-0

13. The Level of Livelihood Assets Ownership among Vulnerability Group in East Coast of Malaysia

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ABSTRACT:
This paper aim to analyze the level of livelihood assets ownership among vulnerability group in Kelantan, East Coast of Malaysia. A total of 300 respondents comprising the vulnerability group in the rural area, State of Kelantan has been chosen to achieve this goal. Based on Sustainability Livelihood Analysis, a structured questionnaires has been develop to collect information on the livelihood assets, which consist of human, financial, social, natural and physical assets. This study found that the human asset is the key asset which contributes to the livelihood compared to other assets of the vulnerability group in Kelantan. This study will benefit the policy makers, which directly involved with the development of rural communities. This study also proposes a number of remedies that need to be addressed in order to improve the sustainability of livelihoods among vulnerability group.

Keywords: sustainability, vulnerability group, livelihood assets

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1. Introduction

The sustainable livelihoods idea was first introduced by the Brundtland Commission on Environment and Development, and the 1992 United Nations Conference on Environment and Development expanded the concept, advocating for the achievement of sustainable livelihoods as a broad goal for poverty eradication [1].
In 1992 Robert Chambers and Gordon Conway proposed the following composite definition of a sustainable rural livelihood, which is applied most commonly at the household level namely, a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term.
Of the various components of a livelihood, the most complex is the portfolio of assets out of which people construct their living, which includes both tangible assets and resources, and intangible assets such as claims and access. There are five different types of assets own by individual to build their livelihoods which consists of natural, social, human, physical and financial assets. Livelihood assets ownership was related to achieve sustainability livelihood. Based on this statement, government intervention more focus and emphasize for this purpose. In Malaysia, government has implemented various policies such as *Rancangan Malysia Lima Tahun (RMLT)*, Government Transformation Planning, and Economic Transformation Planning and so on to increase level of income households. This is very important to ensure the households especially in the poor group bracket will achieve sustainability livelihood. Therefore understanding the livelihood assets among poor group is very important for the implementation of development plans in future. This paper aim to analyze the level of livelihood assets possession among poor in Kelantan, Malaysia. Kelantan which register one of the highest poverty incidence in Malaysia [2]. This study also calculate the sustainability livelihood index to further explaining the analysis of these assets.

2. Materials and Methods

This study is confined to Kelantan which situated in East Coast of Northern Malaysia which ranked second in terms of poverty rate. There are 300 respondents among vulnerability group (paddy farmers, coastal fisherman and rubber tapper) involve this study. Data was collected using a structured questionnaires which was designed based on Sustainable Livelihood Analysis (SLA) frame work. Data analysis consists of the descriptive statistic of livelihood assets to get a better understanding of the ownership livelihood assets among vulnerability group or poor group. To compare the ownership between five livelihood assets, this study using sustainability livelihood index [3].

$$Index_{sd} = \frac{S_d - S_{min}}{S_{max} - S_{min}}$$

Where, S_d was the original sub-component for community *d*, and S_{min} and S_{max} were the minimum and maximum values, respectively, for each sub-component determined using data from the same community surveyed. The household percentiles determined as 0 at minimum level and 1 at maximum level.

3. Results

3.1 Ownership of Livelihood Assets

Human assets: Department for International Development [4] assumes human assets as a combination of capabilities, skills and knowledge, and material health which enable households and individuals to make livelihoods and attain secure livelihood outcome [5]. Human asset entails a combination of abilities that endow the individual or households or individual towards earning livelihoods accomplishment. Based on this study, it show 10.3 percent of those who never attended school among the vulnerability group and 16 percent respondents have successfully completed secondary school education. A total of 36.7 percent respondents has received education at primary school level only. The study found that respondents vulneralbility group have health problems which accounted a high percentage of 30 percent. Most of the health problems encountered among the respondents are diabetes, hypertension and heart problem. The outcome of the survey showed most of the respondents were found to be never attended a lecture or talks on health issues. The percentage of respondents who attend this lecture shows the percentage does not even reach 50 percent out of total respondents. Only 17 percent of respondent attended the training and knowledge program organized.

Financial Assets: Lasse emphasize financial assets denotes the financial resources that people use to achieve livelihood objectives [1]. The definition applied here is not economically robust. In this definition, it includes flows as well as stocks, and it can contribute to consumption as well as production. This study find out average income per month among respondent RM1227.93 (USD306) and income expenditure RM 910.94 (USD227) per month. Overall respondents received subsidies from the government. Various types of interventions by government have been implemented to help the less fortunate to improve their living standards. Among the subsidies granted is in the form of fertilizer subsidy, equipment/ mechanization, intensives for replanting and so on. This study also found that around 31.3 percent of respondents do have savings.

Physical assets: Physical assets means the required accessibilities facilities needed by households or individuals like transportation good facility, good housing, safe drinking water, and accessibility to medical facilities, market and schools [6]. In this study, the distance between the residences to the city also affects the ability of the people in rural areas to obtain the services provided. Findings from the survey found the average distance between the respondent's house to the city is within a 3.23 km. However, 18 percent among respondents have more than 5 km distance from their house to the city. The distance to the city very important to evaluate so that the vulneralbility group not facing the food dessert problem. From this study also find out overall the respondent has at least a motorcycle. This type of vehicle ownership percentage exceeds more than 90 percent. In terms of car ownership, study show 52.3 percent respondent have a car. On the other hand, ownership of household goods in terms of media entertainment and information, most of the respondents has a television (97 percent) and 78.3 percent own a radio.

Natural capital: Goldman point out natural capital is the term used for natural resource stocks from which resource flow and services (e.g., nutrient cycling and erosion protection) that are useful for livelihoods are derived. Natural capital is constituted by a wide variation in resources from intangible public goods such as the atmosphere and

biodiversity to divisible assets used directly in the production of goods (such as trees, land) [7]. In this study 23 percent respondents was taken protein from fishing, 29.7 percent gardening practices and 21.7 percent use environment resources as a food sources.

Social assets: To increase individual's capability, social asset also represents social resources which provide prospects to the vulnerable households through social relations and interactions like bonds, bridges and linkage which bring equal mutual benefit to both parties in the social relations [8]. This study find out 44.7 percent respondents involve in society either political parties or non-governmental organization. In community level, only 52 percent respondent involve in community activity.

Index of livelihood assets: Index of the livelihood assets was ascertained based on selected indicator as shown in Table 1. General scores were calculated by means of a Composite Index on the basis of the standardized process of the above data. Results are shown in the following (Figure 1). Of the five livelihood capitals, human assets possessed the highest value (0.65) and social assets possessed a moderate high value (0.516) followed by natural assets (0.46). This represents how human assets such as education, experience, skill, knowledge would affect production and lifestyle in order to improve the livelihood among vulnerability group in Kelantan, East Coast of Northern Malaysia. Financial assets and physical assets ownership register relatively low values (0.33 and 0.4 respectively). Of the five livelihood assets, financial assets provided the most significant influence. The lack of financial assets would inhibit this group to increase production scales and develop infrastructures that would, consequently, make it difficult to achieve livelihood diversification. Lending policies to this group should produce a certain offset by improving environmental investments, strengthening the effect of cooperative organizations and associations, and improving the overall financial assets ownership of this group. This would enable and motivate in the improvement of other assets, thereby contributing to the general improvement of the livelihood level of vulnerability group [9].

Table 1: List of indicators for livelihood assets

Human Assets	**Financial Assets**	**Natural Asset**	**Social Assets**	**Physical assets**
Highest level of education Head of Household	Household income	Ownership of land	Position in society or organization	Water sources
Working experience	Income from non-economic activities	Ownership livestock	Involvement in community activity	Housing characteristic
Knowledge level	Subsidies recipient	Food resources from environment	Involvement in political party	Distance to town
Training attend	Saving amount		Involvement in agriculture society	Vehicle ownership

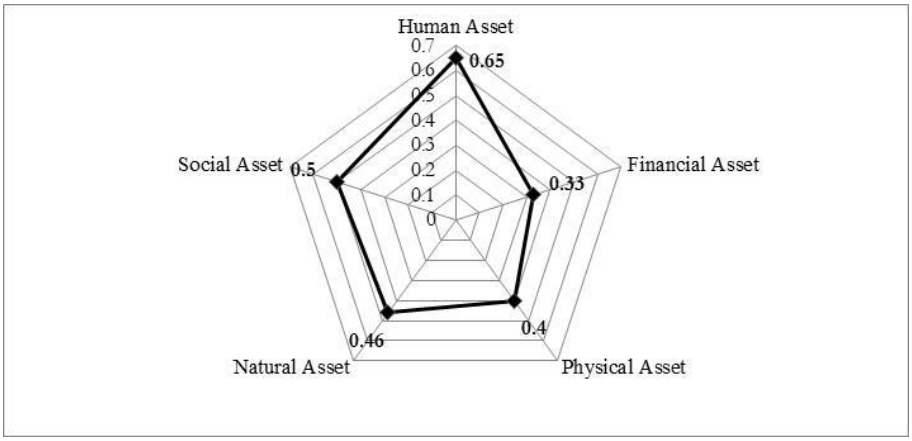

Figure 1: Livelihood assets spider diagram for vulnerability group in Kelantan, Malaysia

Conclusion

Understanding the current situation especially livelihood assets among vulnerability group or poor group is very important for government to implement the best practice to assist this group. Different livelihood activities have different requirements, but a general principle must be established among this vulnerability group, who are amply endowed with assets are more likely to make positive livelihood choices. They can choose from a range of options in order to maximize the achievements obtained from positive livelihood outcomes rather than being forced into a given strategy due to being the sole option available [9].

Based on this study it shows that, to increase better lifestyle among this group, warrants accessibility to quality education and skills training for the next generation this group will enhance for a healthier future. At the same time, head of households who are self-employed such farmers, fisherman and smallholder will be encouraged to adopt modern technology to increase productivity and income. Structured modular program focusing on modern farming techniques and good agricultural practiced need to intensify. To increase financial assets, rural entrepreneurship need to be encouraged among this group. The entrepreneurial orientation program will focus on stimulating local entrepreneurial talent and growth of indigenous companies [10]. Governmental institutions also should actively adopt effective means of financial support in order to prompt farmers to abandon agricultural production and engage in non-agricultural enterprises, thereby achieving an industry-oriented lifestyle [9].

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References

[1] Lasse K, (2001). The Sustainable Livelihood Approach to Poverty Reduction. International Development Cooperation Agency, Sweden. http://www. forestry.umn.edu/prod /groups/cfans/@pub/@cfans/@ forestry/documents/ asset/cfans_asset_202603.pdf.

[2] Malaysia (2017) Household Income & Poverty http://www.epu.gov.my/en/socio-economic/household-income-poverty

[3] Hahn, MB, Riederer, AM, Foster, SO (2009) The livelihood vulnerability index: A pragmatic approach to assessing risks from climate variability and change—A case study in Mozambique. Global Environmental Change 19(1): 74–88.

[4] Department for International Development. (2001). *Sustainable livelihoods guidance sheets*. www.livelihoods.org/info/info_guidanceSheets.html#6: DFID.

[5] Krantz, L. (2001). The sustainable livelihood approach to poverty reduction, SIDA. Division for policy and socio-economic analysis. Retrieved from- http://www.forestry.umn.edu /prod/groups/cfans/@pub/@cfans/@forestry/documents/asset/cfans_asset_202603.pdf

[6] Samsudin, S., & Kamaruddin, R. (2013). Distribution of the livelihood asset among the hardcore poor: Evidence from Kedah, Malaysia. *World Applied Science Journal, 28,* 38-42. DOI: 10.5829/idosi.wasj.2013.28.efmo.27008

[7] Goldman I, (2000). Sustainable Livelihoods Approaches: Progress and Possibilityes for Change. http://www.eldis.org/vfile/upload/1/document/0812/ SLA_Progress.pdf.

[8] Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 9,* 95–120. http://doi.org/10.1086/228943.

[9] Su. F, & Shang, H.Y. (2012). Relationship analysis between livelihood assets and livelihood strategies: A Heihe River asin example, *Sciences in Cold and Arid Regions*, 4(3): 0265–0274

[10] Malaysia (2011). 11th Malaysian Plan. Economic Planning Unit, Prime Minister's Department. Putrajaya: Prime Minister's Department

14. Constraints of Biosecurity Adoption on Beef Cattle Farms

Veronica Sri Lestari

ABSTRACT:
Biosecurity is very important to be applied in the farm in order to prevent cattle from contagious diseases. The aim of this research was to know the level and constraints of biosecurity adoption by beef cattle farms in South Sulawesi. This research was conducted in 2017 in Luwu regency, South Sulawesi province. Total sample was 31 beef cattle farmers who were choosed through purposive sampling. Data on biosecurity adoption level included vaccination, sanitation and traffic arrangements. Data were obtained through observation and interview using questionnaire. There were 21 questions for the level of biosecurity adoption. If beef cattle farmers adopt biosecurity, the score was 1, on the other hand, if beef cattle farmers do not adopt biosecurity, the score was 0. To know the adoption barrier, Delphi method and Focus Discussion Group were used. Data were analyzed descriptively. The results showed that the adoption level of beef cattle breeders was categorized as "high adopter". Factors inhibiting the application of biosecurity to beef cattle farmers sequenced from the highest percentage were shortage of extension workers, shortage of veterinarian, lack of technical knowledge of animal husbandry and lack of capital.

Keywords: adoption, beef cattle farmers, biosecurity, constraints

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1. Introduction

Beef cattle produce meat for the community. The growth of livestock population in Indonesia is slow because there are still pregnant cattle were slaughtered, beef cattle farmers used to traditional maintenance system. The ownership is between 2-3 heads per farmer, the community considers cattle as a savings that can be sold at any time. The Indonesian government has issued livestock policy and innovated livestock technology, improved management to increase cattle population. One of the important government policies in order to prevent transmission of infectious diseases is biosecurity.

According to FAO (2008), biosecurity is the key to prevent the spread of disease and infections. Biosecurity is made up of three components: segregation, cleaning and disinfection.

Biosecurity practices consisted of isolation, traffic control and sanitation. Isolation prevents contact between animals within a controlled environment. Traffic control includes traffic onto one's operation and traffic patterns within one's operation. Sanitation addresses the disinfection of materials, people and equipment entering the operation and the cleanliness of the people and equipment in the operation (Sharma, 2010). Biosecurity measures in cattle farms consisted of animal movement, equipment sharing and companies and contractors visiting the farms (Brenan and Christley, 2012).

Adoption is a mental process through which an individual passes from hearing about an innovation to its adoption (Rogers, 1962 in Karki and Bauer, 2004). There are five adoption stages namely: awareness, interest, evaluation, trial and error, and the last is

adoption (Ban and Hawkins, 1999).

The application of biosecurity and good livestock breeding has in fact experienced several obstacles. Some previous research proves that according to Channappagouda *et al.* (2016), inadequate knowledge on diseases of cattle and their control were perceived as the major constraints by the dairy farmers respectively in adoption of scientific animal breeding and health care practices.

According to Mutibvu *et al.* (2012) the most critical constraints to increase animal production were disease problems, feed and water shortages and inadequate extension service.

Ayoade and Akintonde (2012) argued that late adoption of innovations was due to irregular visits of extension agent. According to Gangasagare and Karanjkar (2009), numbers of farmers did not care to vaccinate and accept other health measures for their animals.

Ashraf *at al.* (2013) found that farmers do not have technological knowledge and they lack in resources to create interest toward technicality attainments. More importantly, role of Livestock Extension Field Staff was negligible. Brenan and Christley (2012) said that many beef cattle farmers are carried out infrequently or not at all. This may be due to many factors, including cost (in time and money), lack of proven efficacies of practices and lack of relevant education of veterinary surgeons, producers and other herd health specialists.

According to Adams and Yankyera (2015), diseases and pests menace, insufficient veterinary offices and animal health professionals were the major three constraints affecting animal health management in northern Ghana

Based on these facts, the researcher interested to conduct research on the level and constraints of biosecurity adoption in beef cattle farmers in Luwu regency, South Sulawesi province.

2. Research Method

The research was conducted in Luwu regency in 2017. Sample was 31 beef cattle farmers who were choosed purposively. To know the level of biosecurity adoption, observation and interview by using questionnaire were conducted. The questionnaire was consisted of vaccination, sanitation and traffic. Guttman scale was used in this research, if the answer was YES the score was 1, if the answer was NO, the score was 0.

The level of biosecurity adoption was calculated by adoption index (Karthikeyan, 1994 in Rahman, 2007):

$$\text{Adoption index} = \frac{\text{Respondent total score}}{\text{Total possible score}}\ x\ 100$$

Depending upon the extent of adoption of biosecurity measures, the respondents were categorized as follows:

(1). Low adopter (up to 33%)

(2). Partial adopters (34 – 66%)

(3). High adopters (67 – 100%)

To know constraints of biosecurity adoption, data were collected through Delphi method and Forum Group Discussion. The Delphi method is a long range of forecasting techniques that elicits, refines, and refers to the collective opinions and expertise of the expert panel (Gupta and Clarke, 1996). According to Dilworth (1992), the Delphi Method is a systematic tool for obtaining consensus from an expert group (panel). Each member

of the expert group is preserved independently, so that each member is free to express an opinion. The Delphi method is expected to get opinions, consensus or problems qualitatively. The expert group coordinator will usually ask a problem to each group member by passing the questionnaire. The Delphi method is considered appropriate to encompass opinion for objective vision formulation with consideration when subjective factors are expected to be very important or when accurate quantitative data are difficult to obtain. The goal is to reduce the negative effects of interaction groups and to gain the most reliable consensus of the opinions of a group of experts (Gupta and Clarke, 1996; Dalkey and Helmer, 1963; Dalkey, 1969). The hallmark of the Delphi Method is that all participants are treated as unknown persons (Schroeder, 2000). It aims to reduce the influence of feeling hesitant or offensive to other participants who are considered to have influence or a higher position. Ciptomulyo (2001) also characterizes the Delphi Method: (1) the ability to accommodate individual subjective opinions on an iterative basis and the presence of controlled feedback in the assessment of group responses, (2) the anonymous nature of the survey allows for free expression of opinion and no dominance effect, and (3) all respondents are actively involved at the beginning of the process and survey round. According to Barry *et al.* (2000), there were three groups of participants in the Delphi Method: (1) the decision maker is a group of experts as a panel, (2) the coordinator of one or more tasks preparing, distributing, tabulating and summarizing it during the decision process lasts, and (3) the respondents are a number of people whose decisions are assessed and considered. In practice, respondents are required if decision makers need to get input before making a decision. Conversely, if the decision maker has been able to make decisions based on ability, then the respondent is no longer needed. Therefore, this Delphi method more often involves two groups only, namely decision makers and coordinators. The approach can be done by interviewing directly or using electronic mail and then comparing and analyzing the responses of the experts, and then reporting back to the participants for a response (Graham *et al.*, 2003).

In this research, Delphi method was used through three times meeting. Constraints of biosecurity adoption were asked to beef cattle farmers at the first meeting. The second meeting was conducted with the same question as the question at the first meeting after a week. The last meeting was stopped after the constraints of biosecurity adoption remain the same as the second meeting. The third most frequent answers were identified as the constraints of biosecurity adoption of beef cattle farmers.

3. Results and Discussion

3.1 Characteristic of Respondents

As can be seen in Table 1. mayority of respondents were men (83.87%) with the average age was 43.49 year. Their education was low because the just spend for 7.839 year at school. The number of their family on average was categorize as small family. The number of beef cattle belong to respondents on average was small (4.355 head) and their experience on handling beef cattle was good enough (10.065 year).

Table 1. Characteristics of Beef Cattle Farmers

Characteristics	Mean	Standard Deviation	Percentage
Sex			
a. Male			83.87
b. Female			16.13
Age (year)	43.49	11.598	
Education (year)	7.839	2.282	
Family size (person)	4.419	1.566	
Number of beef cattle (head)	4.355	2.402	
Experience (year)	10.065	7.215	

3.2 Biosecurity Adoption

As can be seen in Table 2. the level of biosecurity adoption of beef cattle farmers was categorize as "high", because on average the percentage was higher than 66%. It was 85.21%. Meaning that beef cattle farmers in Walenrang district, Luwu regency adopt biosecurity. The highest biosecurity adoption was traffic in pens (99.63%) which included animal traffic, feeding equipment, vehicle and people traffic followed by sanitation (96%), and the lowest biosecurity adoption was disease prevention and vaccination (60%).

Table 2. Biosecurity Adoption

No	Variables	Score	Percentage
1	Disease prevention and vaccination		
	a. Know the health history of the herds from which cattle are purchased	1.0	20
	b. Transport animals in clean vehicles	0.6	12
	c. Loading area is located at the perimeter of the operation	0.2	4
	d. Dead animal pickup area located so rendering trucks do not contaminate the operation	1.0	20
	e. Keep a record of visitors to the operation	0.2	4
	Total	3.0	60
2.	Sanitation		
	a. Attempt to prevent manure contamination of feed and equipment used orally	1.0	25
	b. Clean equipment used orally between animals	1.0	25
	c. Regularly evaluate the activities on my operation to assess the potential for contaminating cattle	0.83	20
	d. If manure accidently contaminates feed or water, an immediate remedy is provided	1.0	25
	Total	3.83	96
3	Traffic		
	a. Attempt to prevent cross contamination between healthy and sick/dead cattle	0.97	12.4
	b. Have a control program for outside animals which could spread disease (rodents, etc)	0.7	8.9
	c. Use different equipment to feed and to clean pens or completely clean between use.	0.8	10.2
	d. Never step in the feed bank	0.37	4.73
	e. Never leave manure-heuling equipment in pens with different groups of animals	0.5	6.4
	f. Clean contaminated vehicles and equipment before use around healthy cattle	0.8	10.2
	g. Routinely clean and disinfect feeding equipment and cattle handling equipment	0.7	8.9
	h. Routinely clean and disinfect equipment used to medicate cattle	0.7	8.9
	i. Limit people's access to cattle pens, feed mixing and storage area and treatment area	0.17	2.2
	j. Facilities provide a clean area for restraint, treatment and isolation of sick cattle	1.0	12.8
	k. Handle highest health status animal first (young calves, healthy older cattle and sick animal last)	0.4	5.1
	l. Clean contaminated vehicles and equipment before use around healthy cattle	0.7	8.9
	Total	7.81	99.63
	Average		85.21

3.3 Constraints of Biosecurity Adoption

Table 3. Constraints of Biosecurity Adoption by Beef Cattle Farmers

No	Constraints	Frequency (%)

1	Lack of extension worker	38.0
2	Lack of veterinarian	29.0
3	Lack of knowledge	25.0
4	Lack of capital	8.0
	Total	100.0

Table 3 showed that the most constraints of biosecurity adoption by beef cattle farmers was lack of extension worker. One extension worker must cover a big area with many farmer groups. Beside that the condition of land was mountainous. It takes time to go to farmer group using motor bike. This research agree with that of Mutibvu *et al.* (2012), Ashraf *at al.* (2013), Ayoade and Akintonde (2012).

The second constrain was lack of veterinarian. This was the same as the first constraint. Most of veterinarian worked at Animal Husbandry Service in Luwu province. Beside the long distance from province to rural area, the number of veterinarian was also small. This agree with that of Adams and Yankyera (2015) who argued that insufficient veterinary offices was the mayor constraint of ruminant farmers' decision to participate in veterinary services in Northern Ghana.

The third constraint was lack of knowledge especially about cattle diseases and how to prevent cattle diseases. This is related to the low level of education of respondents and the lack of training and extension, especially on animal health. This research was supported by Brenan and Christley (2012), Gangasagare and Karanjkar (2009), Channappagouda *et al.* (2016).

The fourth constraint was lack of capital. The farmers do not have capital to make pens according to the requirements of good maintenance management. The pens were made from wood. Beef cattle were removed from the garden from morning until late afternoon for grassing. During the evening, beef cattle went back to their pens. This agree with that of Ahmed *et al.* (2016).

Conclusion

Based on this research, it can be concluded that eventhough the level of biosecurity adoption was categorized as high adopter, beef cattle farmers faced constraints on biosecurity adoption such as lack of extension worker followed by lack of veterinerian, lack of knowledge and lack of capital.

References

Adams, F. and K. O. Yankyera. 2015. Determinants of small ruminant farmers decision to participate in veterinary services in Northern Ghana. Journal of Veterinary Medicine and Animal Health. Vol 7(5): 193-204.

Ahmed, K., Tamir, B., Mengistu, A. 2016. Constraints, Opportunities and Challenges of Cattle Fattening Practices in Urban and Peri-Urban Kebeles of Dessie Town, Ethiopia. J Fisheries Livest Prod 4: 203.

Ashraf, S. M. Iftikhar, G.A. Khan, B. Shahbaz and I. Ashraf. 2013. Performance evaluation of the dairy farmers regarding adoption of precise dairy farming practices in the Punjab, Pakistan. African Journal of Agricultural Research. Vol. 8(29), pp. 4074-4080.

Ayoade A.R Akintonde J.O. 2012. Constraints to adoption of agricultural innovations among women farmers in Isokan Local Government Area, Osun State. International Journal of Humanities and Social Science Vol. 2 No. 8 [Special Issue – April 2012] 57

Barry, R., Stair, R.M. dan Hanna, M.E. 2000. Quantitative Analysis for Management. Prentice Hall, New Jersey.

Brenan, M.L. and R.M. Christley. 2013. Cattle producers' perception of biosecurity. BMC Veterinary Research. 9 (71): 1 - 8.

Buhman, M., G. Dewell and D. Griffin. 2000. Biosecurity Basic for Cattle Operation and Good Management Practices (GMP) for Controlling Infectious Diseases. NebGuide. University of Nebrasca. Lincoln Extension. Institute of Agriculture and Natural Resources. Nebrasca.

Channappagouda, B., Deekshit, G.V.1, Bharadwaja Krishna and Mahesh S D. 2016. Constraints in adoption of scientific animal breeding and health care practices-farmers'point of view. International Journal of Science, Environment and Technology, Vol. 5(5): 3435 – 3439

Ciptomulyo, U. 2001. Integrasi metode Delphi dan Prosedur Analisis Hierarkhis (AHP) untuk identifi kasi dan penetapan prioritas objektif/kriteria keputusan. Jurnal IPTEK 12: 42-52.

Dalkey, N. dan Helmer, O. 1963. An experimental application of the Delphi method to the use of experts. Journal of the Institute of Management Science 9 (3): 458–467.

Dalkey, N.C. 1969. The Delphi Method: an Experimental Study of Group Opinion. Research Paper RM-5888-PR. The Rand Corporation, June.

Dilworth, J.B. 1992. Operation Management: Design, Planning and Control for Manufacturing and Services, Mc. Graw Hill, New York.

FAO. 2008. Biosecurity for Highly Pathogenic Avian Influenza. Animal Production Health Paper. Rome. Italy.

Gangasagare, P.T. and L.M. Karanjkar. 2009. Constraints in adapting animal husbandry practices by the dairy farmers in the marathwada region of Maharashtra. Veterinary World, Vol.2(9):347-349.

Graham, B., Regher, G. dan Wright, J.G. 2003. Delphi as a method to establish consensus for diagnostic criteria. Journal on Clinical Epidemiologi 56: 1150-1156.

Gupta, U. G. dan Clarke, R. E. 1996. Theory and Application of The Delphi Technique: A Bibliography (1975-1994). Technological Forecasting and Social Change 53(2): 185- 211.

Karki, L.B. and S. Bauer. 2004. Technology adoption and household food security. Analysing factors determining technology adoption and impact of project intervention: A case of smallholder peasants in Nepal. The Deutscher Tropentag. 5-7 October 2004, Humboldt University Berlin.

Mutibvu, T., Maburutse, B. E., Mbiriri, D. T., and Kashangura, M. T. 2012. Constraints and opportunities for increased livestock production in communal areas: A case study of Simbe, Zimbabwe. *Livestock Research for Rural Development. Volume 24, Article #165*. Retrieved February 3, 2018, from http://www.lrrd.org/lrrd24/9/muti24165.htm

Schroeder, R.G. 2000. Operation Management: Contemporary Concepts and Cases. Mc Graw-Hill, New York.

Sharma, B. 2010. Poultry production, management and bio-security measures. The Journal of Agriculture and Environment Vol:11, pp: 120-125.

Van den Ban, A.W. and H.S. Hawkins. 1999. Penyuluhan Pertanian. Penerbit Kanisius. Yogyakarta.

15. Relationship between Breeder Characteristics and Adoption of Artificial Insemination in Bali Cattle

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ABSTRACT:
Artificial Insemination was a program aimed at increasing the production of livestock as well as the income of farmers. The study was conducted from July to September 2017 in Balusu District, Barru District, South Sulawesi Province, Indonesia. The population in this study was the whole Bali cattle breeders who adopt artificial insemination technology located in District Balusu, Barru regency was as much as 548 spread in six villages.With using Slovin formula obtained by the sample amounted to 85 respondents. Kinds of data used in research these were qualitative data and quantitative data. Sources of data used were primary data and secondary data. Methods of data collection were observation and interview. Analyzes used in this research was Rank Spearman. The results showed that closely related to the adoption of IB, namely formal education and temporary business scale associated with the weak of age, family dependents and income.

Keywords: Adoption,artificial insemination, Bali cattle,characteristics

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1. Introduction

The problems faced in the field of animal husbandry in Indonesia are still low productivity and genetic quality of cattle. This situation occurs because the majority of farms in Indonesia is still a conventional dairy farmers, where the quality of seed, the use of technology and skills are still relatively low breeders. Artificial insemination is the alternative technologies that are being developed in an effort to increase the productivity of local cattle biologik Indonesia through breeding technology which results relatively quickly and was satisfactory and has expanded implemented is the cattle livestock took a superior import (Hastuti, 2008). The implementation of the activities of artificial insemination (IB) is one of the efforts the application of appropriate technology and its success is influenced by five factors namely (i) the quality of frozen semen breeders level, (ii) knowledge and caring breeder in doing detection of lust (iii) body condition score of beef cattle health (iv) and (v) the skills and the attitude of the inseminator (BIB,2011; Dwiyanto,2012; Caraviello et al 2006) so one factor that affect IE breeders. The human factor is a very important factor in the success of the IB program because it has a central role in the activities of the IB services. The human factor, the means and the conditions of the field is a very dominant factor. Inseminator and the breeder is spearheading the implementation of the IB at once as the party responsible for the successful or whether the IB program in the field (Hastuti et al, 2008).

2. Research Methods

The research was carried out in July – September 2017 in Barru Regency Balusu Subdistrict, South Sulawesi. This research is a survey research in the form of observational methods are purely cross-sectional approach, namely a study done with observation a moment or in a given time period and any subject of study It is only done once observations during research (Machfoedz, 2007). The population in this research is the entire Bali cattle farmers who adopt the technology of artificial insemination that reside in district Balusu IE as much as 548 scattered in six subdistricts/villages. By using the sample Slovin formula obtained amounted to 85 people respondents. Types of data used in this research is qualitative data and quantitative data. The source of the data used, namely primary data and secondary data. Method of data collection i.e., observation and interview. Analytical tools used in this research is the Rank Spearman.

3. Results and Discussion

3.1 Adoption Artificial Insemination

Adoption is a process that occurred since the first time someone hears something new for the person to adopt (accept, implement, use) new things. In the process of adoption, targeted farmers take a decision after going through several stages. At first, an innovation targeted farmers know, that could be something really new or that has long been found but is still new to the targeted farmers. If the targeted farmers apply an innovation, then the targeted farmers abandon the old ways (Abraham, et al., 2003).

Adoption is a decision to use a completely new idea as a way of acting is the best. Innovation is a process of mental decisions, since a person is aware of any innovations to take the decisionto accept or reject it and then tighten it. The decision of innovation is a type of decision making that is typical (Suprapto and Fahrianoor, 2004).

For the adoption of artificial insemination in Barru Regency of Bali cattle needed and already applied by cattle farmers. For details of attribute the adoption of artificial insemination can be seen in Table 1

Table 1. Attributes of the Artificial Insemination Technology Adoption

No	Category	Total (Person)	Percentage (%)
1	Number of Cows in IB		
	1	58	68,2
	2	21	24,7
	3	5	5,9
	4	1	1,2
2	Applying Breeders year IB		
	1996 – 2002	3	3,5
	2003 – 2009	2	2,3
	2010 – 2017	80	94,2
3	IB has been appropriately applied in Barru		
	Yes	7	8,2
	No	78	91,8
4	IB is a necessity in Barru		
	Yes	80	94,1
	No	5	5,9

No	Category	Total (Person)	Percentage (%)
	IB better than Natural Mating		
5	Yes	59	69,4
	No	26	30,6

Source: Primary Data Once processed, 2017

Table 1 shows the breeder just doing the IB on one cow them for an average of 1-11 livestock ownership tail consisting of the parent, male, virgin and calf. So who can in IB only 1 or 2 heads just because some parent is mated naturally. Most farmers begin to perform artificial insemination in cows in 2010 to 2017. However, there are three farmers who had long been implementing IB which began in 1996.
According right breeder IB already applied in Barru because it is a necessity. Artificial insemination has become a necessity because based on the fact that there bulls have been hard to find. The bulls are focused in fattening.

3.2 Factors Related to the characteristics breeders Adoption Artificial Insemination

3.2.1 Age

Age is one indicator that shows the person's physical abilities. People who have an older age physically weaker than the person who is younger. Age a breeder can influence their work productivity in the farm business activities. Age is also closely related to the mindset of farmers in determining management system which will be applied in business activities peternakan.Klasifikasi respondent's age can be seen in Table 2

Table 2. Classification of Respondents based on Age in district Balusu

No.	Age (years)	Total (person)	Percentage (%)
1	0-14	0	0
2	15-64	64	87,9
3	≥ 65	11	12,1
	Amount	85	100

Source: Bahar, 2017.

Classification of respondents based on age showed that 87.9% of respondents who adopted the IB technology in Bali cattle in the district belong to the productive age Balusu Barru which have a range of ages between 15-64 years. The condition suggests that the relatively prolific breeders in the sense of physical well ability so that it can leverage in developing a farm business. In accordance with the opinion of Swastha (1997) in Saediman (2011) that a person work productivity will increase in accordance with increasing age, then decline back towards old age. Wahid, S., (2012) adds that the aging of the population is grouped into three: (1) age 0-14 years is called young / age has not been productive, (2) age 15-64 years of age called adult / working age / child bearing age, and (3) age 65 years or older is called aging / age unproductive / age also fits the opinion jompo. Nurlina (2007) in Herath et al (2012), age and educational background breeder affect one's ability to accept something new or adopt innovations. For farmers aged 25-40 years parameters usually adopter early, early adopter age 41-45, age 46-50 years adopter end and more than 50 years may be a repellent group

3.2.2 Education

In animal husbandry education factor expected to help people in an effort to increase production and productivity of livestock being kept. Adequate education level will have an impact on improving the performance and management capabilities run farm. Classification of respondents by level of education in the District Balusu Barru can be seen in Table 3.

Table 3. Classification of Respondents According to Education.

No.	Level of education	Total (person)	Percentage (%)
1	No school	6	7,1
2	elementary school	51	60
3	junior high school	14	16,5
4	senior High School	11	12,9
5	Diploma 3	1	1,2
6	graduate	2	2,3
	Amount	85	100

Source: Bahar, 2017

Table 3 shows the education level of respondents in District Barru Balusu ie at the elementary level at most that SD with the number 51 (60%) and the lowest is the level of D3 is 1 person (1.2%). This indicates that the level of education of farmers who do not adopt the IB technology in Bali cattle is still very low. This will affect the mindset of decision making financing of the business. This condition suggests that one of the reference person in decision-making is where the higher education level of one's education level it will be bold in the decision making. This is in accordance with the opinion Reksowardoyo (1983) that the education will increase knowledge, develop attitudes and foster the interests of farmers, especially in the face of change.

3.2.3 Livestock Ownership

Owners of livestock indicates the number of Bali cattle were maintained and owned by the breeder.To see the number of Bali cattle holdings which did IB can be seen in Table 4.

Table 4. Cattle Classification Based on Total Ownership Bali Bali Cattle

No	Owners Livestock (Tail)	Total (person)	Percentage (%)
1	1-11	76	89,4
2	12-21	7	8,3
3	22-32	2	2,3
	Amount	85	100

Source: Bahar, 2017

In Table 4 shows that the ownership of cattle Bali in Bali cattle ranchers who do not adopt the technology IB Balusu Bali cattle in the district indicate that livestock ownership highest in 1-7 tail with the number of farmers is 76 people with a percentage of 89.4%. Farmers who do not adopt these technologies have a number of animals a little. If seen from the number of animals in each breeder can be classified in the farms. This is in accordance with the opinion Fadilah et al., (2007) found that farm business group with

the number of small-scale livestock also called farms.

3.2.4 Income Level

Income or income is all income earned by the family in the form of money or services. According to the statistics Central Agency (BPS) in 2008 revenue is classified into four, namely:

a. Very high income brackets (> IDR 3,500,000 per month)
b. High income groups (IDR 2,500,000 - IDR 3,500,000 per month)
c. Medium income brackets (IDR 1,500,000 - IDR 2,500,000 per month)
d. Lower income brackets (<IDR 1,500,000)

According to Fatah, the economic capacity of rural communities will determine the level of participation in development (2006). Therefore we can conclude the public with a high level of economic capacity, high participation. While people with a low level of economic capacity is also low participation, because they will vote for. Earn a living so that his participation was lacking. Based on the income level, most of the respondents belong to the farmers who can afford it, this can be seen in Table 5

Table 5. Distribution of farmers who adopt IB Technology According Income Level

No	Income Level (IDR/ month)	Total (person)	Percentage (%)
1	≤ 1.000.000	8	9,4
2	2.000.000 – 5.000.000	62	72,9
3	6.000.000 – 10.000.000	13	15,3
4	11.000.000 – 15.000.000	1	1,2
5	≥ 15.000.000	1	1,2
	Amount	85	100

Source: Primary Data Once processed, 2017.

Table 5 shows that the farmer's adopted income is highest in the range of IDR.2.000.000-IDR.5.000.000, this indicates that the breeder is on the medium scale upwards, this is in accordance with the classification of BPS (2008) that the interval> IDR 3,500,000 is very high income brackets, IDR 2,500,000 - IDR 3,500,000 per month is high income groups and IDR 1,500,000 – IDR 2,500,000 per month is medium income brackets

3.2.5 Number of Family Members

The number of family members contributes substantially to the livestock business because the main source of labor is active and productive family labor. Conversely, the large number of family dependents, but not contributing positively to livestock business will be a burden for the livestock business (Rahmah, 2014). The number of family members of farmers who adopt IB can be seen in Table 6

Table 6. Number of Family Members Balusu Respondents in the district, Barru

No	Number of Family Members	Total (person)	Percentage (%)
1	1-2	61	71,8
2	3-4	22	25,9
3	< 4	2	2,3
	Amount	85	100

Source: Results of Primary Data Processed

For the number of family members indicates the number of 3-4 persons is the highest number (47.7%). The number of family members influences in managing a business, in line with Sobait et al (2011) opinion that the number of family members of a rancher can affect the business activity of the farmer because the number of family members can supply the availability of labor that can assist his activities and if the larger number of family members the greater the family needs that must be met

3.3 Characteristic Factors Associated with Artificial Insemination Adoption

To determine the relationship between factors: age, formal education, knowledge of IB, business scale, income and number of family members with adoption of artificial insemination can be seen in Table 7.

Table 7. Factors Related to Artificial Insemination Adoption

Factors Characteristic	coefficient of relation Rank Spearman		
	Adoption of artificial insemination		
	Value Korelasi Rank Spearman(rs)	Sig	relationship level interpretation (Gullford)
Age	-0,025	0,818	Very weak
Education	-0,227	0,037	weak
Knowledge about artificial insemination	-0,033	0,768	Very weak
Scale enterprises	-0,054	0,626	Very weak
income	-0,087	0,427	Very weak
Dependent of family	0,005	0,961	Very weak

Table 7 shows that:

1. The relationship between the age level with the adoption rate is very weak category and the direction of the relationship is inversely related if the variable X is high then the low Y variable is indicated by the value of negative and the relationship is not significant
2. The relationship between formal educations with the adoption rate is in the weak but definite category and the direction of the relationship is inversely related to the weak but definite variable relationship and significant relationship
3. The relationship between knowledge about IB and adoption rate is very weak category and the direction of the relationship is inversely related if the variable X is high then the low Y variable is indicated by the negative value and the relationship is not significant
4. The relationship between the scale of business and the level of adoption is in the category of very weak and the direction of the relationship inversely proportional means if the variable X high then low Y variable that is marked with a negative value and the relationship is not significant
5. The relationship between income and adoption rate is in very weak category and the direction of the relationship is inversely related if the variable X is high then the low Y variable is indicated by the negative value and the relationship is not significant
6. The relationship between the number of family members and the adoption rate is in very weak category and the direction of the relationship is inversely related if the variable X is high then the low Y variable is indicated by the negative value and the relationship is not significant

4. Conclusions

Characteristics of breeders is associated with the weak adoption of IB in Barru district so it is necessary to do intensive extension activities so that knowledge about the benefits of IB can be known by beef cattle farmers.

References

Asghar B, R S Marzieh. 2011. Factors affecting Adoption of Artificial Insemination in Dairy Farms of Ardabil Province (a comparison of models). Iranian Journal of agricultural economics and development research.42(2):287-300

Badriyah N dan R Setiawan.2012. Hubungan Pengetahuan Peternak Sapi Potong Terhadap Keberhasilan IB di Kecamatan Sarirejo Kabupaten Lamongan.Jurnal Ternak 3(2) :10-18

Balai Inseminasi Buatan (BIB). 2011. Buku Pintar Inseminasi Buatan. Balai Inseminasi Buatan, Lembang.Direktorat Jenderal Peternakan dan Kesehatan Hewan, Kementerian Pertanian

Bayey J D and A I Nache.2014. The Effect of Socio-Economic Characteristics of Cattle Farmers on The Adoption of Artificial Insemination Technology in Kaduna State of Nigeria. IOSR Journal of Agriculture and Veternary Science.7(9) 11-17

Caraviello,D.Z.K.A.weigel,P.M.Fricke,M.C.Wiltbank,M.J.Florent,N.B.Cook,K.V.Nordlund,N.R Zwald and C.L.Rawson.2006. Survey of Management Practices on Reproductive Performanceof Dairy Cattle on Large us Commercial Farms. Department of Dairy Science, University of Wilconsin, Madison 53706. School of Veterinary Medicine, University of Wisconsin, Madison. Journal of Dairy Science.89(12):4723-4735

Diwyanto,K. 2012. Optimalisasi Teknologi Inseminasi Buatan Untuk Mendukung Usaha Agribisnis Sapi Perah dan Sapi Potong. Bunga Rampai.Puslitbangnak

H M Salim,M a Halim,N Akter and M H Rashid. 2004. Evaluation of Adoption Status of Artificila Insemination Techninique on dairy cattle at Farmers level. Pakistan Journal of Biological Sciences. 7(5) : 674-678

Hastuti,D. 2008. Tingkat Keberhasilan Inseminasi Buatan Sapi Potong Ditinjau dari Angka Konsepsi dan Service Per Conception. Mediagro.4(1):12-20

Herawati T.A Angraeni.L Praharani, D Utami.A Argiris. 2012. Peran Inseminator dalam keberhasilan Inseminasi Buatan pada sapi Perah. Informatika Pertanian. 21(2) :81-88

Howley P,C O Donoghue,K Heanue. 2012. Factors Affecting Farmers Adoption of Agricultural Innovations : A panel data analyisis of the use of artficila Insemination among dairy afrmers in Ireland. Journal of Agricultural Science :4(6):171-179

Labetubun J,F.Parera,S.Saiya.2014. Evaluasi Pelaksanaan Inxeminasi Buatan pada Sapi Bali di Kabupaten Halmahera Utara. Agrinimal.4(1) :22-27

Melessa A,J Jemal and A malesse. 2013. Factors affecting the level of adoption of dairy technologies in Ada'a and Lume Distrcits, East Shoa-Ethiopia. Agricultural Science Research Journals.3(8) :237-243

Murwanto A G.2008. Karakteristik Peternak dan Tingkat Masukan Teknologi Peternakan Sapi Potong di Lembah Prafi Kabupaten Manokwari. Jurnal Ilmu Peternakan. 3(1):8-15

Prokopy,L.S.,Floress.K.,Klotthor-Weinkauf,&Baumgarts-Getz.2008. Determinants of agricultural best management practice adoption:Evidence from the literature.Journal of Soil and Water Conservatioan.63(5):300-311

Rathod P,M Chander &Chetan S G.2017. Adoption status of artificial insemination in indian dairy sector :application of multinomial logit model. Journal of Applied Research.45(1):442-446

Tefera S S,J K Lagat & H K Bett. 2014. Determinants of Artificial Insemination use by smallholder dairy Farmers in Lemu-Bilbilo District,Ethiopia.International Journal of African and Asian Studies. Vol 4.pp 91-98

Tophianong T.C,Agung B,Erif M N. 2014. Tinjauan Hasil Inseminasi Buatan Berdasarkan Anetrus Pasca Inseminasi pada Peternakan Rakyat Sapi Bali di Kabupaten Sikka Nusa Tenggara Timur. Jurnal Sain Veteriner.32(1): 46-54

Umam K,N.Kusrini,D Kurniati.2012. Hubungan Antara Karakteristik dengan Persepsi Peternak Terhadap Inseminasi Buatan pada Sapi Potong Kelurahan Tuan-Tua Kecamatan Benua Kayong Kabupaten Ketapang.Jurnal Sosial Ekonomi Pertanian. 1(3):23-28

16. New Indian Urbanism: Emerging Issues on Sustainability and Urban Ecology

Dr. Arup Sarkar

ABSTRACT:
India is on the verge of being emerged as the most populated country of the world. To manage the massive urban population, smarter, sustainable and greener cities are envisioned in India's newly adopted urbanization policy. While smart city program with techno-infrastructure interventions for a few selected cities leave the Indian urban ecological spaces uneven, various issues on social, cultural, economic and environmental sustainability put forward challenges which are yet to be addressed. In this paper the author presented a critical analysis of current urban growth trend in the Indian urban scenario and delved into the issues on peoples' participation, inclusive planning and environmental considerations. Citing various case studies from Indian urban trends, the author argues that a comprehensive sustainable inclusive urbanization policy is attainable with convergence of the mission in practice and a vision for the future with alternative path of self reliance for the urban poor in India.

Keywords: Sustainable Development, Inclusive Planning, Smart City, Peoples' Participation

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1. Introduction

With a total population of 1.21 billion and an annual growth rate of 1.64 percent, India is fast cruising into becoming the most populous country of the world. The success of agenda for the Sustainable Development Goals (2015) depends much on the population giants of the world and India's contribution in several fields is crucial. This paper aims to delve into the ground realities, analyze government initiatives and highlight prospects and constraints of the present situation

2. Sustainable Development Goals

Sustainable Development Goals are a set of seventeen global economic, social and environmental goals identified in 2015 by United Nations. It was a long journey of the UN's efforts since the United Nations Conference on the Human Environment, Stockholm during 5–16 June 1972, to bring together 193 member states of the world in its strive to address economic, social and environmental issues for a sustainable future for the planet Earth. There are 169 targets for the 17 SDG goals. Each target has indicators between 1 and 3, used to measure progress toward reaching the targets. There are 304 indicators in all that will measure compliance. It was argued that coherent and balanced

trade off is necessary while implementing action plans for achieving individual goals (Nilsan 2016). This is in particular important in the Indian context.

3. Trends in Population and Urbanization

In 2011, a total number of 377 million people lived in 7935 towns/cities (census, 2011) constituting about 31.2 % of the total population. The number of towns has significantly increased from 5161 in 2001 to 7935 in 2011. If we critically look into the definition of urban areas in India, a strange revelation may be obtained. As per the Census of India all places with a municipality, corporation, cantonment board or notified town area committee, etc. are urban, and all other places which satisfies the following criteria: i) A minimum population of 5,000; ii) At least 75 per cent of the male main working population engaged in non-agricultural pursuits; and iii) A density of population of at least 400 persons per sq. km., are urban. Thus for the villages to acquire an urban tag, the three criteria are to be achieved simultaneously. For an example, Gahmar is largest village in India, situated in Ghazipur district of Uttar Pradesh. It has a population of 75,000 and failed to attain the density and male working population criteria. There are many villages in the total of 640,867 nos. of villages in India which are close and yet to be identified as urban. About 17 percent of the villages are having more than 5000 population, and their number is increasing. However, the societal demands of these villages for provision of modern amenities and services are poorly addressed[6]. Addressing this issue with a review on definition of urban areas, the urbanization in India may take a surprising leap ahead.

4. Addressing Poverty and Hunger

The National Policy for Farmers (NPF) was framed in 2007. *Pradhan Mantri Krishi Sinchayee Yojana* (PMKSY), an initiative on mass scale irrigation was launched in 2014 with a capital investment of 7.5 billion USD for five years[7]. Other government initiative, including extension of existing programs and introduced in 2014 and after, focus of various aspects such as food security, agricultural credit, crop insurance, minimum support price, e-marketplace, seed development initiatives etc.

Gross irrigated crop area in India was 82.6 million hectares, and produced 275.11 million tonnes of food grains during 2016-17 (Sally, 2017). And still the country was home to around 194.6 million undernourished people according to a 2015 report[8] of Food and Agriculture Organization (FAO) of United Nations. The 2017 report of FAO[9] indicates 38.4% of children under five in India were stunted and 15% of the children remaining are hungry, 51.4% of women in reproductive ages were anemic, while obesity in adults rose from 14.6 million in 2015 to 29.8 million in 2017.

[6]India's Villages Grow Larger, Smaller Ones Disappear, *Indiaspend*, October 26, 2012 http://www.indiaspend.com/investigations/indias-villages-grow-larger-smaller-ones-disappear; Accessed 3 June 2018.

[7]Annual Report, 2016-17, *Department of Agriculture, Cooperation and Farmers welfare*, Government of India; http://agricoop.nic.in/sites/default/files/Annual_rpt_201617_E.pdf; Accessed June 10, 2018.

[8]The State of Food Insecurity in the World, 2015. *Food and Agricultural Organization*, United Nations.

[9]The State of Food and Agriculture: Leveraging Food System for Inclusive Rural Transformation, (2017). *Food and Agricultural Organization*, United Nations.

Food as a legal right was strengthened with introduction of mid-day meals at schools and *anganwadi* systems to provide nutrition to pregnant and lactating mothers. The National Food Security Act (NFSA), 2013 was enacted to ensure food and nutrition security for the most vulnerable section of the society. Concerns were expressed on food security in the media (Joshi & Fan, 2017) time and again, but it seems that for achieving SDG goal 1 and 2 India needs to have a long march ahead.

5. Housing

There is a severe housing shortage in India. According to Government of India, there was a shortage of 26.53 million units of housing shortage in 2012. With a revised calculation, total urban housing shortage during 2012 was re-estimated to be around 18.78 million (MHUPA, 2017). About 17 per cent of urban population amounting to 65 million lived in slums in 2011. Only 87.4 per cent of the households in urban areas and 32.7 percent in rural India have access to toilets (NIUA, 2016). 60 per cent of the metropolitan households have access to safe drinking water, while for the non-metropolitan cities it is 51.7 percent. For non-metropolitan class I cities about 84.5 percent households have some sort of latrine in the premises, while only 28.2 percent have flush toilets with piped sewer. Homeless in Indian cities were 0.9 percent amounting to 3.4 million. There were 201 towns in 2011 where more than 75 per cent of the households practiced open defecation, and the percentage increases with size of town going smaller. Smaller town lack most of the urban amenities in much larger proportions. 'Housing for All' project aims at providing a home to every poor urban household by 2022. 'The Pradhan Mantri Awas Yojana' is being implemented during 2015-2022 and will provide central assistance to Urban Local Bodies and other implementing agencies through States and Union Territories for in-situ Rehabilitation of existing slum dwellers using land as a resource through private participation, credit linked subsidy, affordable housing in partnership and subsidy for beneficiary-led individual house construction targeting all statutory towns. '*Swachh Bharat* (Clean India) Mission' aims to eradicate open defecation by 2019.

6. Transportation

Transportation in Indian cities is phenomenal with associated congestion, pollution, noise and crowding. Studies reveal that passenger traffic in India is likely to grow at more than 8% per year and freight traffic at more than 5% per year during the period 1990–2021 (Ramanathan & Parikh, 1999). The nodal agency for planning and development, The National Institution Transforming India (NITI *Aayog*), admits in its official website[10] that the progress in implementation of the provisions of National Urban Transport Policy, launched in 2006 and revised in 2014, has been far from satisfactory.
Number of vehicles in India rose from 0.3 million in 1951 to 141.1 million in 2011. Personalized private vehicles such as cars and two-wheelers grew at Compounded Annual Growth Rate (CAGR) of 9.6 per cent and 10.3 percent per annum respectively between 1999 and 2009, and highest rate was recorded in the metropolitan cities. Suburban rail network too plays important role in public transport system in large cities in India. In

[10] http://niti.gov.in/content/sustainable-urban-transport-way-forward#; Accessed 3 June 2018.

Mumbai it carries over five million passengers daily and accounts for 58 per cent of total public transport passengers in the region, equivalent to 80 per cent of total passenger-kilometer. Kolkata, Lucknow, Chennai, Delhi, Pune, Hyderabad and Goa have suburban railway service. Operational city bus service is available in only around 65 cities among 7935 cities in total (IIHS, 2015). City railway system (Metro Rail) is in service in ten cities, and planned for seventeen cities. A Monorail system in operational in Mumbai, and there are proposals for Light Rail system in several cities. Tram, an antique mode of electric car transportation, is still operational in Kolkata.

It has been identified in several studies that lack of integration in national policies in various sectors is prerequisite for achieving the SDGs (Heeckt et.al., 2017). Urban systems become insensitive to SDGs to address short term gain. An example of such insensitivity may be a curious case of Kolkata, India's 3rd most populous metropolitan area, where in 2012 the Kolkata Police's jurisdiction was extended to the city's peripheries, and bicycles, clubbed with cycle van, hand cart and pull cart, were banned from 174 roads[11], having been identified as slow moving vehicle causing traffic congestion. Facing severe criticism from public, traffic regulations were amended re-opening 112 roads to cyclists in 2013. However, in 2014 the ban was re-imposed for 174 roads again[12].

Over all, it is observed that India far from achieving the SDG goal number 9 (Industry, Innovation and Infrastructure), 11 (Sustainable Cities and Communities) and 13 (Climate Action) related to inputs from transportation sector, and serious efforts are desired to introduce high quality public transit system with connectivity with non-motorized mode and para-transit. Effective land use policies with transit oriented development and integrated ticketing, walking and cycling should be priority[13].

7. Urban Renewal and Smart City Program

It is pertinent to mention on various government initiatives which were launched or revitalized since 2014 in order to address various issues related to sustainable development. 'Heritage City Development and Augmentation *Yojana* (HRIDAY)' program was launched to preserve and revitalize the unique character of a heritage city and facilitate inclusive heritage-linked urban development including sanitation, security, heritage revitalization, livelihoods by exploring various avenues including involvement of the private sector. '*Atal* Mission for Rejuvenation and Urban Transformation (AMRUT)' aims for providing basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities which will improve the quality of life for all. 500 cities are brought to its fold focusing on basic urban infrastructure and to bring in good governance through reforms and capacity building. 'The Smart Cities Mission' aims to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.

[11]https://scroll.in/article/828176/in-kolkata-citizens-resist-police-attempts-to-squeeze-bicycles-off-the-road; Accessed 3 June 2018.

[12]http://www.thehindu.com/news/national/other-states/fresh-notification-on-banning-cycles-in-kolkata/article5735828.ece; Accessed 3 June 2018.

[13]United Nations (2017). Transport and Sustainable Development Goals Transport and communication bulletins for Asia and the Pacific, No. 87, ESCAP.

Intension of the Government of India had been reflected in various international platforms apart from notifications from time to time. Ms. Paulomi Tripathi, First Secretary in India's Permanent Mission to the United Nations, stated at the 51st Session Commission on Population and Development[14] in April 2018 that development of well-planned and fully serviced new areas or 'green-fields' around cities in order to accommodate the rapidly expanding population was a part of the urban strategy of the government of India.

8. Concluding Remarks

Sustainable Development Goals are interlaced and complex and achieving them needs perfect balancing in policy framework (Klopp & Petretta, 2017). Stress more on urban systems are bound to encourage rural to urban migration in an already top-heavy urbanization in India. There is a growing concern on privacy of big data in the smart city systems (Townsend, 2013). Embedded in traditions and customs, society reacts to introduction of technologies in diverse manner. Critics argued that the smart city mission overlooks the range of inequality and diversity in Indian cities (Randhawa 2017), and unless participation of each section of the society is ensured with dialogues and sharing of responsibilities, systems are bound to crash. Achieving Sustainable Development Goals needs mutual cooperation between stakeholders and inclusive participation. With a general election of the Parliament in the horizon in every five years, India will have to strive hard to achieve it unless it has a long term plan.

Reference

Nilson, M/, Griggs, D. & Visbeck, M. (2016). Sustainable Development Goals, Nature, 534(7607):320, *AcademicOneFile*; Accessed 3 June 2018.

India's Villages Grow Larger, Smaller Ones Disappear, *Indiaspend*, October 26, 2012 http://www.indiaspend.com/investigations/indias-villages-grow-larger-smaller-ones-disappear; Accessed 3 June 2018.

Annual Report, 2016-17, *Department of Agriculture, Cooperation and Farmers welfare*, Government of India; http://agricoop.nic.in/sites/default/files/Annual_rpt_201617_E.pdf; Accessed June 10, 2018.

Madhvi Sally (2017). India set for record foodgrain output in 2017-18: Agriculture ministry, The *Economic Times*, 27 February 2018; https://economictimes.indiatimes.com/news/economy/agriculture/india-set-for-record-foodgrain-output-in-2017-18-agriculture-ministry/articleshow/63098420.cms; Accessed 3 June 2018.

The State of Food Insecurity in the World, 2015. *Food and Agricultural Organization*, United Nations.

The State of Food and Agriculture: Leveraging Food System for Inclusive Rural Transformation, (2017). *Food and Agricultural Organization*, United Nations.

Joshi, P.K. and Fan, S. (2017). Sustainable Development Goals: Strengthening rural-urban linkages is the key for India, Financial Express; 11 May 2017. https://www.financialexpress.com/opinion/sustainable-development-goals-strengthening-rural-urban-linkages-is-the-key-for-india/663049/; Accessed 3 June 2018.

MHUPA (2017). Report of the technical group on urban housing shortage (TG 12) (2012-2017), National Building Organization, Government of India.

[14]Business Standard, April 11, 2018. Unplanned urbanization poses serious development challenges: India to UN. Retrieved from https://www.business-standard.com/article/pti-stories/unplanned-urbanisation-pose-serious-development-challenges-india-to-un-118041100233_1.html; Accessed 3 June 2018.

NIUA (2016). Towns of India – Status of demography, economy, social structure, housing and basic infrastructure, HSMA HUDCO NIUA collaborative Research.

Ramanathan, R. & Parikh, J. K. (1999). Transportation sector in India: an analysis in the context of sustainable development, *Transport Policy*, 6(1):35-45. https://doi.org/10.1016/S0967-070X(98)00030-4; Accessed 3 June 2018.

http://niti.gov.in/content/sustainable-urban-transport-way-forward#; Accessed 3 June 2018.

IIHS (2015). Urban transport in India: Challenges and recommendations; http://iihs.co.in/knowledge-gateway/wp-content/uploads/2015/07/RF-Working-Paper-Transport_edited_09062015_Final_reduced-size.pdf; ; Accessed 3 June 2018.

Rode, P., Heeckt, C., Ahrend, R., Huerta Melchor, O., Robert, A., Badstuber, N., Hoolachan, A., and Kwami, C., 2017. Integrating national policies to deliver compact, connected cities: an overview of transport and housing. Coalition for Urban Transitions, London and Washington, DC. Available at: http://newclimateeconomy.net/content/cities-working-papers; Accessed 3 June 2018.

https://scroll.in/article/828176/in-kolkata-citizens-resist-police-attempts-to-squeeze-bicycles-off-the-road; Accessed 3 June 2018.

http://www.thehindu.com/news/national/other-states/fresh-notification-on-banning-cycles-in-kolkata/article5735828.ece; Accessed 3 June 2018.

United Nations (2017). Transport and Sustainable Development Goals Transport and communication bulletins for Asia and the Pacific, No. 87, ESCAP.

Business Standard, April 11, 2018. Unplanned urbanisation pose serious development challenges: India to UN. Retrieved from https://www.business-standard.com/article/pti-stories/unplanned-urbanisation-pose-serious-development-challenges-india-to-un-118041100233_1.html; Accessed 3 June 2018.

Klopp, J. M. & Petretta, D. L. (2017). The urban sustainable development goal: Indicators, complexity and politics of measuring cities, *Cities*, 62:93-97.

Anthony M. Townsend (2013). Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia, W W Norton Company: ISBN 0393349780.

Randhawa, A & Kumar, A. (2016). Exploring sustainability of smart development initiatives in India, *International Journal of Sustainable Built Environment*, 6 (2):701-710.

17. Examining Sustainable Mobility in Low-cost Neighbourhoods in Khartoum-Sudan

Dr. Zuhal Eltayeb Awad, Zainab Osman

ABSTRACT:
By the beginning of the current century the state of Khartoum-Sudan start giving direct support to low- income families by providing neighborhoods with built houses to solve housing problem. The problem is that these neighborhoods lack proper standards of sustainable urban mobility which lead to bad living conditions. Five neighborhoods are selected as case studies. The research has two methodological phases: a comparison between neighbourhoods by criteria (geospatial data) describing their physical characteristics and field observation.The current situation of the neighborhoods were analyzed and the outcomes were compared with the UN Habitat model of sustainable neighborhood focusing on location, proximity to potential work areas ,urban mobility and street network characteristics. The research found that all the selected neighborhoods are accessible by private transportation (mini buses and cars) and within neighborhoods by (Ructias) . They have clear road hierarchy with no special roads dedicated for bicycles or pedestrians. Car ownership's ranging from 20 – 30 %. and there is no sufficient parking space. The research recommended adding sidewalks, parking spaces and green routs that can help identifying roads and improve their usability and giving priority to pedestrians, cyclists, and public transport. Introducing shared-use mobility services such as car sharing.

Keywords: low-cost neighborhoods, sustainable mobility, road hierarchy

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Examining Sustainable Mobility in Low-cost Neighborhoods in Khartoum-Sudan

Z. E. Awad, Z. O. Gaafer

Abstract
By the beginning of the current century the state of Khartoum-Sudan starts giving direct support to low- income families by providing built houses to solve housing problem. The problem is that these neighborhoods lack proper standards of sustainable mobility. Five neighborhoods are selected as case studies. The research has two methodological phases: a comparison between neighbourhoods by criteria (geospatial data) describing their physical characteristics and field observation.The current situation of the neighborhoods were analyzed and the outcomes were compared with the UN Habitat model of sustainable neighborhood focusing on five parameters :location, proximity to potential work areas ,urban mobility street network characteristics and walkability .The research found that all the selected neighborhoods are accessible by private transportation (mini buses and cars) and within neighborhoods by Ructions . They have clear road hierarchy with no special roads dedicated for bicycles or pedestrians. Car ownership's ranging from 20 – 30 %. and there are no sufficient parking spaces. The research recommended adding sidewalks, parking spaces and green routs that can help identifying roads and improving their usability and giving priority to pedestrians, cyclists, and public transport. The research encouraged shared-use mobility services such as car sharing.

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1. Introduction

Sustainable development is an important concept yet comprehensive and complex at the same time. It was first presented in the 1987 Report of the Brundtland Commission, Our Common Future, as "*meeting the needs of the present generation without compromising the ability of future generations to meet their own needs*." (Holden et al. 2014). It was clearly outlined in the 17 sustainable development goals (Rio +20), in which Goal 11 presents a clear statement that urban development can be a major concern in sustainable issues "*Make cities and human settlements inclusive, safe, resilient and sustainable*" (United Nations, 2016) . Sustainable development is seen as a process that links environmental protection with economic, social and cultural sound development. This approach to community sustainability was developed in Melbourne Australia and adopted at the Earth Summit, 2002 and is called the Melbourne Principles (UNDP 2002) and known as the four pillars of sustainability: cultural vibrancy, economic prosperity, environmental responsibility and social justice. Sustainability in regard of transportation is defined as diminishing both mobility and the negative of traffic (Clercq and Bertolini. 2003), therefore, Policies for sustainable urban development should include measures to reduce

the need for movement and to provide favorable conditions for energy-efficient and environmentally friendly forms of transport. (Jabareen 2004). The Circles Project, as a collaborative network of colleagues and associates who have been working together in various capacities to contribute to sustainability, linked the built form of the urban development with transport in the ecological domain (The Circles Project 2007). At the macro level of the town "Sustainable transportation" is defined as "*transportation services that reflect the full social and environmental costs of their provision; that respect carrying capacity; and that balance the needs for mobility and safety with the needs for access*" (Jordan and Horan 1998). And at the micro level of communities (Egan.2014) identified sustainable transport and connectivity as good transport services and communication linking people to jobs, schools, health and other services. Transport facilities comprise public transport, that help people travel within and between communities and facilities to encourage safe local walking and cycling.

Sustainable development at the neighborhood level is define as a "*development that responds to the local needs without compromising the ability of people globally to respond to their own needs*" The Haute Quality Environmental and Economic Rehabilitation (2006). The concepts of healthy communities and livability are strongly linked with transport, as it is one of the in-put determinants of health and livability (Lowe et al 2013). Barton and Grant conceptual model of the determinants of neighborhood health and livability linked buildings and places with streets and routes at the built environment level (Barton and Grant 2013). When integrating health with planning, there are many facets of planning and design that affect health and well-being such as cycle networks that encourage healthy activities and safer environment which reduces car reliance. Today the streets as argued by Angela et al (2012) have been spaces used primarily by cars in the past they were focal points for exchange and social gathering.

Therefore, a successful sustainable urban design of neighborhood meets the needs of the community that means including the community's culture and character and the quality of infrastructure and social services as well as the design street pattern**.** In order to design a sustainable mobility within neighborhoods sufficient amount of work zones should be located within walking distance of the transit stop and with minimal automobile parking and maximum bicycle parking (Strong (2001)). The evaluation criteria of sustainable neighborhoods presented by The LEED (2014) identifies smart location and linkage to encourage development within and near existing communities and public transit nfrastructure, and access to quality transport. UN Habitat (2014) has developed five principles as a new strategy for sustainable neighborhood planning one of them is: Adequate space for streets and an efficient street network: The street network should occupy at least 30 per cent of the land and at least 18 km of street length per one km^2 by combining walkability and public transport catchment area. In developing countries badly located low-income housing projects place a huge burden on the residents in terms of the transport subsidy, and also results in households spending a high proportion of their meagre income on transport, that is not considered to be sustainable in the long term and leads to urban sprawl (Aucamp et al 2001). Two types of Accessibility indices within neighborhoods are developed as part of the study by Wilber Smith Associates (2008): Public Transport Accessibility Index which measure the distance to the nearest place or activity and Service Accessibility Index which measure. the number of places or activities within a given distance. They describe how efficiently with less time and travel distance a

person can reach there.

2. Research Methodology

This paper presents part of a research carried to evaluate urban sustainability in low-cost neighbourhoods in Khartoum analysing six urban parameters : political management and community participation, urban morphology and typology, urban mobility, access to social infrastructure, sustainable basic infrastructure and employment and income generation The research has followed qualitative and quantitative methods which included: analysis of documents, photo documentation, observation, and statistical data.

The research has two methodological phases: (1) a comparison between the planning pattern of the selected neighbourhoods and U N Habitat model of sustainable neighborhood design describing their street network design and (2) a field observation. The U N Habitat model of neighborhood design is a simple model demonstrates the balance between street and other land uses (see figure (1)). In street network model, both street hierarchy and block size are considered. In an area of one square kilometer, nine vertical and nine horizontal streets are designed to form a street network. The distance between two adjacent streets is 111 m, and the total street length is 18 km. Street network model design in a 1 km. square area should be design as the following:

1. The distance between two arterial routes is between 800 to 1,000 m.
2.The distance between two adjacent streets is 100 – 150.
3.The total street length is 18 km.

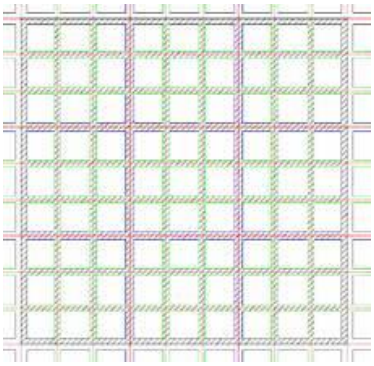

Figure (1) Street network model design
Source: UN Habitat. 2014

3. Selections of the Case-Studies

Sudan is a country with population of 35,482,233 and a growth rate of 1.7 %. As a capital -Khartoum is concentrating 26 percent of the national population and maintaining a growth rate that is double the national rate of 3.5 percent. (Sudan Central Bureau of Statistics (2013)). The capital is comprised of three towns: Khartoum, Khartoum North and Omdurman. The area of Khartoum capital is 22142 Sq.km and the density is 239 people/sq.km, the average size of household is 6.5 people (UN Habitat .2009). This overwhelming predominance of Khartoum attracts massive migration from different

regions, shaping its multi-ethnic urban pattern that result in housing problem, so that the government gives direct support to low- income families, by providing core units. Five neighborhoods- built by the Khartoum State Housing and Development Fund- are selected as case studies: Elthawra hara 72, Elthawra hara 75, Alandalas 17, Eltelal 1 and Elwadi Elakhader 21 (see figure (2)).

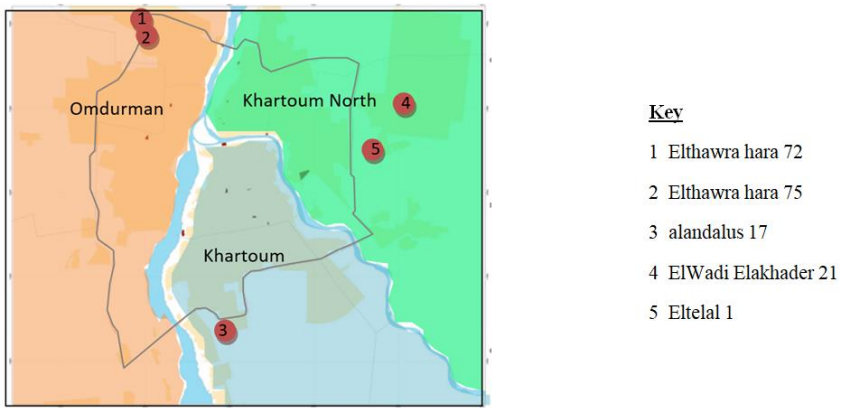

Figure (2): Location plan of the selected neighborhoods
Source: Awad and Jaafar (2016)

4. Presentation of the Case-Studies

4.1 El Thawra Hara 72

The area of the neighborhood is 993,982 m², about one square kilometer, the neighborhood contains ten vertical and eighteen horizontal streets. The distance between two adjacent streets is 115 m, and two arterial routs is 1000m (see figure (2)), and the total street length is 16,285 m.

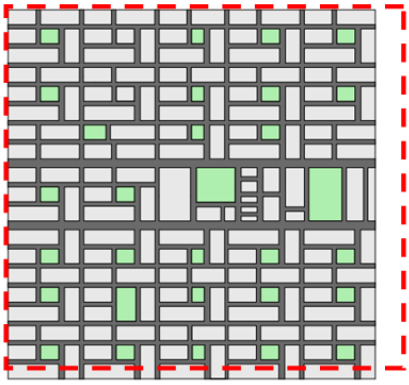

Figure (3): Design of Streets network of El Thawra hara 72.
Source (Khartoum State Housing and Development Fund Archieve).

4.2 El Thawra Hara 75

The Area of the neighborhood is 2,139,223.296 m², the selected area of the neighborhood is one square kilometer, it contains fifteen vertical and ten horizontal

streets. The distance between two adjacent streets is 110 m, and the distance between two arterial routs is 800 m (see figure (4)), and the total street length is 19,234 m.

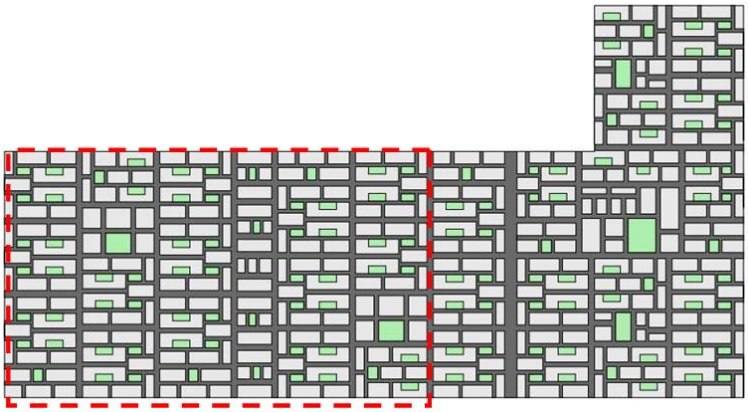

Figure (4): Design of Streets network of El Thawra hara 75.
Source (Khartoum State Housing and Development Fund Archieve).

4.3 Andalus 17

The area of the neighborhood is 970,920.000 m², about one square kilometer, the neighborhood contains thirteen vertical and eleven horizontal streets. The distance between two adjacent streets is 130 m, and the distance between two arterial routs is 700m (see figure (5)), and the total street length is 10,792 m.

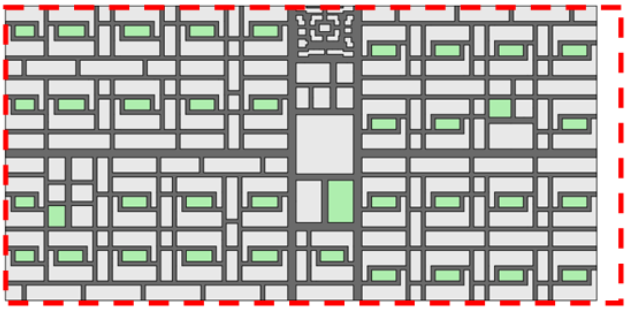

Figure (5): Design of Streets network of Andalus 17
Source (Khartoum State Housing and Development Fund Archieve).

4.4 El Wadi akhdar 21

The Area of the neighborhood is 683,280.011 m², it is less than one square kilometer, the neighborhood contains seven vertical and thirteen horizontal streets. The distance between two adjacent streets is 110 m, and the distance between two arterial routs is 870m (see figure (6)), and the total street length is 14,052 m.

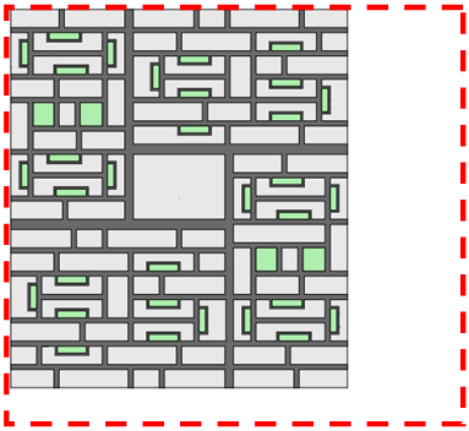

Figure (6): Design of Streets network of El Wadi akhdar 21
Source (Khartoum State Housing and Development Fund Archieve).

4.5 El Tilal 1

The Area of the neighborhood is 573,552.000 m², it is less than one square kilometer, the neighborhood contains ten vertical and ten horizontal streets. The distance between two adjacent streets is 100 m, and the distance between two arterial routs is 800m (see figure (7)), and the total street length is 14,931 m.

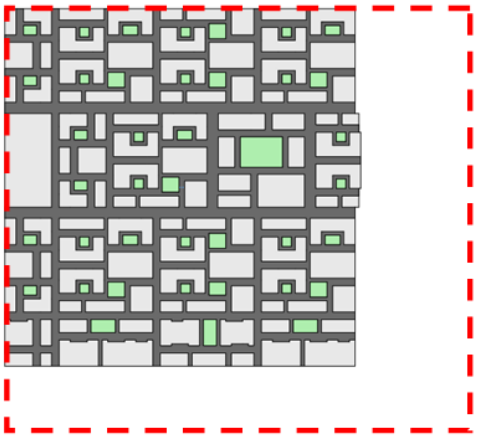

Figure (7): Design of Streets network of El Tilal 1.
Source (Khartoum State Housing and Development Fund Archieve).

5. Analysis

Location: Khartoum state has four circular roads that connect the capital in three different levels (Figure 8) the smaller level connects the internal administrative and service districts in the three main towns, the second level connects main residential zones through all of the localities and used to diffuse the conjunction in the center of Khartoum, the third circular route -where all the five case studies are adjacent - connects the industrial transportations, highway for outer state traveling lines and imported goods. The proximity of the neighborhoods to the third circular route provides a great

opportunity for income generation if grasped by residents of those neighborhoods. the third circular route connects also with Eljaily petrol filtration plant, it also connect to eastern transportation rout, the road can be considered a great source of income to the users that can also limit the need to travel to the work zones if well invested ,It is assumed that when the physical separation of activities is smaller, travel needs are likely to be lower and easily met by walking, cycling, and environmentally friendly transport, Land use planning has a key role to play in the attainment of these objectives.

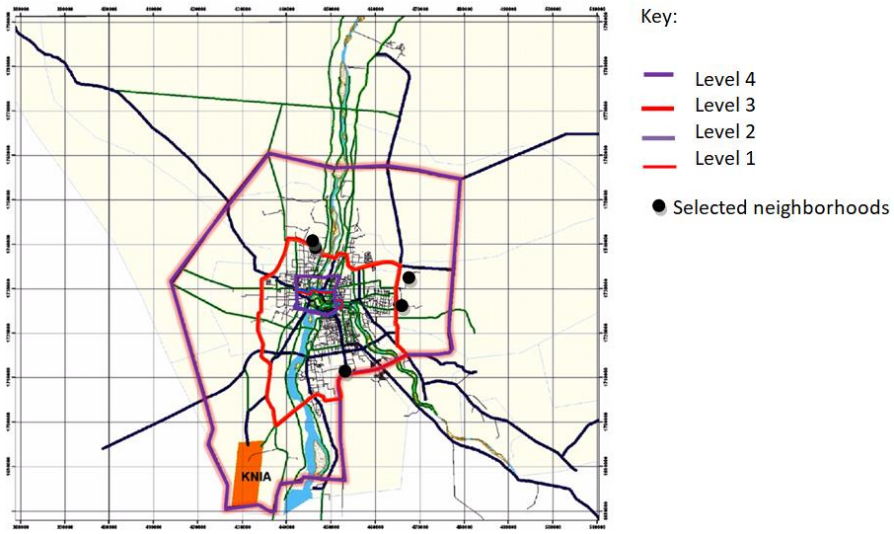

Figure 8: location of Selected neighborhoods according to Khartoum state ring roads Source (Khartoum State Structural Plan.2008).

Proximity of potential work areas: Proximity of potential work areas to the selected neighborhoods are measured using the distance to the nearest agricultural zone, to the nearest industrial area, to the nearest town center and Khartoum center (See table 5.4). The distances are not long as the nearest farming area is 2.00 km to Eltilal and the furthest is 6.1kmto ElThawra hara 72 and the nearest industrial area is 5.60 km to Alandalus and the furthest is 17.40 km to ElWadi ElAkhdar 21.

Table 1: Proximity to potential work areas. Source (the researcher).

Neighbourhoods	Distance to town center	Distance to Khartoum center	Distance to agriculture area	Distance to industrial area
ElThawra hara 72	10.800 km	18.200 km	6.200 km	8.300 km
ElThawra hara 75	12.100 km	19.140 km	6.100 km	9.120 km
Andalus 17	16.000 km	16.000 km	4.700 km	5.600 km
ElWadi ElAkhdar 21	20.400 km	22.450 km	5.800 km	17.450 km
ElTilal 1	17.000 km	18.800 km	2.600 km	13.700 km

Land-uses: As for the land uses, street networks represent 31% -39% of the total area of the neighborhoods , which is higher than UN habitat recommendation (2014) for sustainable neighborhoods planning that street network should occupy 30% of the total area of the neighborhood .Open spaces in all the neighborhoods are few, they represent a

small portion of the total area of the neighborhoods ranging from 6 % in Eltilal 1 to 9% in Elthora hara 72. The residential areas ranging from 48% in ElTilal 1to 56% in ElAndalus 17 and ElWadi ElAkhdar 21. (see Table (2)).

Table 2: Main areas in case studies. Source (the researcher).

Neighborhood	ElThawra hara 72	ElThawra hara 75	Andalus 17	ElWadi ElAkhdar 21	ElTilal 1
Street Area	325,693 m² 33%	769,360.552 m² 36%	80,935.000 m² 31%	210,773.828 m² 31%	223,969.913 m² 39%
Service Area	45,324 m² 4%	80,074.849 m² 4%	317,211.071 m² 7%	45,012.000 m² 7%	41,535.000 m² 7%
Open Spaces Area	86,699 m² 9%	179,187.295 m² 8%	61,998.000 m² 6%	42,372.000 m² 6%	33,486.000 m² 6%
Residential Area	536,266 m² 54%	1,110,600.6 m² 52%	65,783.478 m² 56%	385,122.183 m² 56%	274,561.087 m² 48%
Total Area	993,982 m²	2,139,223.296 m²	525,927.451 m²	683,280.011 m²	573,552.000 m²

Urban Mobility: Regarding urban mobility in the capital -Khartoum, the public transportation is inefficient and based on buses and mini-buses. Most of the selected neighborhoods lack good transport connectivity with other parts of the capital they are accessible by private mini- buses used as public transportation and private cars and within neighborhoods by Ructions (see picture (1)), car ownership ranges from 20 – 30 % of the total number of inhabitants. There are no special roads within all the neighborhoods dedicated for bicycles or pedestrians which are against the sustainable design of street network and sustainable mobility. Some inhabitants plant trees in front of their houses so that some streets are shaded (see picture (2)) but there are no sufficient parking spaces. Table (5.11) summarizes urban mobility within the selected neighborhoods**.**

Picture 1: Public transportation – mini buses and Ructions. Source (the researcher).

Picture 2: Shaded streets within neighborhoods. Source (the researcher).

Table 3: Urban Mobility. Source (the researcher).

neighborhoods	ElThawra hara hara 72	ElThawra hara hara 75	Andalus 17	Eltelal 1	El Wadi Elakhader 21
Public transport -ation (Bus)	No	No	No	No	No
Private transport – ation (Ructions)	Yes	Yes	Yes	Yes	Yes

Private transport -ation (minibus)	Yes	Yes	Yes	Yes	Yes
Bicycle paths	No	No	No	No	No
Pedestrian ways	No	No	No	No	No
Paved roads	Yes	Yes	Yes	Yes	Yes
Car ownership	25%	30%	25%	20%	27%

Streets network Characteristics: The distance between two adjacent streets in the selected neighborhoods ranging from 100 m to 130m which is near to the recommended distance- 115m. The distance between two adjacent arterial streets in all the neighborhoods are within the recommended range 800 -1000 except in Andalus 17 which is below the recommendation. The total street length in all the neighborhoods are less than the recommendations except in ElThawra hara 75 which is more than the recommendation. Some of the peripheral roads and a few internal roads of the neighborhoods are paved. Table (4) summarizes characteristics of the streets network of the selected neighborhoods

Table 4: Streets network characteristics. Source (the researcher).

neighborhoods	Total street length	distance between two adjacent streets	distance between two adjacent arterial streets
Thawra hara 72	16,285 m	115 m	1000m
Thawra hara 75	19,234 m	110m	800m
Andalus 17	10,792 m	130 m	700m
ElWadi ElAkhdar 21	14,052 m	110m	870m
Tilal 1	14,931 m	100m	800m

All the selected neighborhoods have good hierarchy of roads that feeds the neighborhood, support different functions and play a critical role in the safety of the neighborhood. The road widths of the case studies are starting from the main arterial roads (20 – 24m) all the way to cluster roads that leads to the cluster open area (8 – 10m) as shown in table (5).

Table 5: Hierarchy of roads. Source (the researcher).

neighborhoods	8m	10m	12m	15m	20m	24m	40m
ElThawra hara 72		*	*	*		*	
ElThawra hara 75		*	*	*	*		*
ElAndalus 17		*		*	*		
ElWadi ElAkhdar 21	*		*		*	*	
ElTilal 1	*			*		*	

Walkability: Walkability in the selected neighborhoods is measured by the walking distance to key services; which ranging from 280 m in ElWadi ElAkhdar 21to 625 m in El Thawra hara 75 as shown in table (6). Two neighborhoods only (El Thawra hara 72 and Andalus 17) have good walkability according to the recommendation of UN Habitat - 400 to 450 m. It was noticed that the shape of the neighborhood and the location of the service center play a key role in walkability, therefore ElThawra hara 75 has a longitudinal shape so that it has the longest walking distance to service center. Encouraging public transport in the selected neighborhoods is measured by the walking distance to bus stations; catchment area for minibuses in the selected neighborhoods ranging from 500 m

in El Thawra hara 75 to 1000 m in El Thawra hara 72 as shown in table (6), also two neighborhoods only (El Thawra hara 75 and ElWadi ElAkhdar 21) encourage public transportation as the recommended distance by UN Habitat is 320-640 m to each bus station.

Table 6: Walking distance to service center and Minibus catchment area radius Source (the researcher).

Neighborhoods	Walking distance to service center	Minibus catchment area radius
El Thawra hara 72	430 m	1000 m
El Thawra hara 75	625 m	500 m
Andalus 17	400 m	700m
ElWadi ElAkhdar 21	280 m	615 m
El Tilal 1	570 m	770 m

6. Conclusion

The existing process of allocating housing units to individuals without regard to where they work is not practical and needs some intervention. It is more economic to locate housing projects on more accessible land. The increase in land costs can be easily recovered by the savings in transport subsidy. Starting with choice of location of the selected neighborhoods most of them are adjacent to the third loop road that connects the industrial routes in Khartoum. Two neighborhoods are adjacent to potential working areas: Andalus 17 is adjacent to a big business center -Elkalakla and El tilal is next to an agricultural project. Street networks represent 31 -39% of the total area of the neighborhoods, which is higher than UN habitat recommendation that indicates inefficient planning leading to urban sprawl.The majority of the residents use public transportation which is a more sustainable solution as only 20 – 30% of the residents own vehicles. Most of the selected neighborhoods lack good transport connectivity with other parts of the capital. All neighborhoods' roads have good hierarchy; the road widths range from 40 to 20 m for the arterial roads and 8m for local roads. Streets are not walkable and there are no cyclist friendly routes, and lack sufficient parking spaces. Two neighborhoods only (Thawra hara 72 and Andalus 17) have good walkability and also two neighborhoods only (Thawra hara 75 and ElWadi ElAkhdar 21) encourage public transportation according to the recommendation of UN Habitat.

7. Recommendations

To improve sustainable mobility in neighborhoods several actions should be taken as follows:

- Choose accessible locations for housing projects, locations that can keep settlements compact and more energy efficient.
- Improve transportation connectivity of the neighborhoods with other parts of the capital.
- Increase the compactness of the neighborhoods by reducing the area of streets network.
- Locate main services at the center of neighborhoods to improve walkability and provide sub-centers to reduce walking distances.
- Arrange the public transport routes so that a bigger area of the neighborhood is

provided by public transport.
- Encourage public transport, bicycles and even mobility by walking.
- Promote bicycle usage to students and nearby workers by providing adequate facilities and cultural intervention strategies to make bicycles popular.
- Emphasize the good hierarchy of streets by designing streets themselves, adding sidewalks, and green routs that can help identifying the streets and improve their usability.
- Improve the pedestrian paths by providing detailed designs to different street widths that shows cars routes, green lines, infrastructure, bike lines and pedestrian paths.
- Separate lanes for bicycle routes and sidewalks should also be considered in the design. - Provide Sufficient parking space.
- Introduce Shared-use mobility services such as car sharing, which was once used in Sudan.

Reference

Angela, M.G. Giele,S. Barbosa (2012).Sustainable Neighborhoods and Social Housing Urban Projects: A Comparison between Brazilian and European Practices. World Congress on municipal engineering and Sustainable Communities.

Aucamp C. A. and Moodely G. Y. (2001). Making Low-Cost Housing Projects More Accessible for Public Transport in Ethekwini:What are the Cost? Traffic and Transportation Department, City Engineers Unit, PO Box 680, Durban.

Awad,Z,E and Jaafer,Z. (2016).Sustainability evaluation for low-cost housing projects in Sudan with special reference to Khartoum State Fund for Housing and Development projects. Journal of Engineering and Architecture. Volume 4, No.2. ISSN 2334-2986 (Print) 2334-2994 (Online) the American Research Institute for Policy Development.

Barton, H. and Grant, M. (2013) Urban planning for healthy cities: A review of the progress of the European Healthy Cities Programme. *Journal of Urban Health*, 90 (1). pp. 129-141. ISSN 1099-3460 Available from: http://eprints.uwe.ac.uk/16288

Clercq, F, and Bertolini. L. (2003). Achieving sustainable accessibility: An evaluation of policy measures in the Amsterdam area. Built Environment 29 (1): 36-47.

Circles of Sustainability. (n.d.) http://www.circlesofsustainability.org Retrieved march 2018.

Egan. J. (2014). The Egan Review Skills for Sustainable Communities. In the common goal:Defing and measuring sustainable communities . london: RIBA Enterprises Ltd

Holden E, Linnerud K and Banister D. (2014). Sustainable development: Our Common Future revisited. Global Environmental Change 26. pp 130–139.

Jabareen, Y. (2004). A knowledge map for describing variegated and conflict domains of sustainable development. Journal of Environmental Planning and Management 47 (4): 632-642.

Jordan D, and Horan T, (1998). Identification and Prioritization of Environmentally Beneficial Intelligent Transportation Technologies. Report prepared for California PATH Program, Berkeley, CA: California PATH.

Leed. (2014). *The Leed v4 for Neighbourhood Development.* U.S Green Building Council.

Lowe, M., Whitzman, C., Badland, H., Davern, M., Hes, D., Aye, L., Butterworth, I. and Giles-Corti, B. (2013), Livable, healthy, sustainable: What are the key indicators for Melbourne neighborhoods? Research Paper 1. Place, Health and Livability Research Program, University of Melbourne.

Strong, k. s. (2001). *sustainable urban neighborhoods.* florida: the graduate school of the university of florida.

Sudan Central Bureau of Statistics. (2013). Sudan in figure 2008-2012. Ministry of the Capinet-Sudan.

The Haute Quality Environmental and Economic Rehabilitation. (2006). *The Haute Quality Environmental and Economic Rehabilitation.*

UN Habitat. (2014). a-new-strategy-of-sustainable-neighbourhood-planning-five-principles. Retrieved august 2017, from unhabitat.org: https://unhabitat.org/

UN Habitat. (2009). *Urban Sector Studies and Capacity building for Khartoum State.* Khartoum: UN Habitat.

United Nations. (n.d.). *Sustainable Development Goals SDGs.* Retrieved October 2016, from Sustainable Development: www.sustainabledevelopment.un.org

UNDP. (2002). Melbourne Principles for Sustainable Cities. United Nations Environment Programme Division of Technology, Industry and Economics

Wilber Smith Associates. (2008). *Study on Traffic and Transportation Policies and Strategies in Urban. Areas in India*; Ministry of Urban Development: New Delhi, India.

18. The Relationship between the Disappearing Usage Value of Urban Space and Gentrification; Is Gentrification a Profitable Trade-Off?

F. Gozde Koseoglu PhDC, Prof. Nihan Özdemir Sönmez

ABSTRACT:
This paper investigates the lost usage value of the city center within the framework of the property handover in Fikirtepe Regeneration Project and the gentrification process experienced by the old settlers. The paper aims to explain the nature of the change that takes place in the social structure of regeneration area and transforming of the city center's usage value into the exchange value associated with the changing of social structure. The paper also aims to express what this replacement mean for old settlers and to discuss if the gentrification is a profitable trade-off for them. The data obtained from the questionnaires and the in-depth interviews conducted with the old settlers of regeneration area and the investors who prefer to buy real estate from the new projects in the region, have been analyzed in order to identify the relationship between lost usage value of the city center and the old settlers' perception regarding to the gentrification. The study demonstrates that: i) There is a socio-culturel change in the regeneration area. ii) The old settlers of gentrified area and also the investors, perceive gentrification as a process of obtaining financial gain iii) The usage value of the center disappears as a result of this perception of gentrification. Briefly, the paper aims to show a relationship between the lost importance of usage value in urban space and gentrification process.

Keywords: Urban Regeneration, Gentrification, Usage Value, Exchange Value, Urban Land Rents, Real Estate Economic Rents, Istanbul.

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1. Introduction

Because of the differences in economic rent that emerges during the gentrification process, the gentrification projects realised in city centers result in change of property. During the process of change of property, that is, gentrification; the city center loses its use value for the old settlers of the urban regeneration area. However, during this process, the city center gains a new meaning that represents the exchange value, both for the old settlers and the new owners of the gentrified area. In other words, there is a causal link between the gentrification process and the lost use value of the city center. Therefore, the handover process in the gentrified area causes the city center to

lose use value, transforming the value of the urban space to exchange value.
To put forth this relationship, this paper resorts to the questionnaires conducted with old settlers and new owners within the scope of the field study carried out in the Fikirtepe Urban Regeneration Area. The first questionnaire was conducted with the land holders and users living in the area being gentrified. Fikirtepe Urban Regeneration Area encloses the quarters of Dumlupınar, Eğitim, Merdivenköy, and Fikirtepe. According to the reports[15] which laid the foundation for the regeneration plan prepared by The Ministry of Environment and Urbanisation in 2013; the number of people living in the project area is 50,000, with an average household size of 3.25 people. According to TUIK, it is seen that there has been a decrease of 13,076 people in the total population of the mentioned four quarters since the start of the regeneration process. Bearing in mind that this decrease in the neighborhood population is due to the demolitions and evacuations in the urban regeneration area, it has been assumed that the current population is 36,924, with an average household size of 3.25 people. On this basis, the target population for the survey to be applied to the land holders and users was determined to be 11,362 households. For calculating the proper sample to represent the target population consisting of 11,362 households, including land owners and users, the following formula was used: ν = N τ2 π θ / δ2 (N−1) + τ"πθ. Assuming the (d) value, which is the error margin rate, as 0.07, and confidence interval as 95%, field studies were launched with the aim of completing 193 questionnaires. As a result of the 2-month field study, a total of 206 land owners and users were surveyed. In the other questionnaire, the investors who preferred to be landlords in the real estate projects realised in the area were surveyed. It is learned from the Kadıköy Municipality and the project developers that approximately 70,000 housing units are planned to be built in the risky area of the region. The same formula was used to determine the number of samples, and the confidence interval was assumed as 95%. However, because of the adverse circumstances that made accessing the participants difficult, the (d) value, which is the error margin rate, was assumed as 0,10. When these values are substituted in the formula; the number of elements in the sample set to be selected from the target population consisting of 70,000 residential investors was determined as 95.9. At the end of a two-month-long survey study, 96 participants were surveyed as was intended.

2. Briefly on Gentrification and the Rent-Gap Theory

The increase in land value seen in urban regeneration processes leads to other changes in physical patterns as well as ownership patterns, in other words, urban regeneration projects turn into gentrification projects. Creating the urban land rents through ownership and land values, the urban regeneration process starts with the encounter of the lower class and the newly-emerging middle class, but it ends up with the lower class leaving the regeneration area (Sam 2010).
According to Harvey (2003), the capital takes action again and again in order to purge the capital rent areas off of immigrants and the poor. Furthermore, Harvey (2003) also points out that during the urban regeneration process, the public sector balances the destructive

[15] Kadıköy District Fikirtepe and Surrounding 1/5000 scale master development plan explanation report, accepted with Ministry approval dated 02.08.2013, numbered 12984, and 1/1000 scale implementary development plan explanation report

power of market change, and supports the structural conditions that the capital needs.
Neil Smith (1979), explains the regeneration process that he names as the revaluation of the capital, with the rent-gap theory. According to this approach, also known as the critical approach, the bigger the rent-gap is the more attractive the city center becomes for the capital investments. The rent-gap in question reflects the difference between the "potential" and the "capitalised" values of a land (Soytemel and Şen 2014).
With better opportunities after the World War II, there were new policies employed to encourage the middle class and the working class to produce again. During this period, with the migration to the suburbs and the appreciation of the properties in the suburbs, the urban lands started to get empty. Therefore, in parallel with the capital movement towards new suburbs, city centers regressed and the land value gap between the two regions brought about the rent-gap (Smith 1996).
With the new search for profits acting on the global level by re-valuating the "underdeveloped" city areas to prevent the capital in the center from losing value, the "rent-gap" between the locations that lost value and the locations that gained value following industrialization (Smith 2002, Soytemel and Şen 2014) became an influential factor in the world geography (Şen 2011).
The Rent-Gap Theory correlates the capital investments that gravitate towards the areas in the city periphery and the capital gravitating towards the old city centers revaluated following this process, and it forms a relation of causality between the two (Sam 2010). The rent-gap in a region where the potential rent is high will put pressure to regenerate the buildings that fail to meet the needs that change with the new conditions and turn into unprofitable real estates (Smith 1996). During this process, the rent-gap attracts the capital investment to regeneration areas, because the rent-gap acts as an incentive for investing in the land (Smith 2002, Soytemel and Şen 2014).
Based on this explanation, it would be true to say that the biggest rent-gap will emerge in urban regeneration projects taking place in slum areas in central locations. The reason for the huge rent-gap is that the buildings in these slum areas have a high potential value at the end of the regeneration projects because of their central locations, despite the fact that they no longer meet the changing needs and they have turned into unprofitable real estates. Due to the huge rent-gap, the change in the broken-down physical pattern of the city center affects the ownership patterns, and the increase in value in the central urban areas results in gentrification. The central location of the regenerated urban area gains a new meaning reflecting the exchange value.

3. Migration from the City Center

The field study conducted in the Fikirtepe Urban Regeneration Area shows that the land owners moving from Fikirtepe are scattered across different areas of the Anatolian Side, and the study also underlines the fact that the majority of the land owners move away from the city center.
The questionnaires conducted within the field study show that almost all of the land owners remain in Istanbul, but they move away from the city center and gravitate towards the city peripheries.
A participant's words "*Everybody has scattered along the rural area right above TEM. Not one person moved to Bagdat Caddesi.*" shows that the land owners remained in Istanbul but their

movement was from the city center to the periphery.
The TEM Motorway, which starts from Europe and ends in Iran, has been one of the most crucial factors that determines the future of urban development in Istanbul, since the day it was opened to service. The settlements along the TEM that are close to the bridge connection points thrived in a short period of time, and the settlements with illegal housing that are enriched by the linking roads grew rapidly.(3. Bridge Evaluation Report) Therefore, by drawing a line between the priorly built-up central areas of the city and the rapidly growing and developing areas, it created an inner island. This imaginary line created by TEM Motorway sets a new central border that broadens the central borders that were determined by the first bosphorus bridge.

Chart 1. The distribution of the destinations of land owners who left Fikirtepe by the line that is assumed to determine the central borders

Point of Departure	Number	Percentage (%)
Inner Island	101	27.5
Outside the Line	266	72.5
Total	367	100.0

When the data obtained from the questionnaires conducted with the land holders and users from Fikirtepe is analysed, it is seen that 72.5% of the land holders from Fikirtepe headed towards the settlement areas outside the central line drawn by TEM. In other words, 72.5% of the land owners who sold their real estates and left Fikirtepe are pushed outside the line determined by the coastal road and TEM (Chart 1).
In short, the population who left the gentrified area moved from the city center to the periphery, and the majority of the land owners moved to different points outside the line that is assumed to represent the borders of the city center.

4. Gentrification as a Profitable Trade

The huge rent-gap emerging in the urban regeneration projects realised in city centers turns gentrification, which is inevitable most of the time, into a profitable trade for the actors involved in the process.

4.1 Selling the Location in the City Centre

The answers given by the land holders and users to the question "What does urban regeneration mean to you?" addressed to them within the scope of the field study show both their expectations from the urban regeneration project and how they perceive the gentrification process.
Within the scope of the questionnaires conducted with the Group 3 participants, the land holders and users were asked the question "What does urban regeneration mean to you?", and they were asked to rate the following options from 1 to 5: increase in the land value and financial gain, construction of earthquake-resistant buildings, increase in environmental quality, increase in socio-cultural facilities, moving/exile from Fikirtepe.
According to Chart 1, which was prepared based on the answers given by the land holders and participants, it is seen that the option of increase in the land value and financial gain got higher points than the other options which are solutions to problems

which creates the need for urban regeneration such as increase in environmental quality, increase in socio-cultural facilities, construction of earthquake-resistant buildings.

Chart 2. Rating by land owners and users to express what urban regeneration mean to them

What does urban regeneration mean to you?	Order	Rate
Increase in land value and economic gain	1	885
Construction of earthquake-resistant buildings	2	780
Increase in environmental quality	3	527
Increase in socio-cultural facilities	4	491
Moving/exile from Fikirtepe	5	336
Total		3019

Despite the main reasons that make urban regeneration essential; illegal, dense and poor housing, buildings under disaster risk, poor physical conditions, limited access to social reinforcements, and lack of green areas; participants from Fikirtepe perceive the urban regeneration process as an increase in the land value and economic gain. In other words, the majority of land owners from Fikirtepe regard the gentrification process in the region as a means of economic gain.

Chart 3. The distribution of land owners' satisfaction with the increase in the land value by whether or not they will reside in Fikirtepe after the urban regeneration process

Are you going to continue to reside in Fikirtepe after the urban regeneration process?		Are you happy with the increase in the land value in Fikirtepe?				Total
		Very dissatisfied	Dissatisfied	Satisfied	Very satisfied	
Yes	Number	1	5	18	16	40
	Percentage	0.70	3.60	12.90	11.50	28.80
No	Number	2	7	49	35	93
	Percentage	1.40	5.00	35.30	25.20	66.90
No answer	Number	0	1	3	2	6
	Percentage	0.00	0.70	2.20	1.40	4.30
Total	Number	3	13	70	53	139
	Percentage	2.20	9.40	50.40	38.10	100.00

The participants' responses to the questions show that they are happy with the increase in land value even though they will leave Fikirtepe after the urban regeneration process. Chart 3 makes a comparison between the satisfaction of the participants and whether or not they will continue to reside in Fikirtepe, and it is shown that the land owners do not complain about the gentrification process as long as they acquire economic gain at the end of the urban regeneration process. (Chart 3).

At the end of the urban regeneration process that the land owners regards as a means to obtain financial gain, they find it agreeable to leave the urban regeneration area and move to another part of the city, in return for economic gain. The only endeavour of the old settlers of Fikirtepe during the gentrification process was to increase their economic gain.

Field study shows that the vast majority of the land owners are not concerned about staying in the city center, on the contrary, they expect to leave the city center in return for a satisfactory economic gain. This manner of land owners who want to sell their location in the city center in return for a satisfactory revenue shows that their location in the city center is now transformed into an exchange value and the use value of the city center is no longer important for them.

4.2 Buying the Financial Gain of the City Centre

The data obtained from the questionnaires conducted with the participants who prefer to make a real estate investment show that the primary expectation of the investors who prefer to buy real estate within the projects realised in Fikirtepe Urban Regeneration Area is to obtain financial gain.

Within the scope of the said questionnaire, the participants were asked why they preferred Fikirtepe for investment, and they were asked to give points to the following options in accordance with their importance: investment opportunities and the expected increase in the real estate value, central location, transportation facilities, building quality, accessibility to the socio-cultural facilities, living standards, social reinforcement and abundance of green areas, because you love Fikirtepe.

In Chart 4, which was prepared according to the points given by the investors, it is seen that the highest point was given to the option of investment opportunities/expected increase in the real estate value. This option is followed by central location and transportation facilities. And, even tough they are the main components of the need for urban regeneration, it is seen that options such as building quality, accessibility to the socio-cultural facilities, living standards, social reinforcement and abundance of green areas ranked lower in the chart.

Chart 4. The Reasons Why Investors Prefer Fikirtepe

Why did you prefer Fikirtepe for investment?	Order	Points
Investment opportunities/expected increase in the real estate value.	1	450
Central Location	2	446
Transportation facilities	4	407
Building quality	5	385
Accessibility to the socio-cultural facilities	6	379
Living standards	7	377
Social reinforcement and abundance of green areas	8	370
Because you love Fikirtepe	9	250
Total		3508

40 of out 97 participants said they will live in the real estate themselves, 36 said they will rent the real estate, and 20 said they will sell the real estate. (Chart 5).

Chart 5. The ways the investors utilise the real estate that they bought

How are you going to utilise the real estate you bought in Fikirtepe?	Number	Percentage
Residence	40	41.20
Renting	36	37.10

Selling	20	20.60
No answer	1	1.00
Total	97	100.0

The majority of the investors who bought real estate in Fikirtepe preferred to by 1+1 apartments. It is seen that the number of investors who preferred to buy 3+1 and 4+1 apartments is much lower. Out of 97 participants, it is seen that the number of those who preferred to buy 1+0 apartments is 5, the number of those who preferred 1+1 is 42, while the number of those who preferred 3+1 is 2, and the number of those who preferred 4+1 is 1. (Chart 6).

Chart 6. The type of real estate that the investors bought in Fikirtepe

Which apartment type did you buy in Fikirtepe Urban Regeneration Area?	Number	Points
1+0	5	5.20
1+1	42	43.30
2+1	31	32.00
3+1	16	16.50
4+1	2	2.10
No answer	1	1.00
Total	97	100.00

The results of the field study show that the investors buy the real estate as an investment, and the majority of them will either sell or rent their real estates.
The data obtained in the field study indicates that those who buy real estate from the urban regeneration projects expect a financial gain that will stem from the increase in the land value.
In other words, the participants buy real estate from the regeneration area in the city center as a means to provide them with financial gain. For the investors in question, the city center represents an exchange value that will provide them with financial gain, and it has nothing to do with the use value.

5. Evaluation; The Relationship Between the Disappearing Use Value of Urban Space and Gentrification

The study sheds light both on the gentrification process that took place in Fikirtepe urban Regeneration Area, and on the direction of movement of the population that left the gentrified area. 72.5% of the population that left the Urban Regeneration Area settled outside the line which is assumed to determine the borders of the city center, that is, they moved away from the city center. The vast majority of the land holders moved away from the center and left the city center.
The results of the study show that gentrification is a process of obtaining financial gain not only for the land holders but also for the investors who bought real estate within the urban regeneration area. The vast majority of the land holders are not concerned about remaining in the city center, on the contrary, they want to sell their locations in the city center in return for financial gain. In other words, land holders yield returns by selling the

advantageous location of the city center during the gentrification process.
On the other hand, those who buy real estate from the projects realised in the urban regeneration area, that is, the new owners of the gentrified area also expect financial gain. The new owners of the gentrified urban regeneration area are in fact buying the economic rent of the city center. Gentrification process is a trade-off not only for the new owners of the urban regeneration area, but also for the old settlers.
The most important output of the study is the relationship between the gentrification process and the lost use value of the city center. Both old and new owners have an expectation of obtaining financial gain throughout the urban regeneration process, which results in the exchange value of the city center.The size of the rent-gap emerging during the urban regeneration process turns gentrification into a process of obtaining financial gain both for the old and the new owners of the city center. Thus, city center completely loses its use value for the actors of the gentrification process.

References

E. Soytemel, B. Şen: Kentsel Mekanda Üçlü İttifak, *İstanbul Üniversitesi İktisat Fakültesi Dergisi*, 44, March 2011, 1-21.

N. Sam: Soylulaştırma Süreçlerine Ekonomik Bir Yaklaşım: Rant Farkı, *Marmara Üniversitesi İ.İ.B.F Dergisi*, *29* (2), 133-151, 2010.

N. Smith: Gentrification, The Frontier and The Restructuring of Urban Space, (Eds N. Smith and P. Williams), *Gentrification of the City*, 15-34, Routledge, 2013.

B. Şen: Kentsel Mekanda Üçlü İttifak, *İstanbul Üniversitesi İktisat Fakültesi Dergisi*, 44, March 2011, 1-21.

D. Harvey: *Sosyal Adalet ve Şehir*, İstanbul:Metis Yayınları, 2003.

N. Smith: Toward a Theory Of Gentrification: A Back to the City Movement by Capital, Not People, *Journal of American Planners Association, 45* (4), 538-548, 1979.

19. The Impact of Urban Form in Sustainable Urban Planning Policy in Brussels-Capital Region

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ABSTRACT:
This paper examines how urban form affects the sustainable development of cities. It look at the case of Brussels, a city and a region with a very distinctive position in Belgium and in Europe, where public and political institutions have developed together detailed management plans to ensure the responsible management of the city in environment, social and economic terms. The paper first examines the concept of urban form and its constituent features. It then analyses two main questions: How can urban form indicators be integrated in decision-making process for sustainable urban planning? What urban development priorities are in place in Brussels-Capital Region and how do they impact the urban form development of the city? By proposing an analysis on the notion of urban form in Brussels-Capital Region, this paper intends to equip designers and decision makers with a better overview the type of city environmental strategies that can be deployed in the early stages of urban development projects.

Keywords: Urban form, Density, Polycentric, Brussels-Capital Region, Policy development

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1. Introduction

The analysis of urban form is an important design tool to examine the formation and the development of cities' physical environment over time. Cities' diversity and complexity is somehow reflected in the variety of approaches to describe and explain their physical form. These approaches provide different answers to questions such as, what is the form of a city? From which point of view do we analyze it? What are the various kinds of forms that we are talking about? How does the study of urban form can be used in urban planning? Depending on the answers to these questions, urban planning will have different and definitive features.

Environmental, social and economic constraints have forced public representatives, architects and planners to rethink urban planning. The adaptation to local climate conditions and the need to envisage buildings that respect and enhance the environment have become primary concerns for urban designers, which are in turn strongly influencing the shape of cities. The different approaches to urban practices have gained in

further complexity, and so a great array of different approaches exist -smart growth, sustainable cities, eco-cities, liveable-cities, green and low-carbon cities.
This research is an attempt to bridge the different urban form analyses. We argue that, particularly due to the development of the sustainable urban design, there is a need for one methodology that takes account of the new context of complex urban form system and also of the multiplicity of methods to analyze the urban system. The difficulty of this endeavor lies in simplifying urban complexity in such a way that it can be easily grasped by the mind, while avoiding reductive schemes, which disregard the specificity of the issue. For this, this article takes the concept of urban form both as a descriptive term, in that it refers to the shape of a city, and as an instrument for planning, as it makes us consider how urban form affects the different functionalities and their impact on the city. In doing so, the article does not provide an exhaustive account of the definition and method of analysis of urban form, but examines its main features to think about, investigate and work with urban built environment.
Thus, we seek to contribute to the development of a methodology to examine urban form in the current context of sustainable development. The study could also be used as a policy tool to set up guidelines and support a more integrated sustainable approach to urban regulation and decision-making.

2. The City as a Complex Urban Form

Sustainable urbanism has been defined by Farr (2008) as 'walkable and transit-served urbanism integrated with high performance buildings and high-performance infrastructure'. Approaches seeking to develop sustainable urbanism practices combine urban growth and environmental protection, and include three fundamental dimensions: spatial development, socio-economic development and environmental-ecologic values (Albayrak & Eryilmaz, 2017). Spatial development focuses on the urban form and addresses urban development concerns, mostly linked to the urban sprawling-compact development dilemma. The discussion around urban form and its relationship with sustainability has been mainly framed by a duality between the compact and disperse urban form. The study of the link between, urban form, density and sustainability presents contributions from theoretical and practical works which address density and sustainability at various levels, from city planning and urban design to public space and architectural design. According to Elkin, Hillman, and McLaren (1991), sustainable city 'must be of a form and scale appropriate to walking, cycling and efficient public transport, and with the compactness that encourages social interaction'. This definition refers to the European medieval cites. On the other hand, Jenks, Burton, and Williams (1996) highlighted that, the compact city is not necessary as compact and sharp-edges as the medieval city. Above all, the debate on sustainable compact city model is still on going in scientific community and numerous recent researches have been conducted, for instance, Joo Hwa P. Bay and Lehmann (2017).
It becomes clear that there are several views as to what a compact city is, that the compact city is not necessarily a homogeneous phenomenon. A main difference of view seems to be whether the sustainable city form should be monocentric or polycentric. Jabareen (2006) illustrates some advantages of the polycentric model: efficient for more sustainable modes of transportation, promote diversity, social cohesion and cultural

development as well as a preservation of land from country-side and a breakdown of the mono-functionality. On an other hand, the monocentric model as defined by Frey (1999) as a 'compact form core to edge, with large concentrated centres' can help to, increase in alternative modes of transport (pedestrian streets, bicycles…), save land-use, conservation of countryside surrounding the cities, optimize and save both cost and size of the infrastructure of urbanization and reduce distance to activities increasing functional mix of land. However, such model of development is remarkable only at relatively small city in order to promote good access to facilities.

It seems that there isn't a common agreement on what is the "ideal" formal concept of sustainable urban form.

In the context of the development of urban sustainable perspectives, various authors have pointed out to the importance of understanding the urban form as a key element of urban sustainability. Porta (2001) for instance, examines the relationship between urban form and urban (social) sustainability by looking at how urban form affects the living behavior of local inhabitants in their utilization of public spaces, and in their social interaction. Jabareen (2006) has identified and assess four sustainable urban form concepts, and concluded "the ideal sustainable urban form according to the design concepts (…) is that in which high density and adequate diversity, compact with mixed land-uses and its design is based on sustainable transport, greening, and passive solar energy". For his part, Kärrholm (2008) has pointed out the importance of a careful investigation of the spatial scale and claims for a deeper morphological understanding of sustainable urban form rather than listening the ideal models. Moreover, the use of indicators to assess urban form is on the increase. Cities like Paris, London, Amsterdam or Brussels, for instance, have established a dashboard of indicators for sustainable planning.

Despite this attention, the concept and the role of urban shape have not been well established in the debate of sustainability development. While the three main elements of sustainable urban form have been examined - that is (1) the formal concepts, (2) the design criteria, (3) the scale of intervention – the impact of the urban form on urban sustainability remains elusive. This might be due to methodological difficulties linked to defining the most desirable form for a sustainable city and to measure the city's approach to urban sustainability.

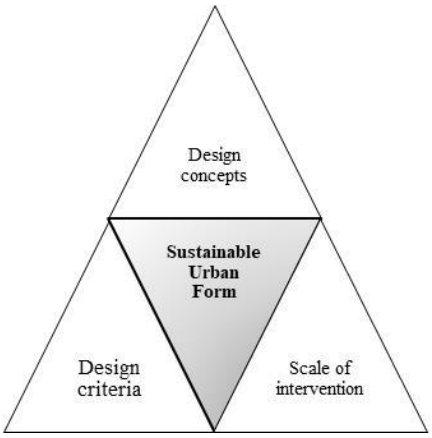

Figure 7: Aspects of research in sustainable urban form

3. Understanding Urban Form

The difficulties of analysing the urban form lies, in the polysemy of the concept as well as the multidisciplinary aspects of this field of study: no agreement on the vocabulary, nor on the definition of the object analysis exist in urban form analyses. As noted by Merlin and Choay (2015), the term urban morphology is used in different senses, depending on whether it refers to an object of knowledge, urban form or the means that enable knowledge.

The second difficulty is related to the growth and changes of cities. Indeed, the recognizable opposition that existed in medieval towns with walls between inside vs outside, has been replaced by the dichotomy centre vs periphery in industrial cities. Human behaviour, needs, and technological development have been completely transformed, and so the humanized urban landscape described by Lynch (1964) has become endangered. Urban form, in this sense, represents a particular conception of a city in a period of time. The historical path of designing the whole city that has been lost during the modernist period needs to be taken into account in the future study of the urban form.

The interest in urban morphological analysis lies, first, in the enhancement of the relationships between different levels of organization of the urban fabric, second, in the identification of conflicts or convergence of relations established between street forms, buildings and plots.

The main components of urban form have been highlighted by Borie and Denieul (1984) (1) the path system is the connecting system of the country, which is the structural axis, (2) the plot system, which is the system partition of the territory into land unit, the plot fragments the territory, (3) the build system, which is all the masses of the urban build form, with their function or their size, and to finish, (4) the open space system, or the void, which is all un-built parts of the urban form - public or private. Thus, it seems that the form of the city is established in the relation between the distribution mode (outdoors space) and the occupancy mode (built space), which existing in a given area. Overall, these are the elements which have to be analyzed (i) by themselves, (ii) between themselves and (iii) in their relationship with other urban elements (Figure 8).

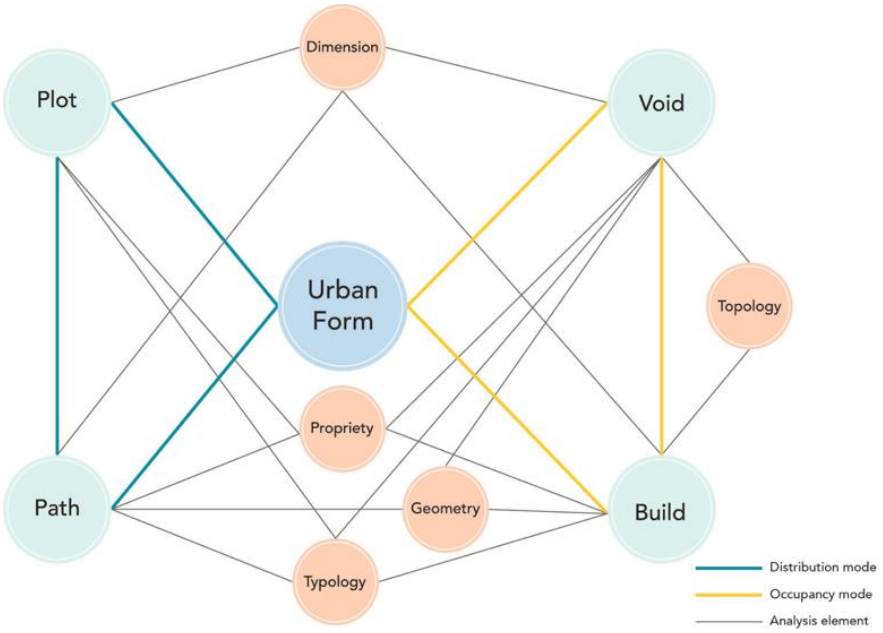

Figure 8: Urban form elements and systems

In brief, our understanding of urban form is that is an artefact, related to the aggregation of different elements - from void to build and from plot to path - in a define landscape which needs to be designed with a time process in order to form an urban tissue.

4. Methodologies of Analysis Urban Form

Different schools of thought have fueled the ongoing debate on the analysis of urban morphology and the study of urban form. Four schools can be identified: (1) the Anglo-German school (Conzen, 1962), (2) the French school (Philippe Panerai, Jean Castex, & Depaule, 1977), (3) the Italian school (Muratori, 1960) and (4) the Space Syntax approach (Hillier, 1996) - after the 60s. While the first three have focused on the urban form in a descriptive and explanatory manner, Space Syntax approach has been concerned with how urban form is studied. They differentiate one another according to a) their historical approach to the analysis of the urban form; b) the examination of the type and morphology of the city and c) the analysis of the space and configuration of the city. Approaches looking at city's –morphology and configuration have origins in the fields of urbanism and architecture, while the historical and spatial analytical approaches have come out of the field of geography (Figure 9).

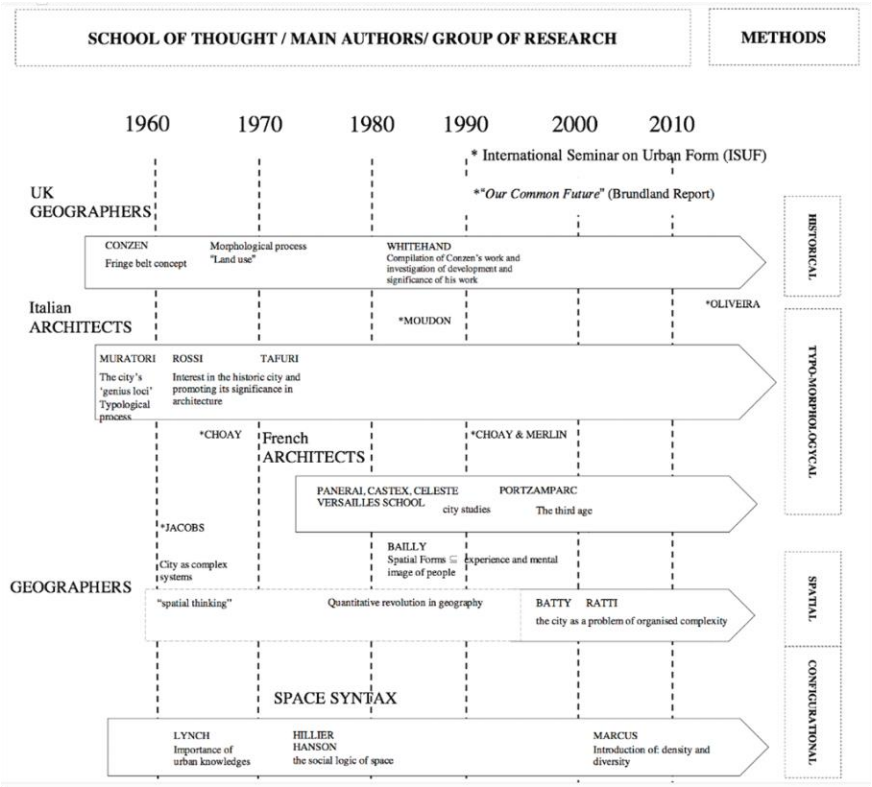

Figure 9: Picture of the keys references on urban form and urban morphology analysis

For historical approaches, the study of urban form across time is the main tool for understanding the shape of the city. This approach is based on the hypothesis that a city is a repository of history and material. Town plans are considered as a main source for analysis.

The historical approach examines two main objects in parallel:

Urban form is man-made and constructed overtime,

Second, is a focus on the ideal formation and structuration of its urban artefact.

The Italian school of thought (Muratorian School) rose during the 60s in reaction against modernist architecture and in rejection of history. The urban form it seen as the form of the urban fabric. The architects of the Muratorian School developed the typo-morphology approaches, which combine the study of urban morphology and study of architectural typology, at the junction of the two disciplines of architecture and urbanism. The typo-morphology method intends to upgrade the existing urban fabric and rejects the modern urbanism. Scholars ascribed to this approach think that the history of the city is embodied in the shape of the building in the street and in the plot, unlike modernists, who make abstractions on the history of a place.

In this context, the objective of this school of thought is to create a "storia operante" (active history) (Muratori, 1960). This "active history" should be able to guide the choices of the present, throughout including for intense the dematerialization of urban tissue types. In this perspective, "every built object is seen as the individualization of an

historical process of specialization of forms" - where past, present and future are linked in an historical continuity - and belongs to a built type (Muratorian School, 1960).
The typo-morphology analysis mainly focuses on:
Making a critical assessment of the urban fabric's shape
Identifying structural concept link to the cultural identity of places and to the built heritage
To define measures to control the transformation of the built environment and to provide guidelines for supervising urban projects.
The use of typo-morphology methodology in the understanding of urban areas has a long research tradition (Moudon, 1997). However, the reach of this method into urban design practice has been limited (Hall, 2008) due mainly to: the difficulty of typological classification, the structure of the complex urban form, and the fact that more work is required on recent city forms (Grahame Shane, 2011). Moreover, various authors agree that there is a need to integrate different morphological approaches to obtain a more complete and complex set of urban environmental attributes (P. Conzen, 2010).
The quantitative revolution in geography (beginning of the 60s) and the development of Open Geographic Information System (GIS) and open data has enabled an increasing utilization of spatial analysis in planning tasks (Weber, Tammi, Anderson, & Wang, 2016). Cellular Automata (CA), Agent Based Models (ABM) and fractals studies have provided complementary information to develop spatial analysis
Network analysis and analysis of any spatially defined objects are in the core of spatial analytical studies. Spatial approach can be portrayed as the scientific analysis of data (Thill, 2018). While the primary protagonists of this method were geographers (M. Dacey, B. Berry and others), they positioned their research at the boundaries of multiple disciplines which enable cross-relations and adoption of the spatial analytical approach by other disciplines (urbanism, architects, economics, ecologist…). In urban planning, the spatial analytical approach intends to pass over the difficulties in describing the urban environment and seeks to the representation of the city as "a geometry of order on many scales, a geometry of organized complexities" (Batty & Longley, 1994). Spatial analysis methods allow to model spatial data, processes, and relationships in more nuanced, realistic ways than core GIS methods. Compare to the two-previous form of urban form analysis, the spatial analytical approach is more heterogeneous. Seeking to understand the spatial structure and dynamics of cities, Batty used a range of methods in his work enclosed in the book 'Cities and complexity' (Batty, 2007). According to Kropf (2009), Michael Batty's work and Centre for Advanced Spatial Analysis' work at University College London are the best to characterize the spatial analytical approach. They approach the city as a problem of organized complexity. Batty suggests that to understand cities "we must view them not simply as places in space but as systems of networks and flows"(Batty, 2013).
For their part, starting from the "syntactic" analysis of Provençal and English hamlets, Hillier and Hanson (1984) focused on the street system, using spatial accessibility as a key concept, in line with the Space Syntax school. The relationships between space and movement are two fundamental aspects of this approach. In doing so, they developed a new definition of the study object of the urban space with focus on the networks, structure of space and the social logic inherent in its representation. This focus on space emphasized the boundaries between the emerging Space Syntax and other approaches.

They believed on the importance of studying the relationships between space, building and urban area instead of considering space on its own or simply as its defining surfaces.

5. Discussion and Conclusion

Urban form and its study are always dependent on the researcher and their background. From the research on literature review above, urban morphology analysis provides a comprehensive spatial context by first identifying the drivers of development and second situating spatial trends in history. Considering architectural and geographical approaches to the study of urban form, the morphological analysis requires; the classification of urban tissue by kinds, period of development and hierarchy of scales, in order to understand the production and transformation process of urban form, and to guide quality design practice. Following these three levels of organization, this research combined spatial and analytical tools to offer an integrated conceptual framework for studying the sustainable urban form (Figure 4).

First of all, the following three principles of our understanding of the urban form analysis have been highlighted and represented as analytical tool in our conceptual framework:

Urban form is defined by four primary complementary systems: street network/ path (Pa), plot (P), built patterns (B) and open spaces/ void (V) (cf. figure 2); the Type,

Urban form can only be understood historically since urban form evolves constantly in response to social, environmental, economic and technological developments (Williams, 2014); the Time

Urban form can be viewed from various geographical scales (Tsai, 2005); the Space

Secondly, the urban form needs to be understood with its spatial formation, architectural and environmental qualities of its forms in the context of sustainable urban development. Therefore, the primary elements of the urban tissue –Pa, P, B and V-, are no longer as simple as such. Regarding the structure of the complex contemporary urban fabric, there is a need to fine-tune their understanding - as analytical tool - according to their:

Formal concepts,

The design criteria, and

The scale of intervention.

Understanding the range of issues across sustainability goals in the design process, is needed in order to address them at any given scale and to understand how urban design decisions will affect outcomes at the larger and/or smaller scale. Thus, the investigation of spatial scale as one vital aspect of sustainable urban form development have been addressed mainly throughout the scale of the city (e.g. the compact city model) or the neighborhood level (Kärrholm, 2008). However, in discussions link with polycentric vs monocentric model, for instance, research are focused at the regional scale (Okabe, 2005) where policy makers are deeply involved. It is then clear that some design concepts are more appropriate at certain scales than others.

Thirdly, cutting across the debate on sustainable urban form, there are a number of key concepts, which have been reported in the section above - for instance, the notion of compactness, sustainable transport, density, mixed land uses, among others- which need to be taken into account in the sustainable urban form analysis. These concepts represent the grid of spatial analysis in our conceptual framework.

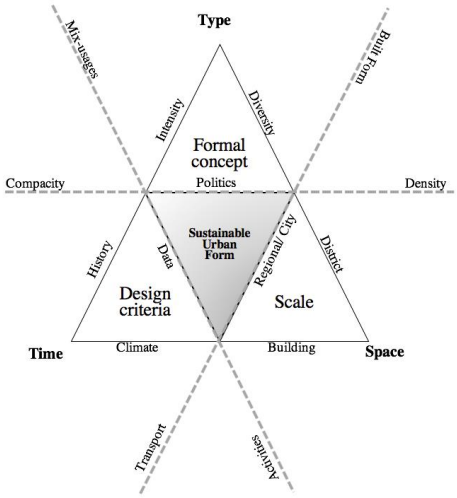

Figure 4: Conceptual framework to build an sustainable urban form

By studying the concept of urban form trough first, the four schools of thought and then replace it in the actual debate of sustainable urbanism we were able to synthetize in one conceptual framework the key design planning strategies, the elements of analysis needed and the hot point to study the urban form in its complexity.

Today, urban design practice requires a strong foundation with both physical and spatial responsibilities to guide future developments. In this sense, the research has proposed a new methodological framework, which could serve this purpose. This framework offers a way to monitor sustainable urban form. The theoretical background behind the framework is founded on a detailed review of the urban form literature and the typo-morphological approach in order to provide a bridge between them.

In doing so, we try to contribute to a better conceptualization of the terms "urban form" and "urban morphology", - which are often used interchangeably since there is no clear definition of their meaning- in the context of sustainable urban development. By breaking down the concept of urban form to its constituent elements, we are able to establish the relationship between urban form and urban system and urban structure.

Overall, we argue that a better understanding of these different forms and factors is needed in order to help with the future city development. Thus, urban form is not considered to be simply a set of data, but a subject of inquiry that depends on an assumed initial definition and conceptualization (Lévy, 2005).

The research can also be extended regarding the availability and the cost of land and the socio-economic profile of the residents and how these are reflected in the development of sustainable urban form.

References

Albayrak, A. N., & Eryilmaz, Y. (2017). Urban Growth in Sustainability Perspective. *Int'l Journal of Advances in Agricultural & Environmental Engg. (IJAAEE), 4*(1).

Batty, M. (2007). *Cities and complexity : understanding cities with cellular automata, agent-based models, and fractals* (1st MIT Press paperback ed.). Cambridge, Mass. ; London: MIT.

Batty, M. (2013). *The New Science of Cities*: The MIT Press.

Batty, M., & Longley, P. (1994). *Fractal Cities: A Geometry of Form and Function*.

Borie, A., & Denieul, F. (1984). *Méthode d'analyse morphologique des tissus urbains tradiotionnels*. Retrieved from http://unesdoc.unesco.org/images/0006/000623/062310fb.pdf

Elkin, T., Hillman, M., & McLaren, D. (1991). *Reviving the city : towards sustainable urban development*

Frey, H. (1999). *Designing the city : towards a more sustainable urban form*. London ; New York: E & FN Spon.

Grahame Shane, D. (2011). Transcending Type: Designing for Urban Complexity. *Architectural Design, 81*, 128-287. doi:10.1002/ad.1197

Hall, T. (2008). Bridging the gap: Applying urban morphology to successful planning practice. *Urban Morphology, 12*, 54-57.

Hillier, B., & Hanson, J. (1984). *The social logic of space*. Cambridge Cambridgeshire ; New York: Cambridge University Press.

Jabareen, Y. R. (2006). Sustainable Urban Forms : Their Typologies, Models, and Concepts. *Journal of Planning Education and Research 26:38-52 DOI: 10.1177/0739456X05285119 © 2006 Association of Collegiate Schools of Planning.*

Jenks, M., Burton, E., & Williams, K. (1996). *The Compact City: A Sustainable Urban Form?*

Joo Hwa P. Bay, & Lehmann, S. (2017). *Growing Compact: Urban Form, Density and Sustainability*: Routledge.

Kärrholm, M. (2008). *Setting the Scale of Sustainable Urban Form - Some scale-related problems discussed in the context of a Swedish urban landscape*. Paper presented at the Architectural inquiries, Goteborg.

Kropf, K. (2009). Aspects of urban form. *Urban Morphology, 13*(2), 105-120.

Lévy, A. (2005). Formes urbaines et significations: revisiter la morphologie urbaine. *Espaces et Sociétés,* pp25-48.

Lynch, K. (1964). *The image of the city* (1st M.I.T. Press pbk. ed.). Cambridge, Mass.: M.I.T. Press.

Merlin, P., & Choay, F. (2015). *Dictionnaire de l'urbanisme et de l'aménagement*.

Moudon, A. V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology, 1*, 3-10.

Muratori, S. (1960). *Studi per una operante storia urbana di Venezia*. Roma: Instituto poligrafico dello Stato.

Okabe, A. (2005). Towards the Spatial Sustainability of City-Regions: A Comparative Study of Tokyo and Ranstad. In M. a. D. Jenks, N., (Ed.), *Future Forms and Design for Sustainable Cities* (pp. 55-72). Great Britain: Elsevier.

P. Conzen, M. (2010). The elusive common denominator in understanding urban form. *Urban Morphology, 14*, 55-58.

Thill, J.-C. (2018). Innovations in GIS&T, Spatial Analysis, and Location Modeling. In J.-C. Thill (Ed.), *Spatial Analysis and Location Modeling in Urban and Regional Systems* (pp. 1-6). Berlin, Heidelberg: Springer Berlin Heidelberg.

Tsai, Y.-H. (2005). Quantifying Urban Form : Compactness versus 'Sprawl'. *Urban Studies, vol. 42*, 141-161.

Weber, R., Tammi, I., Anderson, T., & Wang, S. (2016). A Spatial Analysis of City-Regions: Urban Form & Service Accessibility. *Nordregio, Working Paper 2016:2*.

Williams, K. (2014). *Urban form and infrastructure: a morphological review*. Retrieved from

20. Inequalities in the Length of Life of Men and Women Chronic Exposed to Air Pollution

Anna Spychala, M.Sc. PhDC, Joanna Domagalska M.Sc. PhDc, M.Sc. Danuta Rogala PhDc, Klaudia Gut M.Sc. PhDc

ABSTRACT:
According to the WHO air pollution contributes to shortening life expectancy of UE citizens by an average of 8.6 months. The aim of the study was to show the correlation between long-term exposure of inhabitants of the cities to air pollution (PM10) and the length of their life, excluding deaths caused by external causes. Average annual concentrations of PM10 were made using data from measuring stations in the period of twenty years. The average length of life of women and men in 19 cities in the year 2015 were calculated on the basis of register of deaths of which cases of accidents and suicides were excluded. Inequalities in the length of life of men and women are significant between cities. The linear and multiple regression were applied to calculate the relation between exposure to PM10 and the length of men and women life in each of the cities, demonstrating the stronger correlation in men population. The correlation ratio was very high (R = 0,87). The results

showed that the reduction of the average annual PM10 concentration by 1 μg/m3 of air should, as a result of long-term exposure, extend the life expectancy of men by 3 months.

Keywords: PM10, exposure, length of life, inequalities, multiple regression

Anna Spychała, M.Sc. is an Assistant and a PhD student at the Department of Environmental Health at the School of Public Health in Bytom at Medical University of Silesia, Poland. The object of her research is the relation between length of live and exposure to air pollutants, such as: particulate matter (PM10), benzo(a)pyrene, cadmium and lead as well as dioxins, furans and polychlorinated biphenyls.

Joanna Domagalska, M.Sc. is a PhD student in the Department of Environmental Health, School of Public Health in Bytom, Medical University of Silesia in Katowice (Poland). Her scientific activity is focused on health risk factors, health inequalities and environmental health determinants.

Danuta Rogala, M.Sc. is PhD student in the Department of Environmental Health at the School of Public Health in Bytom Medical University of Silesia in Katowice. Her scientific interests include impact of environmental pollutants on human health. Particularly she is interested in air pollutions (suspended dust, cadmium, lead, benzopyrene, polychlorinated biphenyls, furans and dioxins). She assumes in her dissertation that the long time exposure to environmental risk factors, specially carcinogenic, affects the morbidity and mortality of colorectal cancer in the population of the Silesia province and she concentrates on identification of the environmental risk factors conducive to the development of this type of cancer.

Klaudia Gut, M.Sc. is PhD student in the Department of Environmental Health at the School of Public Health in Bytom Medical University of Silesia in Katowice (Poland). She is interested in health inequities of children living in the contaminated areas. Especially she is focusing on heavy metals such as cadmium and lead in environment and their influence on children's health. In her doctoral thesis she indicated the heavy metals in soils as significant health risk factors for children actively using recreational areas.

21. Development of Scales for Measuring the In-person Growth of Young Children: in Japan, China and Korea

Assoc. Prof. Xiangshan Gao, Prof Hajime Aoyagi, Assoc. Prof. Yuichiro Yamagiwa, Assoc. Prof. Takayuki Umezaki, Mai Kominato, Marie Otomo

ABSTRACT:

There is a lot of developmental scales over the world and used in different situations. However, these tests are not perfect in two reasons. First reason is that most developmental scales, including intelligence tests, normally tend to rank the children in the groups of same age focus on in-group growth. However, an examination to capture the in-person growth is necessary. The second reason is that most conventional development tests are created independently by each countries, translated and used in another countries, so there is a problem that global standards are not satisfied. To cope these problems, we tried to develop scales for children less than 4000, 3 to 6 years old in Japan, China and Korea, which have some common child rearing culture and declining birthrate problems. In our research, we examined the validity and reliability of the composition concept, created specific items, investigated, and selected practical items for child rearing. The relevance of the composition concept included content aspect, substantive aspect, structural aspect and external aspect.

Keywords: Development of Scales, In-person Growth, Validity, Reliability, Cross Culture Research

Xiangshan Gao is associate professor of Tokoha University, Japan. Member of the East Asia research group.
Hajime Aoyagi is Honorary professor of Waseda University, Japan. Head of the East Asia research group.
Yuichiro Yamagiwa is associate professor of Tokyo Metropolitan University, Japan. Member of the East Asia research group.
Takayuki Umezaki is associate professor of Konan Women's University, Japan. Member of the East Asia research group.
Mai Kominato is part-time teacher of Obirin University, Japan. Member of the East Asia research group.
Marie Otomo is a staff of Tokyo Hachioji Jevenile Classification Home, Japan. Member of the East Asia research group.

22. Assessing the Self-reported Level of Knowledge, of Romanian Parents with 4-12 Years Old Children, on Emergency Behavior

Valeria Ionascu, Monica Brinzac

ABSTRACT:
The purpose of this research project is to assess self-reported levels of knowledge of parents with children aging from 4 to 12 by examining parental behavior in emergency situations in Romania. This project is a transversal descriptive study that addresses the objective of the research. This study contains 3 phases: Phase 1: Creating and developing a well-tailored questionnaire; Phase 2: Using the above questionnaire to collect data online from the sample population; Phase 3: Data analysis. The final conclusion of this study will shed light on parental behavior that directly impacts the well-being of children. The results, furthermore, will be used to establish a link between the level of education and decision-making abilities during emergencies. This shall help parents avoid negative patterns of behavior and maximize the mental and the physical health of children. In other words, the result of the study will provide a baseline for further interventions, proving that family education can benefit not only human life but can also improve monetary income by reducing material damage.

Keywords: Public Health, Disaster Management, Education, Natural Disasters

Miss Valeria Ionascu second year through BSc degree in Public Health at the Cluj School of Public Health of Babeş-Bolyai University in Cluj-Napoca, Romania. Recipient of a special scholarship for conducting scientific research in the field of public health. Erasmus student to be for the year of study 2018-2019 in the field of Public Health in Esbjerg, Denmark. Interested in several sub-domains of public health: environmental health, epidemiology, global health, etc. Obtained ability of conducting and writing research, communicating clearly and efficiently,

and master the fundamentals of the science of public health. Attended academic events: International Conference on Non-Communicable Diseases (iCONIC).

Miss Monica Brinzac, second year through BSc degree in Public Health at the Cluj School of Public Health of Babeş-Bolyai University in Cluj-Napoca, Romania. Recipient of a special scholarship for conducting scientific research in the field of public health. Erasmus placement student in Italy at a regional health agency. Volunteer at AIESEC, Cluj-Napoca, Romania. Participant in EHMAthon, Budapest, Hungary. Interested in several sub-domains of public health: Sexually transmitted diseases, health management, epidemiology, etc. Obtained ability to multi-task and function well under pressure, all while maintaining a very positive attitude.

23. Evaluation of the Knowledge Regarding the HPV Virus and Cervical Cancer among Romanian Young Women Aged between 18 and 24 Years

Monica Brinzac, Ioana Coci, Valeria Ionascu

ABSTRACT:
The purpose of this research is to assess the level of knowledge regarding the HPV virus and cervical cancer among Romanian young women aged between 18 and 24 years. The study is quantitative as the data is gathered through an online questionnaire. The target group is selected through some pre-established parameters based on the previous searches on Facebook and Google like age, sex, HPV, vaccine, immunization, cervix, cervical cancer. The sample is all the women that reach the parameters aged between 18- 24 years. This age group is called "young adult" and has a higher prevalence of sexually transmitted diseases. The research has three main phases: Phase 1: Creating and developing a questionnaire Phase 2: Collecting data online from the sample population using the questionnaire Phase 3: Data analysis Through the questionnaire it is measured socio- demographic characteristics (such as age, nationality, birthplace, marital status, education level, income); a short background on the sexual life; attitudes and knowledge regarding the HPV vaccine; knowledge on HPV; knowledge on cervical cancer; awareness regarding HPV& cervical cancer. The preliminary results show the knowledge on HPV, HPV vaccination and cervical cancer low as more than 24% of the respondents did not hear of HPV, 29% stated that they have no to very little knowledge on the virus, 25% stated that there is no link between HPV and cervical cancer. More than 10% did not hear of the Pap smear and 38% do not know of the existence of the HPV vaccine.

Keywords: Public Health, STDs, HPV, Cervical cancer

Miss Monica Brinzac second year student in Public Health at the Cluj School of Public Health of Babeş-Bolyai University in Cluj-Napoca, Romania. Recipient of a special scholarship for conducting scientific research in public health. Future intern at Regional Health Agency in Ancona, Region of Marche, Italy through Erasmus placements for 3 months (July- September) in the summer of 2018. Participant in EHMAthon 2018 in Budapest. Enthusiastic volunteer: Save the children, AIESEC, student counselor. Interested in several sub-domains of public health: health management, epidemiology, sexual health, etc. Able to write research proposal and conduct research, to communicate clearly, to learn quickly and efficiently, fluent in Public health. Public health enthusiast, young researcher, eager to learn and to develop both professionally and personally, pragmatic young professional, people oriented.

Miss Ioana Coci, second year student in Public Health at the Cluj School of Public Health of Babeş-Bolyai University in Cluj-Napoca, Romania. Co- author of "Evaluation of the knowledge regarding the HPV virus and cervical cancer among Romanian young women aged between 18 and 24 years". Erasmus student to be for the year of study 2018-2019 in the field of Public Health in Norway. Interested in several sub-domains of public health: mental health, epidemiology,sexually transmitted diseases, etc. Obtained ability of conducting and writing research, communicating clearly and efficiently, and master the fundamentals of the science of public health. Attended academic events: International Conference on Non-Communicable Diseases (iCONIC).

Miss Valeria Ionascu second year through BSc degree in Public Health at the Cluj School of Public Health of Babeş-Bolyai University in Cluj-Napoca, Romania. Recipient of a special scholarship for conducting scientific research in the field of public health. Erasmus student to be for the year of study 2018-2019 in the field of Public Health

in Esbjerg, Denmark. Interested in several sub-domains of public health: environmental health, epidemiology, global health, etc. Obtained ability of conducting and writing research, communicating clearly and efficiently, and master the fundamentals of the science of public health. Attended academic events: International Conference on Non-Communicable Diseases (iCONIC).

24. Exploring Local Citizens' Perspectives to International Development Organizations in their Community: Case Study in Uganda

Ms. Sonia Michaelsen, PhDc

ABSTRACT:
Recently, there has been increased awareness about the need for socially sustainable development projects. Buzzwords like "ownership", "empowerment", and "community participatory development" are abound in development literature, with the belief that such approaches will lead to more sustainable projects. To what extent these ideas are put into practice and whether the local community feels any sense of meaningful participation or ownership from international development organizations (IDOs) are seldom explored. Thus, using a mixed-methods approach in Gulu, Uganda, this study explored 3 questions: 1) What are the opinions of citizens in Gulu towards IDOs and the work that they do; 2) How involved do citizens of Gulu feel with regards to decision-making processes of IDOs; and 3) How respectful do citizens of Gulu feel that foreign staff of IDOs in Gulu are with regards to local culture. A total of 109 citizens participated. Findings were mixed and several themes emerged – positive opinions towards IDOs included educational impact, material support, and support to disadvantaged populations. Negative opinions included westernization and sustainability issues. Similar studies should be conducted in other developing communities, to gain feedback and insight into local perspectives. Such information is vital for organizations to improve and develop more sustainable projects.

Keywords: Uganda, participatory development, community-based research, international

Ms. Sonia Michaelsen is a current PhD candidate at the Universite de Montreal. Prior to beginning her doctoral studies, she completed her master's in International Development at the University of Birmingham, where she completed the research presented here. She is passionate about community participative action research, bridging the gap between knowledge and practice, and using research to improve best practices of non-profits and development organizations. In the past, she has worked for various non-profit organizations, both in Canada and abroad.

25. Conceptual Framework of Sustainable Development Indicators (SDIs) for Local Sustainability Policy in Japan

Takehiro Hatakeyama, PhDc

ABSTRACT:
Comparative indicators, with which local governments monitor and evaluate policy progresses with one another, help effective implementation of policy towards sustainable development (SD), but such policy tools have little developed yet. This study proposes conceptual frameworks of Sustainable Development Indicators (SDIs), taking instance from the Japanese municipal governments. For the purpose, this research conducted a questionnaire to the entire Japanese local governments (n=1,741), inquiring about the extent of the importance of pre-selected indicators for sustainability policy to

derive primary data. Thereafter, Principal Component Analysis synthesized given data into five main factors by which Cluster Analysis (k-means) aggregated the subjects into five groups according to the relevant factors. As a result, applicable indicators are selected in respective groups so that SDIs are accordingly developed. The results indicated five SDIs indicating four approaches, and highlighted the most feasible and the most optimal frameworks. The former had a strong predilection for socioeconomic policies while disregarding environmental aspects despite, which reflected the current trend of local SD in Japan. By contrast, the latter tended to encompass three dimensions of SD convincingly, focusing largely on well-being. Hence, this framework helps complement the lack of environmental orientation and potentially maintain the consistency of public policy.

Keywords: Sustainable development indicators; sustainable development; public policy; local government; Japan

Mr. Takehiro Hatakeyama is a doctoral candidate at Leuphana University of Lüneburg, Germany. He studied environmental policy at the local level as his Master's study in Japan where he attempted to create a model of sustainable development indicators, revealing the policy tendencies that the Japanese local governments seem to have towards sustainable development. His research interest is further on indicators study in sustainability context so that he engages with his doctoral thesis that demonstrates the effectiveness of 'subjective indicators', which capture citizens' perception of sustainability, fosters the effectiveness of public sustainability policy to achieve its goal more effectively.

26. Social Media as a Tool for the Sustainability of Small and Medium Businesses in Macedonia

Dr. Teuta Veseli-Kurtishi

ABSTRACT:
Social media is considered as the main marketing tool for an SME and has shown significant growth in effectiveness lately, as well as in the business sustainability all over the word. Businesses are acknowledging the potential of social media because they do not really exist online if they are not represented across all social channels – and regularly interacting with their followers, journalists who cover the industry, leaders and tastemakers, etc. The main purpose of this research is to analyze some of the SME operating in Macedonia and to find answers about the true effectiveness of social media marketing and their impact on the sustainability of businesses. Using a firm level survey in 54 Macedonian companies in 2017 we investigate the impact of social media marketing on the sustainability of businesses. Results indicate that there is a positive impact of social media marketing on business effectiveness and sustainability, however social media in Macedonia are still in the early stages and there are opportunities for improvement.

Keywords: Marketing, Social Media, Sustainability, SME, effectiveness

Teuta Veseli-Kurtishi, Ph.D. is an Assistant Professor at the Faculty of Business and Economics, South East European University. She received PhD in Marketing at the Faculty of Economics, Department of Marketing, in University of Tirana with the dissertation thesis "Application of promotional strategies in higher education institutions in Macedonia and their impact on attracting new. Her main research interests are application of marketing strategies and their impact in business institutions and education institutions. She is actively engaged in number of subjects at faculty of business and economics. Teuta Veseli - Kurtishi published several scientific papers in international and national journals and participated in many scientific international conferences.

27. Assessment of the Economic Pillar and Environmental Pillar of Sustainable Development in the European Union

Doc. Ing. Emília Huttmanová, PhD, Mgr. Tomáš Valentiny

ABSTRACT:
Sustainability is currently being implemented in a variety of activities. In practice, however, its achievement is complicated and difficult. In the process of achieving sustainability, it is essential to know the components of sustainable development and their current state. In general, sustainable development is perceived through four pillars - economic, social, environmental and institutional. In some cases, however, achieving a positive result in one of them could cause negative results in other(s). This inverse relationship can also be identified in the case of the economic and environmental pillar of sustainable development. The complexity of pillar´s relations is one of the factors which causes considerable complicated achievement of sustainability. The difference of the individual pillars of sustainable development and difference in the individual European Union countries development (despite their relative homogeneity) is an object of our interest. The aim of the paper is to evaluate the current state and development of the economic and environmental pillar of sustainable development in EU countries, using selected indicators.

Keywords: Sustainability, sustainable development, economic pillar, environmental pillar

Doc. Ing. Emília Huttmanová, PhD. She works as assoc. professor at the Department of Environmental Management, Faculty of Management, University of Prešov in Prešov (Slovak Republic). Her scientific and pedagogical activities are primarily focused on the issues of environmental economics, sustainable development, management of sustainability as well as to problems of national economy. As a assoc. prof. she leads these courses: Economy of Environment, Sustainable Development, National Economy and Economic Policy. She has been a co-researcher of successfully completed research projects and currently participates in few scientific and research grants. She is author of many scientific articles (more than 20 are registered in the WOS and SCOPUS database), textbooks and monographs, with a strong citation response. Currently she is Vice-dean for Education and Communication of Faculty of Management University of Prešov in Prešov.

Mgr. Tomáš Valentiny, He is an internal doctoral student at the Department of Environmental Management of the Faculty of Management at University of Prešov in Prešov. His scientific activities focuses mainly on the area of sustainable development and especially to its economic context.

28. The Trial of Poverty Reduction through Sport: The Homeless World Cup

Dr. Chiaki Okada

ABSTRACT:

Although the concept of Sport for Development and Peace (SDP) under the United Nations Office on SDP has been developing in the international community for some years, how sport can contribute to developmental issues and how academia can clarify the concrete outcomes of SDP activities have been discussed from different perspectives. There are many development issues and infinite combinations of 'sport' and 'issues', but we cannot ignore the real fact that there is, indeed, economic poverty at the center of most of these issues. The Homeless World Cup (HWC) is an annual futsal event for homeless people. Almost 600 homeless players sent by national partners from over 60 countries participate. These national partners are currently conducting daily activities in 420 venues worldwide. I conducted several interviews with a number of national partners and participants, and have some observations in the fields from October 2010 to March 2017. I try to clarify the significances of HWC and its related activities in some fields (Zimbabwe, Cambodia, Netherland, Hong Kong, Korea, Japan) comparatively.

Keywords: Sport for Development and Peace (SDP), Homeless World Cup (HWC), poverty reduction, sport, futsal

Dr. Chiaki Okada is Associate Professor of Graduate School of Human Sciences, Osaka University, Japan. I conducted research on "Introduction of sport in the post-conflict countries" in 2004-2006, "Community development through sport in a post-conflict country" in 2007-2009, "Development and peace through sport in developing areas" in 2010-2015, "Poverty reduction in the 'sport for development and peace'" in 2015-2019, all funded by the Japanese government. I have also carried out some projects or activities in Cambodia, East-Timor, South Sudan and Tanzania. My main areas of interest are 1) community development through sport, 2) peace-building through sport, 3) child/youth sport education.

29. Sustainable Development as a Model and Artifact of Modern Civilization

Prof. Tursun Gabitov, Marzhan Alikbayeva PhDc, Aliya Omirbekova PhDc, Dr. Nurlykhan Aljanova, Dinara Saparova PhDc

ABSTRACT:
The modern world civilization endures the period of the radical transformation of the sociocultural basements. At simultaneous existence on Earth of all three waves of the civilization (O. Toffler), the dominating value is gained by the fourth industrial revolution. If XIX and the first part of the XX century the content of all-planetary civilization processes radically changes. The formed new society acts under the different names: "post-industrial society", "information", "technetronic", "telecommunication" civilizations, etc. (D. Bell, R. Aron, O. Toffler, Z. Bzezhinsky, etc.). One of the priority values of the new civilization is the concept of "sustainable development". The article deals with the problem of sustainable development, is an important part of modern culture of peace. There is a growing body of literature, including in Kazakhstan that recognizes the importance of this concept. In these works, also in documents of UNESCO about the culture of the world, sustainable development is understood as the balanced condition of the globalized culture of the world, where the aspiration to preservation of ecological sustainability is combined with the actions directed to the eradication of poverty, social and ethnic cataclysms and conflicts. Relevance of this article lies in reasoning the revision of the values of the previous civilization and the introduction of a new culture of peace. The author considers the possibility of reaching a long-term state of "global balance" and "sustainable development" by mankind.

Keywords: sustainable development, human capital, environmental culture, civilization, innovation, democracy

Tursun Gabitov, Doctor of Philosophy sciences, Emeritus Professor, Department of Religious and Cultural Studies, Al-Farabi Kazakh National University. He works in Al-Farabi Kazakh National University since 1971. Author more than 200 articles, 50 monographs, 40 tutorials and etc. His research areas are: Cultural Studies, Philsophy, traditional culture, axiology, typology of cultures. Leaded following state programs: "National idea as a basis for sustainable development development of Kazakhstan for 2007-2009", state program "Cultural heritage", in the sections "World philosophical heritage" and "Philosophical heritage of Kazakh people", the leadership of a number of fundamental research projects supported by the Ministry of science and education of Kazakhstan, UNESCO and others.

Marzhan Alikbayeva is Candidate of Philosophy Sciences (PhD), works as Associated Professor at Department of Religious and Cultural Studies of Al-Farabi Kazakh National University. Graduated from Al-Farabi Kazakh National University in 2002, studied Arabis Studies. Then made postgraduate program in Social Philosophy during 2004-2007. Author of more than 40 scientific papers, 5 monographs and etc. Research area: Al-Farabi's philosophy, music in Al-Farabi works, management in culture, traditional culture and etc.

Aliya Omirbekova is Candidate of Philosophy Sciences (PhD), works as Associated Professor at Department of Religious and Cultural Studies of Al-Farabi Kazakh National University. Graduated from Al-Farabi Kazakh National University in 2003, studied Philsophy. Then made postgraduate program in Social Philosophy during 2003-2006. Author of more than 50 scientific papers, 7 monographs and etc. Research area: innovation culture, management in culture, axiology, philosophy, tradition and innovation and etc.

Nurlykhan Aljanova is Ph.D., Senior Lecturer at the Department of Religious and Cultural Studies at Al-Farabi Kazakh National University. Aljanova coordinates Al Farabi Kazakh National University Master's degree at the Department Religious and Cultural Studies. Her research focuses towards a Semiotic analysis of communication culture. Aljanova conducts scientific research and pedagogic activity in the following areas: Communication

culture, Media culture, Primal religions, National religions, Myth and ritual, Non-traditional religious teachings and others. Her scientific articles of are devoted to the Kazakh traditional culture, the role of religion in society, Kazakhs communication culture.

30. Assessment of Sustainable Development of the Residential Construction Sector in the Context of Sustainable City Development in Poland

Dr. Marcin Sitek

ABSTRACT:

The issue of quality of life in large agglomerations has become more and more important for many years. The challenges faced by the real estate market relate to its planned further development taking into account all dimensions of sustainable development. The aim of the work is to assess the state of sustainable development of the residential construction sector in Poland. The work assumes that sustainable development of construction is one of the factors determining sustainable development of cities. The research was based on statistical data on the real estate market in Poland and on analyzes and reports published by the Central Statistical Office, NBP, Responsible Business Forum and Agenda for Sustainable Development 2030. The goals of Agenda 2030 were discussed with particular emphasis on stability and sustainability of the real estate market. The value of the urbanization index for large agglomerations in Poland confirmed the very positive effects of the sustainable development of the real estate market. The paper attempts to determine the relationship between the economic value of the housing sector and the consumption of environmental resources, which may lead to the establishment of an indicator that is a new tool for assessing sustainable development.

Keywords: Agenda 2030, urbanization, construction sector, real estate, sustainable development

Dr Marcin Sitek is a graduate of the University of Economics in Katowice, major in Finance and Banking and the Faculty of Management at the Częstochowa University of Technology, majoring in Finance Management. his scientific interests concern mortgage banking as well as the problem of management, investment and the risk of financing investments in the real estate market. Recently, his scientific work focuses on the concept of sustainable construction and its support by creating innovation. In his scientific work, he explores innovative forms of investing and modern concepts of resource management in the real estate market. He devoted part of the work to the risk related to the implementation of innovation on the real estate market and management in the aspect of sustainable development. Conducted systematic research has resulted in 70 Polish and English publications in national and foreign magazines, two monographic works and one individual book study.

31. Interpretive Structural Modeling Approach to Analyze the Interaction Between Key Factors of Risk Management Process in SMEs: Polish Experience

Ing. Iwona Gorzeń-Mitka PhD

ABSTRACT:
Many drivers are shaping the risk management processes in enterprise. Understanding the interrelationships between individual risk drivers is a significantly important for decision making processes. This is a complex challenge especially for SMEs enterprises. This paper aims to identify the most important risk factors and determine the interactions of these factors in risk management process in small and medium firms based on Polish SMEs experience. This study is based on the technique Interpretive Structural Modelling (ISM), in order to delineate a flowchart that shows the main risk factors (and their relationships) influencing the risk management processes in small and medium enterprises. Through a process of modeling it was possible to reach a graphical presentation

that shows the operating sequence of main risk factors in order to understand the logic of their relationship. The final model is a useful tool that can be adopted to optimize decision making process in SMEs from risk perspective.

Keywords: enterprise risk management, interpretive structural modeling (ISM), risk factors, SMEs

Ing. Iwona Gorzeń-Mitka Ph.D. is Assistant Professor of Czestochowa University of Technology, Faculty of Management, Poland. Her research focuses on risk in decision-making process, enterprise risk management, business process planning, risk assessment methodology, risk in organizational culture. Her research has been published in the leading journals in management. She is author (co-author) of 3 book, 110 scientific papers. She has been a member of scientific committees of international journals and scientific international conferences (e.g. AOM, ISI). Among others member of Polish Economic Society, Polish Institute of Internal Control, The Global Association of Risk Professionals, Professional Risk Managers` International Association (PRMIA).

1. Introduction

Risk management, particularly in the field of SMEs management, turns out to be an important challenge. Including risk aspects in decision making process is vital if businesses are to meet their objectives. Including risk aspects in decision making process is vital if businesses are to meet their objectives. As indicate many researchers (Al-Rashidi 2012; Altuntas and Berry-Stölzle 2011; Falkner and Hiebl 2015; Gorzeń-Mitka 2017; Haviernikova 2016; Wieczorek-Kosmala 2014) nowadays risk management becomes a necessity and requires a systematic consideration in decision-making processes of the businesses. It is necessary for all enterprises, but this is particularly important for small and medium sized enterprises (SMEs). Researchers and practitioners agree that the environment within which SME's have to function in the 21st century is one that is increasingly competitive and dynamic (Kana and Mynarzova, 2015; Kuběnka and Slavíček 2016; Kuraś, Kuraś and Lis 2015; Sipa 2018, Sitek 2017). In order that the challenges can be met successfully, it is important that SMEs should be helped to both recognise the risks and then manage them. The diagnosis of key risk factors and determine the interactions of these factors in risk management process in SMEs seems to be a legitimate. The aim of this study is to explore various risk management process determinants in the SMEs, to establish relationships among the them through ISM methodology. In the literature, researchers indicate many techniques to used for modeling and multi criteria decision making. Main of them, which allow for taking into consideration multiple decision criteria simultaneously, are Interpretive Structural Modeling (ISM), Analytic Network Process (ANP) and Analytic Hierarchy Process (AHP) (Jitesh, Arun, Deshmukh 2008). ISM is a well-established methodology for identifying and summarising the relationships among specific elements which define a problem or an issue (Warfiled, 1973, 1982). The proposed model provides a useful tool for SMEs to focus on those determinants of decision making process that are most important for effective risk management. Understanding their relationships will help organisations developed their decision making processes.

The primary purpose of this research is to contribute to the understanding of the relationships between risk management determinants in micro, small and medium size enterprises. Additional aim of this study is, at least partially, fill a gap on the knowledge of risk management in SMEs.

The rest of the paper is organized as follows. Section 2 (Theoretical background) describes the some remarks from literature review on the determinants of risk management in SMEs. Section 3 presents methodological information and research procedure. Section 4 presents and describes the results of research. In Section 5 was indicate limitation of this study and Section 6 concludes.

2. Theoretical background - some remarks from theory and practice on risk management determinants in SMEs

SMEs make significant contributions to the economies of many countries. From the one hand, they are viewed as a source of flexibility and innovation, but from the other hand SMEs are perceived as high-risk ventures. The debate on risk management in SMEs is conducted by academic researchers for nearly 30 years (Gorzeń-Mitka 2016, 2017a, Sheedy and Griffin 2015, He and Lu, 2018), but now

this discuss is more intensive. Islam and Tedford (2012) and Gorzeń-Mitka (2018) consider that risk management is less well developed within SMEs. In this case, the strong organisational culture sometimes mitigates against managing risks in structured way. But it isn't risk culture. A firm's risk culture significantly improves its capability to take strategic risk decisions and deliver business performance targets. According previous authors' studies (Gorzeń-Mitka, 2016, 2017b) risk management culture in SMEs is low.

According to Florio and Leoni (2017) and He and Lu (2018) the SMEs are reluctant to adopt a formal risk management strategy, even though most of studies showed that the key causes of SMEs failure include poor management (Sipa 2018, Wasiluk 2017), lack of risk management planning, and failure to adopt a risk limit threshold. The majority of the SMEs do not have systematic risk management strategies in place (Gorzeń-Mitka 2017a). Verbano and Venturini (2013) and Liebenberg and Hoyt (2003) suggests that risk management practices in SMEs are often very informal, which inhibits their building risk management capacity. In the other hand, Falkner and Hiebl (2015) indicates numerous studies in which shown how SMEs take a proactive approach to risk.

Undoubtedly, the awareness of small and madium enterprises about risk is growing (Sipa 2018, Skibiński 2016; Skowron-Grabowska and Mesjasz-Lech 2016). Gorzen-Mitka (2017a) and Islam, Tedford (2012) revealed that most operators of SMEs considered risk management as important and thinks that it should be incorporated in and integrated with their operations. Risk management practices should be made simple and incorporated in the operational plan and organizational culture of small and medium scale enterprise in a bid to improve business performance (He and Lu 2018).
As the author points out in his earlier works (Gorzeń-Mitka 2018), one of unique research, where factors that influence a company's decision to start an ERM program are indicated is study of Altuntas and Berry-Stölzle (2011). The result of the study was to identify the few relationships. First relationship is positively related with affiliated companies are capital allocation methods, performance measurement mechanisms, the aggregation of risk and the implementation of a risk management culture. Second - positively related with size and sustainable performance are incentive contracts and positively related with the total amount of taxes paid relative to firm assets is implementation of a risk management culture. Study indicates also negatively relationship - its related with past performance are performance measurement mechanisms, incentive contracts, the implementation of a risk management culture and audit. Additionally negatively related with lagged changes in performance are performance measurement mechanisms, the aggregation of risk, ERM adoption and the implementation of a risk management culture. In the end, study indicates that managers are more likely to adopt external ERM components than internal.

Interesting conclusions about the determinants of risk management process provides study by Gatzert and Martin (2013). Regarding the determinants of ERM their findings show that while some determinants (assets' opacity, growth opportunities) are not significantly related to the development of an ERM system or are ambiguous regarding the direction (financial leverage), the company size and the level of institutional ownership are, in particular, identified in most studies as significant factors that positively affect the implementation of an ERM system.

According to Florio and Leoni (2017) and Islam, Tedford (2012) a key elements of successful implementation of risk management process is support from top management. It is especially important in regard of SMEs which are regarded as open to risk taking. In this reason risk management in SMEs should stay focused by top leaders.

Next crucial crucial element shaping the effective risk management system in organization is risk communication. It should be provided against the background of that existing perception. As indicate many researchers to manage risk effectively, it is important to build strong communication flows and data reporting (Beretta, Bozzolan 2004; Gorzeń-Mitka 2017c; Hopkin, 2010).

Author points, that the relationship among risk management factors (especially those point out above) are a key elements to improve decision making process. Taking account of the above, it appears advisable to commence research on the link between selected factors of risk management process in SMEs.

3. Problem formulation and methodology

The aim goal of this study is to determine the relationship among key factors of risk management process in SMEs. In this article relationship among selected factors of risk management

process will be analysed. There is an assumption, proposed by the author, that all variables are interrelated with each other dependence.

3.1. Research method

The current study tackles a assessment of relationship among selected factors of risk management process in Polish SMEs by applying a Interpretive Structural Modelling (ISM). Interpretive Structural Modelling (ISM) is one of the unique management methods that provides a structured method for dealing with complex issues. The concept of ISM was primary introduced by J. Warfield in 1973 and develop by him in the following years (Warfield 1973, 1982).

This method consists of seven steps:

- Identification of the crucial elements that are relevant to the problem.
- Establishing the contextual relationship among elements.
- Developing a structural self-interaction matrix (SSIM).
- Determine the reachability matrix.
- Identify the level partitions.
- Classification of key factors of risk management process based on their driving and dependence power.
- Drawing ISM graph of key factors of risk management process in SMEs.

These method have been applied in different studies in many different areas (Attri, Dev, and Sharma, 2013; Jitesh, Arun and Deshmukh, 2008). In this study it was use ISM method procedure describe by Janes (1988) and Alawamleh, Popplewell (2011).

3.2. Description of the study sample

The study was conducted in first half of 2017 on a sample of 269 companies, categorized, according to the number of employees, as small and medium enterprises (micro-enterprise 21,2%, small-enterprise 58,9%, medium-enterprise 20,8%). Small businesses dominated the sample. The survey questionnaire was addressed to both manufacturing (28,3%), trade (19,6%) and service (15,7%) enterprises. Questionnaires were sent to owners of businesses and people responsible for risk management in companies. A part of questionnaire was developed using ISM methodology to determine underlying relations among these factors. 73 risk management experts from SMEs finally participated in part of the study, regarding the evaluation of the relationship among the factors of the risk management process.

In this study, I concentrate on a key factors referring to a risk management process in SMEs. Leading factors of risk management in SMEs was selected based on literature review. Using the research data collected from 73 respondents and following the ISM method steps, the ISM directional graph is developed.

4. Interaction between key factors of risk management process in SMEs - results of research

Experts judgment are use to describe the contextual relation of all the ten factors. With the use of this methodology, we can identify the direct and indirect relationships between factors of risk management process in SMEs. The results of expert opinion, based on ISM methodology symbols (V,A,X,O), was shown in provide input to structural self-interaction matrix (table 1).

Table 1. Structural self-interaction matrix (SSIM)

	Risk management determinants	1	2	3	4	5	6	7	8	9	10
1	Support from top management		V	V	A	X	X	V	V	V	O
2	Promote communication on risks and a risk culture	A		V	O	X	O	O	O	O	O
3	Defined and transparent rules, procedures	A	A		X	A	A	A	A	A	A

	and internal control										
4	Coherence of risk management with objectives of company	V	O	X		O	O	X	X	X	X
5	Awareness and knowledge of the risk management process	X	X	V	O		O	O	O	O	V
6	Risk description in the company profile context	X	O	V	O	O		A	A	A	X
7	Designation level of risk tolerance	A	O	V	X	O	V		X	X	V
8	Designation of risk respond	A	O	V	X	O	V	X		X	V
9	Designation risk assessment criteria	A	O	V	X	O	V	X	X		V
10	Review of risk management impact to the company's operations	O	O	V	X	A	X	V	V	V	

V - the row influences the column; A - the column influences the row; O - there is no relation between the row and the column;
X - row and column influences each other
Source: own study

A converted symbolic structural self-interaction matrix into binary matrix (elements are 0 or 1) provides the reachability matrix (Table 2). Based on initially reachability matrix, driving power and dependence power were calculated for each criterion - MICMAC matrix (Figure 1). The purpose of MICMAC analysis is to analyze the drive power and dependence power of factors. It is done to identify the key factors that drive the system in various categories. Based on their drive power and dependence power, the factors, have been classified into four categories i.e. autonomous factors (weak drive power and weak dependence power; relatively disconnected from the system, with which they have few links, which may be very strong), linkage factors (strong drive power as well as strong dependence power; any action on these factors will have an effect on others and also a feedback effect on themselves), dependent (weak drive power but strong dependence power) and independent factors (strong drive power but weak dependence power, key factors of system) (Attri, Dev & Sharma 2013). Using this method allows us to arrange selected risk management factors into four distinctive categories. As Figure 1 shown, there were 2 autonomous criteria (2 - promote communication on risks and a risk culture, 5 - awareness and knowledge of the risk management process). It indicates that there were disconnected factors from the system.

Table 2. Reachability matrix table

	Risk management determinants	1	2	3	4	5	6	7	8	9	10	Driver
1	Support from top management	1	1	1	0	1	1	1	1	1	0	8
2	Promote communication on risks and a risk culture	0	1	1	0	1	0	0	0	0	0	3
3	Defined and transparent rules, procedures and internal control	0	0	1	1	0	0	0	0	0	0	2
4	Coherence of risk management with objectives of company	1	0	1	1	0	0	1	1	1	1	7
5	Awareness and knowledge of the risk management process	1	1	1	0	1	0	0	0	0	1	7
6	Risk description in the company profile context	1	0	1	0	0	1	0	0	0	1	4
7	Designation level of risk tolerance	0	0	1	1	0	1	1	1	1	1	7
8	Designation of risk respond	0	0	1	1	0	1	1	1	1	1	7

9	Designation risk assessment criteria	0	0	1	1	0	1	1	1	1	1	7
10	Review of risk management impact to the company's operations	0	0	1	1	0	1	1	1	1	1	7
	Dependence	4	3	10	6	3	6	6	6	6	7	

The rules of transformed the SSIM table into the initial reachability matrix: if in the SSIM is V, then the entry in the reachability matrix becomes 1; if in the SSIM is A, then the entry in the reachability matrix becomes 0; if in the SSIM is X, then the entry in the reachability matrix becomes 1; if in the SSIM is O, then the entry in the reachability matrix becomes 0.
Source: own study

According to Figure 1, the factors 4 - coherence of risk management with objectives of company, 7 - designation level of risk tolerance, 8 - designation of risk respond, 9 - designation risk assessment criteria, and 10 - review of risk management impact to the company's operations, were positioned in the group of linkage criteria.

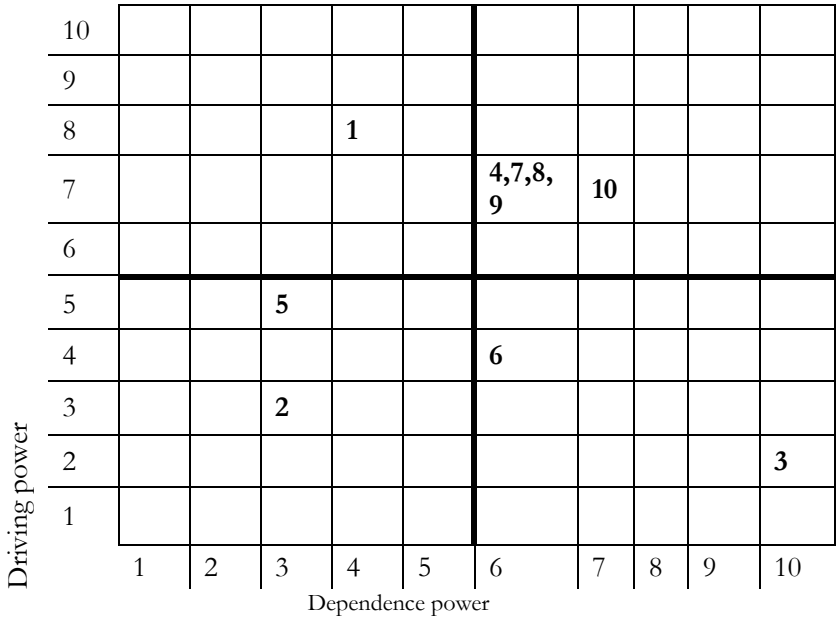

Figure 1. Driver power - dependence diagram
Source: own study

Any stimulate to these criteria may have an influence on the other criteria and therefore get a new feedback from the system. The factor 1 - support from top management- was positioned in the category of dependent criteria. There were also 2 independent criteria: 6 - risk description in the company profile context, 3 - defined and transparent rules, procedures and internal control). In the current study, it was a key factors of risk management system in SMEs.

In next step, following graph (Figure 2) was generated to portray the relationship among selected factors of risk management process in SMEs. The structural model is generated from the final reachability matrix. The Figure 2 portrayed both the direct and the indirect relationships between key factors of risk management process in polish SMEs. It can be seen in Figure 2 that basic elements of risk management process (level of risk tolerance, ways to risk respond, risk assessment criteria) and designation of risk management impact to the company's operations and their objectives are very significant elements for implementation of this process of the Polish SMEs, as they come at the base of the ISM model. Defined and transparent rules, procedures and internal control is the element which most reflects the implementation of risk management process of SMEs. This factor appears at the top of the model.

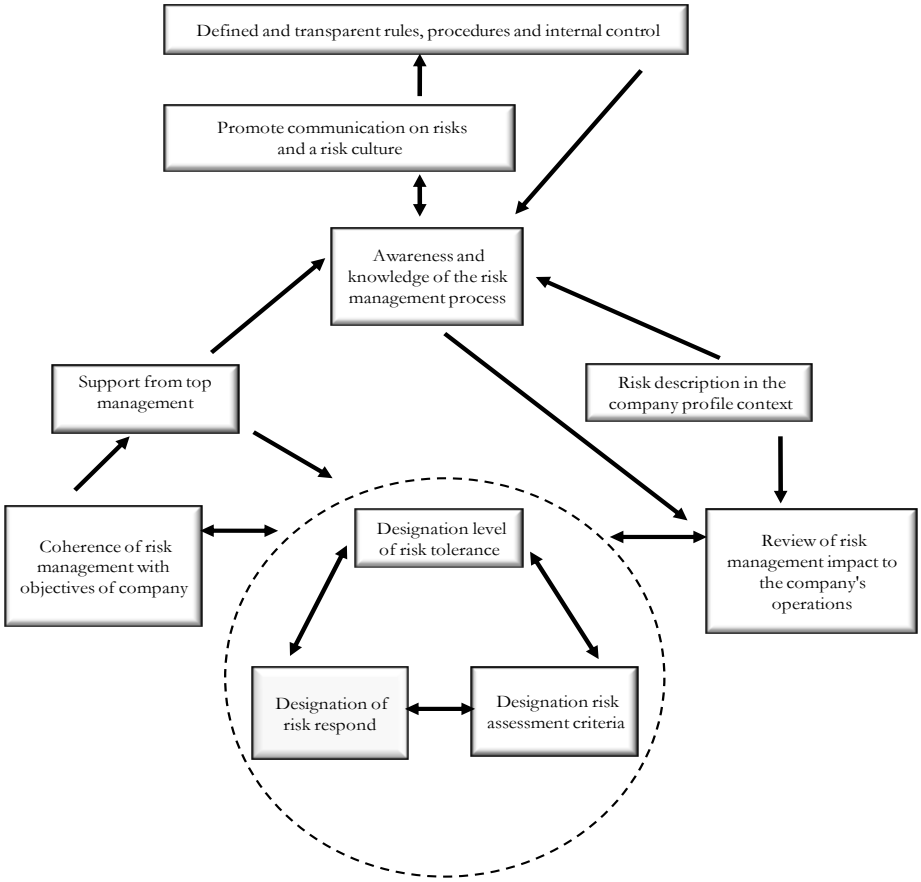

Figure 2. The interaction among key factors of risk management process in SMEs - ISM model
Source: own study

5. Limitation of this study

While this study contributes to fill a gap on the knowledge of risk management in SMEs, some limitations open up avenues for further research. First, study on risk management in SMEs, especially on determinants of this process is undoubtedly a multidimensional concept. In this study are investigated only selected factors of risk management process in SMEs enterprises opinion. There are many other areas of challenges in this area and future research should investigate the relationships between other dimensions of this concept. Second, this research aimed to identify selected challenges in an exploratory way and the ISM methodology was developed using the knowledge of experts, which represents an element of bias. Also, as the research focuses on one specific sector context, the Polish SMEs, the findings are not universally applicable across different sectors or in different countries. Finally, the model has not been statistically validated. Future research could extend this research concept here identified complementing it with dedicated areas such as business aspects.

Conclusions

The objective of the ISM model in this research is to understanding of the relationships between risk management determinants in micro, small and medium size enterprises. The model developed in this paper provides the opportunity to understand the relationships among key risk management factors. As indicate Alawamleh and Popplewell (2011), the task of decision making process is to place high priority on those factors that form the base of ISM model because it is they who would drive other factors, in this case concerning on risk management process. Using ISM methodology it provides an understanding of the relationships among the risk management determinants in the SMEs; classification of determinants under autonomous, dependent, linkage and independent categories and suggested model would help the SMEs to develop strategies to mitigate risks in complexity environment.

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References

1. Alawamleh, M., & Popplewell, K. (2011). Interpretive structural modelling of risk sources in a virtual organisation. *International Journal of Production Research*, 49(20), 6041-6063.
2. Al-Rashidi, Y. A. (2012). *Factors Affecting SMEs decision-makers risk perceptions associated with exporting: A comparison study of emerging and advanced markets*. Griffith University. Available at https://www120.secure.griffith.edu.au/rch/file/8abb561c-a4ef-d37d-63dc-485e0c3f0f58/1/Al_Rashidi_2012_02Thesis.pdf
3. Altuntas, M., Berry-Stölzle, T. R. (2011). *Dynamic determinants of enterprise risk management adoption in the property-liability insurance industry: Evidence from Germany.* [pdf] Available at:<http://www.wu.ac.at/egrie2011/programme/papers/v.b1.altuntas.pdf> [Accessed 15 June 2018].
4. Attri, R., Dev, N., & Sharma, V. (2013). Interpretive structural modelling (ISM) approach: an overview. *Research Journal of Management Sciences*, 2319, 1171.
5. Beretta, S., Bozzolan, S. (2004). A framework for the analysis of firm risk communication. *International Journal of Accounting*, Vol. 39, Issue 3, pp. 265-288.
6. Falkner, E. M., Hiebl, M. R.W. (2015). Risk management in SMEs: A systematic review of available evidence. *The Journal of Risk Finance*, 16 (2), 122 – 144. http://dx.doi.org/10.1108/JRF-06-2014-0079
7. Florio, C., & Leoni, G. (2017). Enterprise risk management and firm performance: The Italian case. *The British Accounting Review*, 49(1), 56-74.
8. Gatzert, N. and Martin, M. (2013). *Determinants and value of enterprise risk management: Empirical evidence from the literature. Working Paper,* No.11 Department for Insurance Economics and Risk Management, Friedrich-Alexander-University (FAU) of Erlangen-Nürnberg.
9. Gorzeń-Mitka, I. (2016). Leading Risk Management Determinants of Small and Medium-Sized Enterprises (SMEs): An Exploratory Study in Poland [in:] *Entrepreneurship, Business and Economics*. Vol. 1. Cham: Springer International Publishing, 289-298

10. Gorzeń-Mitka, I. (2017). The evolution of risk management research: changes in knowledge maps. *Problems of Management in the 21st Century*, 12(2), 106-121.
11. Gorzeń-Mitka, I. (2017a). Bricolage concept in risk culture assessment. *European Journal of Sustainable Development*, 6 (1), 335-343.
12. Gorzeń-Mitka, I. (2017b). *Risk culture in the VUCA world* In: Sustainability and Scalability of Business. Theory and Practice (red.) A. Jabłoński, Nova Science Publishers, New York, 279-290.
13. Gorzeń-Mitka, I. (2017c). *Problems of risk communication in organization - a map of current research trends* In: Aktualne problemy podnikovej sfery 2017 (ed.) MAJTAN S. Vydavatel'stvo EKONOM, Bratislava.
14. Gorzeń-Mitka, I. (2018). Leading markers of risk culture in organization. *European Journal of Sustainable Development*, 7(1), 423–434. https://doi.org/10.14207/ejsd.2018.v7n1p425
15. Haviernikova, K. (2016). The Identification And Classification Of Risks In Terms Of Cluster Cooperation. In *Proceedings of 1st International Conference Contemporary Issues in Theory and Practice of Management* (ed. M. Okręglicka, I. Gorzeń-Mitka, A. Lemańska-Majdzik, M. Sipa, A. Skibiński), Czestochowa University of Technology, 130-136
16. He, C., & Lu, K. (2018). Risk management in SMEs with financial and non-financial indicators using business intelligence methods. *Management*, 16, 18.
17. Hopkin, P. (2010). *Fundamentals of risk management: understanding, evaluating and implementing effective risk management*. London, England; Philadelphia, Pennsylvania; New Delhi, India : Kogan Page, 2014.
18. Islam, A., Tedford, D. (2012). Risk determinants of small and medium-sized manufacturing enterprises (SMEs): An exploratory study in New Zealand, *Journal of Industrial Engineering International*, ISSN 2251-712X, Springer, Heidelberg, Vol. 8, 1-13, http://dx.doi.org/10.1186/2251-712X-8-12
19. Janes, F. R. (1988). Interpretive structural modelling: A methodology for structuring complex issues, *Transactions of the Institute of Measurement and Control*. 10(3):145-154 ·
20. Jitesh, T., Arun, K., Deshmukh, S.G., Interpretive Structural Modeling (ISM) of IT enablers for Indian Manufacturing SMEs. *Information Management and Computer Security*, Vol. 16, No. 2, 2008, 113-136.
21. Kana, R., & Mynarzova, M. (2015). European Union's Contribution to Global Security. *European Business & Management*. 1(2), 25-34.
22. Kuběnka, M., Slavíček, O. (2016). *Relationship Between Level Of Prosperity And Failure Prediction*. In SGEM 2016: Political Sciences, Law, Finance, Economics and Tourism Conference Proceedings. Book 2. Vol. 3. Sofie: STEF92 Technology Ltd., 505-512. ISBN 978-619-7105-74-2.
23. Kuraś, P., Kuraś, M. & Lis T. (2015). Knowledge Management and Technological Development of the Enterprise. *International Journal of Arts and Sciences*. 8(2), 295-302.
24. Lam, J. (2003). *Enterprise risk management*. New York: John Wiley & Sons, Inc.
25. Liebenberg, A.P. and Hoyt, R.E. (2003). Determinants of enterprise risk management: Evidence from the appointment of chief risk officers. *Risk Management and Insurance Review*, 6, 37-52.
26. Sheedy, E. A., Griffin, B. (2015). Risk Governance, Structures, Culture and Behaviour: A View from the Inside. *FIRN Research Paper*. 2529803.
27. Sipa, M. (2018). The factors determining the creativity of the human capital in the conditions of sustainable development. *European Journal of Sustainable Development*, 7(2), 1-13. Doi: 10.14207/ejsd.2018.v7n2p1
28. Sitek, M. (2017). Assessment of Sustainable Building by the Participants of the Local Real Estate Market in Czestochowa. *European Journal of Sustainable Development*, 6(4), 309–319. https://doi.org/10.14207/ejsd.2017.v6n4p309
29. Skibiński, A. (2016). The Changes of the Population Structure and Its Consequences in Selected EU Countries - Some Aspects. *European Journal of Sustainable Development*, 6 (1), 357-368
30. Skowron-Grabowska, B., Mesjasz-Lech, A. (2016). Konkurencyjne uwarunkowania zarządzania zasobami kadrowymi w przedsiębiorstwach w kontekście dostępu do rynku pracy. *Przegląd Organizacji*, 10, 22-28.
31. Verbano, Ch. and Venturini, K. (2013). Managing risks in SMEs: A literature review and research agenda. *Journal of Technology, Management & Innovation*, 8(3), 186-197.
32. Warfield, J. N. (1973). *An assault on complexity*, Battelle Monograph No 3, Battelle Memorial Institute, Columbus. Ohio, USA. Warfield, J. N. 1 973b. 'Intent structures'. IEEE Trans on System, Man and Cybeni, SMC3(2), 133-140.
33. Warfield, J. N. (1982). *Interpretive structural modelling*. In: Olsen, S. A. (ed), Group planning and problem solving methods in engineering management. John Wiley and Sons, Inc, New York, USA.
34. Wasiluk, A. (2017). Pro-innovative Prerequisites for Establishing the Cooperation between Companies (in the Perspective of Creation and Development of Clusters). In K. Halicka & L. Nazarko (ed.), 7th

International Conference on Engineering, Project, and Production Management (T. 182, 755–762). Amsterdam: Elsevier Science Bv.
35. Wieczorek-Kosmala, M. (2014). Risk management practices from risk maturity models perspective. *Journal for East European Management Studies*, 133-159.

32. Economic Development or Environmental Protection? The Dilemmas of the Developing Countries through the Case of the Philippines

Dr. Péter Klemensits

ABSTRACT:
As the term sustainable development has become more important to the world, in the developing countries it means a serious conflict of interest considering the conservation of the environment versus the economic development. For the states of the Global South it is a near-impossible challenge to create a responsible environmental policy and at the same time secure the long-term development of their economies and societies. The case of the Philippines can be cited as an ideal example, as under the presidency of Rodrigo Duterte the government is struggling to reconcile the opposing interests, while the environmental degradation seems to be incontrollable. The present paper examines the challenges confronted by the developing countries in Africa, Asia and Latin America through the case study of the Philippines. The analysis based on the literature presents in detail the sustainable development strategy of the Philippines, President Duterte's environmental policy, and the country's socioeconomic prospects alike. The paper concludes that in favour of the sustainable development the environmental protection can no longer be put into the shade by sheer economic interest, even if the challenge became more difficult for the elites in the future.

Keywords: Sustainable development, economic policy, environmental protection, developing countries, Philippines

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1. Introduction

While the developed countries have already become committed towards the provision of sustainable development, in the states of the global South the compatibility of economic development and environmental protection is a serious issue. In numerous African countries the political and economic conditions do not allow for the pursuance of a responsible environmental policy, but even in the more highly-developed Latin American and Asian regions – where the political, economic and social conditions are more beneficial – there is a serious conflict of interests between the political ambitions aiming at long-term economic and social development and the preservation of the environment for the future generations. This kind of ambivalence can be clearly seen on the Philippines, where - after President Rodrigo Duterte's inauguration in 2016 – the Government made considerable efforts for environmental protection, while they also treated economic development as a high priority (Manahan, 2017). The mitigation of the contradictory interests, however, means a greater and greater challenge, while the damaging of the environment threatens with severe consequences.

The author aims to present all such issues through the model of the Philippines that affect most of the developing countries during the reconcilement of environmental protection and economic policy. Apart from the different geographical, economic and social endowments of the states, in numerous countries the political leadership is not committed towards the double aims similar to the Duterte Government; nevertheless, the success or the failure of the Philippine reforms can serve as a severe lesson concerning the future.

2. The right to development

The objective judgement of the policy of the developing countries leaves much to be desired regarding the developed North, which – besides the internal factors – influences the economic and environmental facilities of the global economies of the South from the outside, too. The protection of the environment is a joint responsibility, which the developing countries should also take a hand with. Nevertheless, they also have the right to development, which means that they have the right to set out on the way that the states of the developed North have already finished. The main point is that any country can need sustainable development; however, this assumes some limited economic development, in close harmony with environmental protection. In this approach, development means not only economic prosperity but also human development, that is, it also includes broader enforcement of human rights and the democratic values (Ngosso, 2013). In the countries of the Global South the political systems decrease the importance of this latter factor, while the reigning elite primarily focuses on the economic development.

As a result of globalization, the exploitation of raw materials has come to the front for the establishment of international competitiveness, while industrialization also continues, enhancing the damaging of the environment (Esty and Ivanova, 2004). The negative consequences of the process can only be supported with the active support of the developed countries, but no consensus have been realized even about the real environmental purposes. A progress is that, to observe the agreements concluded during the Paris Climate Summit in 2015, the developing countries also assumed commitments – challenging though the real intentions of the West – although the resignation of the United States of America in 2017 definitely affected the process adversely, highlighting again the differences between the developing and the developed countries (Plumer, 2017). On the other hand, the absence of the US offers a unique opportunity to developing countries such as China or India, who have become the front-line fighters against the West against climate change but are unable to surrender economic development, too.

3. Case study: the Philippines

With its over 100 million inhabitants, the Philippines has the 34st largest economy in the world and basically belongs to the group of the newly industrialized, emerging nations. Today Asia is considered one of the most rapidly growing economies; in 2017 the country produced a GDP growth of 6.7% (Tubayan, 2018). As a result of the enormous property inequalities, however, 21.6% of the population lived below the property threshold in 2015 (ADB, 2018). In 2017, the unemployment rated 5.7%

besides the 2.9 inflation, which is an especially serious issue in the regions stricken with political, social and religious conflicts (e.g. Mindanao) (Focus Economics, 2018; Altez and Caday, 2017). Besides agricultural and industrial products, the main export articles include raw materials. The greatest challenge for the Government is the different developmental levels of the regions, the unsolved social conflicts, corruption and poor infrastructure (Batalla, 2018).

Unlike numerous African and Latin American countries, the Philippines seems to be in an advantageous position in terms of its development; however, economic development resulted in such extent of environmental damage that cannot be ignored by the Government in the future. In the lack of appropriate industrial sewage cleaning, 58% of the subsoil water is contaminated, and 75% of the river-waters is unsuitable for human consumption (Marrone, 2016). Flowing into the Manila Bay, the River Marilao is one of the 10 most polluted rivers in the world. As a result of uncontrollable deforestation and illegal wood cutting, the forest cover decreased from 70% to 20% during the 20th century (that is, to 1.3 million hectares) (Lasco et al. 2001). Consequently, landslides cause more and more issues. Although to a different extent, air pollution affects 98% of the population, causing the death of every fourth person annually (DENR, 2017). The situation is the worst mainly in Manila and other cities due to the constant smug. As a result of the environment-damaging activity and the global warming, the country has become more exposed to natural disasters as well. In 2013 the Yolanda Typhoon caused the death of at least 6,000 people in the Philippines (Rappler, 2017).

Over the past 30 years, the current Philippine Government has numerously expressed its commitment towards environmental protection; however, little progress has actually been made because the economic interests have surpassed the ecological interests in most cases. The issue of environmental protection was already included in the currently valid constitution that became effective in 1987. Drafted in 1991, the Philippine Strategy for Sustainable Development served as the basis for the Philippine Agenda 21, the draft on sustainable development. Manila also supported the United Nations Framework Convention on Climate Change signed in Rio de Janeiro in 1992, or the Kyoto Protocol ratified in 2003 (PCW, 2018). Later the Clean Development Mechanism was also adopted, supplemented with the commitments laid down in the Kyoto. Besides the presidential decrees and acts, the National Framework Strategy on Climate Change 2010-2022, drafted in 2010, also worth mentioning as a document taking a stand for the preservation of natural ecosystems and the provision of sustainable development (CCC, 2013).

4. President Duterte's agenda

By the 2010s it had become clear that the one-sided enforcement of economic interests has created a situation in the country that threatens with an ecological disaster in numerous areas. However, the ignorance of environmental protection will exert a negative influence on the economic development, too; nevertheless, the Benigno Aquino Government, being in office between 2010 and 2016, failed to find an efficient solution to the problem. Illegal wood cutting and the spread of mining and coal-fired power stations both contributed to the pollution of the air, waters and soil and jeopardized the subsistence of several millions of people, let alone the inducement of natural disasters.

Earlier President Rodrigo Duterte as Mayor of Davao banned mining in the territories under the jurisdiction of the municipality, and in his president election campaign he also demanded the representatives of the sector to entirely comply with the environmental requirements. After his election his Presidency promised significant reforms for the first 100 days. He held out the prospect of the supervision of mining permits, the banning of establishing new mines, ruthless fight against illegal wood cutting and fishing, the reassessment of the energy supply of the country, the introduction of a moratorium against new coal-fired power stations, and the gradual conversion to renewable energy sources (Manahan, 2017). Overall, Duterte promised to take 60 reform actions in 9 subfields, from responsible mining through fight against climate change, until responsible waste management, which were unanimously supported by the environmental organizations.

5. Duterte's socio-economic policy

Duterte's environmental program cannot be separated from the President's economic and social reforms aiming to enhance the development of the country. The economic policy of the Duterte Government, which has been given the name DuterteNomics, primarily aims to make the country one of the high-middle-income economies by 2020. Officially launched in April 2017,

DuterteNomics includes all the economic and social political ideas released by the President as Ten-point agenda in June 2016. Among others, this 10-point program stood up for continuing the macroeconomic policy of the earlier Administration, promised a large-scale tax reform, the increasing of competitiveness, the improvement of the rural areas, healthcare and education as well as the promotion of investments (PCOO, 2017; Miller, 2018). The mid-term plan adopted in 2017 includes the above objectives in their entirety. Based on the opinion of the Filipino citizens, the 25-year long-term vision called Ambisyon Natin 2040 also deems the coordination of economic-social programs and developments as the main objective, and it also attaches great importance to education, because the aim is to establish a prospering "smart and innovative" middle class by 2040 (Update Philippines, 2016).

Nevertheless, the key aspect of DuterteNomics is the Build! Build! Build! Infrastructure Plan, which intends to decrease poverty and promote economic growth and social welfare through infrastructure investments covering the whole country. A considerable part of the scheduled projects facilitates the development of transport and would primarily be realized from state funding. During the 6 years of his office, Duterte plans to devote USD 180 billion to infrastructure developments and raise a part of the costs from foreign sources. In the autumn of 2017 the President approved the launch of 21 projects to the value of USD 16 billion (Reuters, 2017).

Based on the above, the Philippine Development Plan (PDP) 2017-2022 was drafted in 2017, with the primary aim of decreasing the proportion of people living in property to 14% by 2022. Also, besides infrastructure development, he also lays great emphasis on the maintenance of the ecological balance and the creation of a clean and healthy environment. As part of this, the conversion to renewable energy sources, the rehabilitation after natural disasters, the establishment of infrastructure resisting the climate change and the supporting of endangered communities are new elements (NEDA, 2017).

6. Clash of interests

Duterte's plans on environmental protection and economic policy seem to complement each other; however, the clash of opposite interests soon became evident, mainly affecting the mining sector. In June 2016 the President appointed Regina Lopez as head of the Philippine Department of Environment and Natural Resources (DENR), who gained reputation as a dedicated environmentalist and activist and whose initiatives compelled the support of the population, too. Lopez was considered a sworn enemy of open mining and was ready to relentlessly act against mining corporations, keeping the President's promise. Accordingly, she ordered the supervision of all mining activities and announced a moratorium on the new mines (Shneider, 2017). Due to the violation of environmental requirements, the Ministry decided in the closure of 23 mining operations, suspension of 5 contracts and the termination of 75 mineral production sharing agreements, affecting 70% of the metal mines (Manahan, 2017). Although mining comprises only 3% of the Philippine export, the Philippines is considered one of the largest nickel and copper exploiters in the world, and the political influence of the sector is determinative.

In the beginning, Duterte favoured Lopez; however, he searched for a compromise after most government members, headed by Minister of Finance Carlos Dominguez, qualified the action as detrimental to the environment. After the Senate Commission on Appointments failed to approve of Lopez's ministerial appointment in May 2017, the President accepted the decision and appointed Roy Cimatu retired General and former Chief of Staff of the Armed Forces of the Philippines as his successor, who was an acceptable person for the mining lobby, too (Santos, 2017). His duty was to find a compromise between the environmentalists and the mining groups. The interpenetration of the economy and policy and the presence of corruption are certified by Duterte's statement to Lopez: „But you know how it is. This is democracy. And lobby money talks" (Ranada, 2017). In November 2017 the Mining Industry Coordinating Council already proposed the retraction of the order on banning the opening of new mines, which was supported by the Minister, too; however, Duterte refused to do so. In April 2018 the President still held out the prospect of prolonging the moratorium until 2019; but on the other side the enforcement of the earlier decisions concerning the operating mines was not materialized. Finally, in July 2018 the DENR lifted the moratorium on exploration permits for minerals, at the same time it found that 23 of the 27 suspended mining sites are compliant with the regulations therefore only 4 could face closure in the future (Dela Cruz, 2018; Palatino, 2018). Although not all of actions by Lopez have officially been retracted, the economic

interests have gained a victory over environmental considerations, and the radical reforms had no chance of success (Ranada, 2018).

7. The administration's balancing policy

With the appointment of Regina Lopez the President demonstrated that he does not shrink for his aims from brave and radical steps; however, his contradictory statements have already suggested that he is forced to make compromises in the interests of economic development, although he also takes environmental protection seriously. Actually, the Head of State considers the maintenance of ecological integrity and the protection of natural values as aspects of key importance for the realization of the economic and social development, and he only disagrees with their excessive and unlimited exploitation (Manahan, 2017). This is well illustrated by the National Greening Program, under which the Government would like to implement the plantation of forests in an area of 1.2 million hectares between 2017 and 2022 in the interests of sustainable sylviculture (DENR, 2018).
While Regina Lopez aimed at the use of renewable energy sources in 100%, which was favoured by the governmental measures, too, Duterte explained several times that coal is still the cheapest energy source for the industrialization of the country, so he permitted the construction of new power stations (Jerusalem, 2016). He also held out the prospect of rehabilitating the only nuclear station of the country that was built but never commissioned (Lucas, 2016).
Earlier the President criticized the Paris Clime Treaty, which he did not intend to sign, but in February 2017 he did so (Salaverria, 2017). Similarly to the leaders of other developing countries, however, he also held the states of the developed West responsible for the climate change, although for the future of the Philippines he takes the commitment seriously, which however will not be easy to be realized.
Serious environmental concerns have also arisen about the grandiose infrastructure investments despite the fact that Duterte asked the foreign corporations involved in the project to entirely comply with the requirements. The interpenetration of the corruption and the economic and social interests questions whether the Government can give an effective answer to the possible violations of law.
The closing of the tourism paradise of Boracay in April 2018 raised new questions concerning the compatibility of economic interests and environmental protection. Since the state failed to properly solve the issue of sewage supply and waste management on the island despite its promises, Duterte ordered the closing of the island for 6 months and the cleaning of the territory (Villamor, 2018). However, the absence of tourists not only jeopardizes the subsistence of the local population but can also cause a considerable loss of income for the Philippine economy. (In 2017 more than 2 million – mainly Chinese and South Korean - tourists visited the island of Boracay.)

Conclusion

After Rodrigo Duterte had been elected President, the Philippine Government recognized the serious ecological crisis situation and strongly committed towards the issue of environmental protection. At the same time, the Cabinet also prioritizes the economic and social development of the country, which, however, led to the conflict of interests even in the short term. In the past two years, President Duterte – although forced to pass numerous compromises – endeavoured to find a middle course and accelerate the development of the country in harmony with sustainable development. Today it cannot be clearly seen yet how successful his ambitions can be considered; nevertheless, the expectations are significant as compared to the challenge, and this raises several questions with respect to the future. Are environmental protection and industrialization compatible with each other? Will Duterte's reforms reach the desired aim? Can sustainable development be followed, or will economic interests ("lobby money speaks") dominate in the future, too? And finally, can the functioning ecosystems be preserved, or is the country approaching an ecological disaster?
These questions can only be answered by the future, but one thing is certain: each country of the global South faces a similar dilemma, so the model of the Philippines draws our attention to a problem that affects the future of all humanity last of all. Actually, in favour of development, environmental protection has no alternative because the following of short-term economic benefits can result in an irreversible ecological crisis, so it is a mutual interest to establish the appropriate

balance. A great question is when the power elites will realize this and what actions they will be ready to take for the positive outcome.

References

Altez, J. A. and Caday, K. A. (2017). A Mindanaoan President. In: Curato, N. (ed) *A Duterte Reader: Critical Essays on Rodrigo Duterte's Early Presidency*. Cornell University Press, Ithaca, New York, pp 111-126.

Asian Development Bank (ADB), (2018). Poverty in the Philippines. Philippines. Available: https://www.adb.org/countries/philippines/poverty (accessed: April 23, 2018)

Batalla, V. C. (2018). Bypassing Industrial Development. In: Thompson M. R. and Batalla, V. C. (eds.): *Routledge Handbook of the Contemporary Philippines*. Routledge, New York.

Dela Cruz, E. (2018). UPDATE 1-Philippines says 23 of 27 mines pass review, but four may close. *Reuters,* August 2, 2018 Available: https://www.reuters.com/article/philippines-mining/update-1-philippines-says-23-of-27-mines-pass-review-but-four-may-close-idUSL4N1UT21P (accessed: August 23, 2018)

Department of Environment and National Resources (DENR), (2017). Air Pollution: A Public Health Concern in the Philippines. September 24, 2017 Available: https://www.denr.gov.ph/news-and-features/latest-news/3295-air-pollution-a-public-health-concern-in-the-philippines.html (accessed: May 12, 2018)

Department of Environment and Natural Resources (DENR), (2018). Enhanced National Greening Program. Available: https://www.denr.gov.ph/priority-programs/national-greening-program.html (accessed: April 12, 2018)

Esty, D. and Ivanova M. H. (2004). Globalization and Environmental Protection: a Global Governance Perspective. Yale Center for Environmental Law & Policy Working Paper Series, Working Paper 0402, 21 July. Available: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.596.4578&rep=rep1&type=pdf

Focus Economics, (2018). Philippines Economy Data. Economic Forecasts from the World's Leading Economists. Available https://www.focus-economics.com/countries/philippines (accessed: April 23, 2018)

Jerusalem, J. J. (2016). Duterte: Green Energy is Good but We Need Coal. In: *SunStar Philippines*, December 10, 2016 Available: https://www.sunstar.com.ph/article/114723/ (accessed: April 12, 2018)

Lasco, R. D., Visco, R. G., Pulchin, J. M. (2001). Secondary Forests in the Philippines: Formation and Transformation in the 20th century. In: *Journal of Tropical Forest Science*, Vol, 13. No 4, 2001. pp. 652-670.

Lucas, D. L. (2016). Energy Chief Gets Duterte's Green Light for $1-B Nuke Plant Rehab. *Inquirer.net*, November 11, 2016 Available: http://business.inquirer.net/218869/energy-chief-gets-dutertes-green-light-for-1-b-nuke-plant-rehab (accessed: April 22, 2017)

Manahan, M. A. (2017). Philippines Duterte's "schizophrenic" countryside and environmental agenda – Laban-Bawi: Governing the Environment. In: *Europe Solidaire Sans Frontières*, 10 September 2017 Available: http://www.europe-solidaire.org/spip.php?article41966 (accessed: April 12, 2018)

Marrone, R. (2016). Water Pollution in the Philippines: Causes and Solutions. In: *Borgen Magazine*, October 2, 2016 Available: http://www.borgenmagazine.com/water-pollution-in-the-philippines/ (accessed: October 23, 2017)

Miller, J. (2018). *Duterte Harry: Fire and Fury in the Philippines*. Scribe, Melbourne-London.

National Economic and Development Authority (NEDA), (2017). Philippine Development Plan 2017-2022. Pasig City. Available: http://www.iro.ph/article_doc/fc55bc53_PDP-2017-2022-Prepublication-2.pdf (accessed: February 15, 2017)

Ngosso, T. (2013). The Right to Development of Developing Countries: An Argument against Environmental Protection? In: *Public Reason*, Vol 5, No 2, pp 3-20.

Palatino, M. (2018). Duterte Is Killing the Philippines' Environment. In: *The Diplomat,* August 27, 2018 Available: https://thediplomat.com/2018/08/duterte-is-killing-the-philippines-environment/ (accessed: August 29, 2018)

PCOO, (2017). DuterteNomics unveiled. Republic of the Philippines, Presidential Communications Operations Office, April 18, 2017 Available: https://pcoo.gov.ph/uncategorized/dutertenomics-unveiled/ (accessed: January 12, 2018)

Office of the President of the Philippines, Climate Change Commission (CCC), (2013). National Framework Strategy on Climate Change 2010-2022. December 15, 2013. Available: http://www.asialeds.org/sites/default/files/resource/file/nfscc_sgd.pdf (accessed: April 12, 2018)

Philippine Commission on Women (PCW), (2018). Philippine Initiatives to Address Environmental Issues. National Machinery for Gender Equality and Women's Empowerment. Available: http://www.pcw.gov.ph/focus-areas/environment/climate-change/initiatives (accessed: April 12, 2018)

Plumer, B. (2017.). What to Expect as U.S. Leaves Paris Climate Accord. In: *The New York Times*, June 1, 2017 Available: https://www.nytimes.com/2017/06/01/climate/us-paris-accord-what-happens-next.html (accessed: January 12, 2018)

Ranada, P. (2018). Duterte Eyes Open-pit Mining Ban until 2019. *Rappler*, April 09, 2018 Available: https://www.rappler.com/nation/199876-duterte-open-pit-mining-ban-2019 (accessed: April 12, 2018)

Ranada, P. (2017). Duterte on CA votes vs Gina Lopez: 'Lobby money talks'. *Rappler*, May 04. Available: https://www.rappler.com/nation/168889-duterte-gina-lopez-lobby-money

Rappler, (2017). NDRRMC probes high death toll from tropical storm Vinta. December 25, 2017 Available: https://www.rappler.com/nation/192218-vinta-death-toll-evacuation-failure (accessed: January 15, 2018)

Office of the President of the Philippines, Climate Change Commission (CCC), (2013). National Framework Strategy on Climate Change 2010-2022. December 15, 2013. Available: http://www.asialeds.org/sites/default/files/resource/file/nfscc_sgd.pdf (accessed: April 12, 2018)

Salaverria, L. B. (2017). Duterte Finally Signs Paris Agreement on Climate Change. *Inquirer.net,* March 02, 2017 Available: http://globalnation.inquirer.net/153030/duterte-finallly-signs-paris-agrement-climate-change (accessed: April 22, 2017)

Santos, A. P. (2017). Philippines struggles to balance environment, mining. *DW*, May 17, 2017 Available https://www.dw.com/en/philippines-struggles-to-balance-environment-mining/a-38875328 (accessed: April 12, 2018)

Schneider, K. (2017). The Rise and Fall of Regina Lopez, the Philippines' Maverick Environment Minister. In: *Mongabay*, 9 May 2017 https://news.mongabay.com/2017/05/the-rise-and-fall-of-regina-lopez-the-philippines-maverick-environment-minister/ (accessed: April 12, 2018)

Tubayan, E. J. C. (2018). PHL to remain among SE Asia's fastest-growing economies — WB. In: *Business World*, January 11, 2018 Available: http://bworldonline.com/phl-remain-among-se-asias-fastest-growing-economies-wb/ (accessed: April 23, 2018)

Update Philippines, (2016). Duterte admin adopts Ambisyon Natin 2040. Available: http://www.update.ph/2016/10/duterte-admin-adopts-ambisyon-natin-2040/10358 (accessed: February 15, 2017)

Villamor, F. (2018). Idyllic Philippine Resort Island of Boracay Is Closed to Tourists, In: *The New York Times*, April 4, 2018 Available: https://www.nytimes.com/2018/04/04/world/asia/boracay-philippines-tourists-closed.html (accessed: May 12, 2018)

33. Poverty, Inequality, and Development in the Philippines: Official Statistics and Selected Life Stories

Dr. David Michael M. San Juan, Prince Jhay C. Agustin

ABSTRACT:
Mainstream academia's and neoliberal economists' failure to exhaustively explain the roots of the 2008 crisis and point a way towards how the world can fully recover from it, made radical theories of poverty and income inequality more popular and relevant as ever. Official World Bank statistics on poverty and their traditional measurements are put into question and even an IMF-funded study admits that instead of delivering growth, neoliberalism has not succeeded in bringing economic development to the broadest number of people, as massive poverty and income inequality abound in many countries, more especially in the developing world. Drawing from theories on surplus value, labor exploitation, and economic dependency, this paper will present an updated critique of the official poverty line in the Philippines and how official statistics mask the true extent of poverty in the country, thereby figuratively rendering many faces of poverty hidden if not obliterated; analyze the link between poverty and income inequality within the country's neocolonial set-up; and present summarized selected life stories of ambulant vendors, mall personnel, fast food workers, cleaners, security guards and other typical faces of poverty in the Philippines' macro-economically rich capital region – Metro Manila – which serve as fitting counterpoints to the official narrative. Such discussion will be the paper's springboard in presenting an alternative plan towards sustainable development of the Philippines.

Keywords: Sustainable development, poverty, inequality, official poverty line, neoliberalism

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1. Introduction

Mainstream definitions and measurements of poverty levels have come under increasing scrutiny and criticism as radical theories of poverty and income inequality recover their popularity, after more than a decade of neoliberalism's failure to resolve the 2008 crisis that hit America and segments of Europe. Reddy & Lahoti (2016) remark that the "criticisms that have been levelled at the (World) Bank's methodology since the 1990s over key technical questions—PPPs, inflation measures, price variations within countries (in particular the differing costs in rural and urban areas) and the merits of income versus consumption data" remain relevant even after World Bank economists increased the international poverty line from $1.02 to $1.90 in 2014. Meanwhile, Hickel (2016) minces no words in explaining how the United Nations' "MDGs have used targeted statistical

manipulation to make it seem as though the poverty and hunger trends have been improving when in fact they have worsened. In addition, the MDGs use definitions of poverty and hunger that dramatically underestimate the scale likely of these problems. In reality, around four billion people remain in poverty today, and around two billion remain hungry – more than ever before in history, and between two and four times what the UN would have us believe." Even World Bank-friendly experts like Chandy and Karas (2016) admit that there are "contradictions" in official poverty data and "it is surprising that the empirical basis for country and global poverty numbers is rather weak." With regard to incongruities, a 2017 statement on poverty in the USA – by Prof. Philip Alston, United Nations Special Rapporteur on extreme poverty and human rights – which count 40 million Americans in poverty, belies the World Bank's poverty headcount ratio for the USA, which is just at a measly 1%.

Official World Bank statistics on poverty and their traditional measurements are put into question (Moatsos, 2017) and calls are made for the "measurement of poverty in both monetary and non-monetary dimensions" so as to "reduce poverty in all its forms" (Saunders, 2018). Even an IMF-funded study (Ostry et al., 2016) admits that instead of delivering growth, neoliberalism has not succeeded in bringing economic development to the broadest number of people, as massive poverty and income inequality abound in many countries, more especially in the developing world (San Juan, 2017).

Drawing from theories on surplus value, labor exploitation, and economic dependency, this paper will present an updated critique of the official poverty line in the Philippines and how official statistics mask the true extent of poverty in the country, thereby figuratively many faces of poverty hidden if not obliterated; analyze the link between poverty and income inequality within the country's neocolonial set-up; and present summarized selected life stories of ambulant vendors, mall personnel, fast food workers, cleaners, security guards and other typical faces of poverty in the Philippines' macro-economically rich capital region – Metro Manila – which serve as fitting counterpoints to the official narrative. Such discussion will be the paper's springboard in presenting an alternative plan towards sustainable development of the Philippines.

2. Critique of Official Philippine Poverty Statistics

Official Philippine poverty statistics should be subjected to a rigorous critique, if the real extent of poverty is to be revealed as a springboard for realizing the actual breadth and depth of poverty as a national and international problem, which is the first step towards genuinely resolving the problem.

At the outset, the critique could begin with backing up Chossudovsky's (2018) straightforward way of describing official poverty figures in the Philippines as something that "have been manipulated" as the Philippine government only appears to have "adopted the one dollar a day World Bank criterion" while failing "to account for inflation in both the 2012 and 2015 estimates." Such official Philippine poverty statistics focus too much on food poverty and fails to adequately encompass other essential people's needs. Moreover, these statistics don't consider the fact that families can be food-rich (with incomes deemed officially high enough to cover the minimum food threshold set by national authorities) and actually poor at the same time.

Even the official food poverty threshold cannot accurately measure real levels of food

poverty, as it has been shockingly and significantly redefined in 2009. Such recalibration of the food poverty threshold imposed lower and thus cheaper dietary requirements for Filipino citizens, thereby artificially lowering down the official poverty statistics. The new food poverty threshold was so laughable that it was eloquently criticized even by a mainstream statistician who correctly spotted the wide gap between the old and the new methodology for measuring food poverty (Mangahas, 2011a and 2016). For example, Mangahas (2011b) notes that the new menu for the food threshold includes "no meat" for the poor (see Table 1), despite the Philippine government's inclusion of meat in the country's "Daily Nutritional Guide Pyramid" released by the Food and Nutrition Research Institute (see Figure 1).

Table 1. Old and New Menu in the Philipppines' Official Food Poverty Threshold (Mangahas, 2011b)

Meal	Old Menu	New Menu	Changes
Breakfast	• Tomato omelette • Coffee for adults • Milk for children • Fried rice	• Scrambled egg • Coffee with milk • Boiled rice	• Elimination of tomato • Elimination of milk for children • Substitution of fried rice with boiled rice
Lunch	• Fried galunggong • Mongo guisado with malunggay leaves and small shrimps (mung beans sauted in garlic, onion, tomatoes, malunggay leaves and small shrimps) • Boiled rice • Banana latundan	• Mongo guisado with malunggay leaves and dried dilis (mung beans sauted in garlic, onion, tomatoes, moringa leaves and dried anchovies) • Boiled rice • Banana latundan	• Elimination of fish • Substitution of small shrimps with dried dilis
Dinner	• Pork adobo (pork cooked in vinegar, soy sauce, garlic, and black pepper) • Pechay guisado (sauted bok choy) • Boiled rice • Banana latundan	• Fried tulingan (bullet tuna) • Boiled kangkong (swamp cabbage) • Boiled rice	• Elimination of pork • Substitution of pork adobo with fried tulingan • Substitution of pechay guisado with boiled kangkong

Snacks	• Pandesal (small common bread) with margarine	• Plain pandesal	• Elimination of margarine

Fig. 1 Daily Nutritional Guide Pyramid for Adults (Food and Nutrition Research Institute, c. 2018)

As per the latest (2015) official poverty statistics released by the Philippine Statistics Authority (PSA), "a family of 5 needed at least 9,064 pesos (US $174) to meet both basic food and non-food needs monthly" of which 6,329 pesos (US $122) is allotted "to meet basic food needs," allowing only for a meager 2,735 pesos (US $ 53) for "non-food needs." Such pitiful amount for the non-food needs won't cover all the items enumerated by a 2007 resolution of the country's National Statistical Coordination Board (NSCB): 1) clothing and footwear; 2) housing; 3) fuel, light, water; 4) maintenance and minor repairs; 5) rental of occupied dwelling units; 6) medical care; 7) education; 8) transportation and communication; 9) non-durable furnishings; 10) household operations; and 11) personal care & effects." It must be noted that the Philippine government's categories of essential non-food items doesn't include any item related to leisure/entertainment, despite the fact that the United Nations' Universal Declaration of Human Rights (for which the Philippines voted in favor) mentions "the right to rest and leisure…" in Article 24. Other entities such as the European Union's Eurostat (2015) includes leisure in their "quality of life indicators." This laudable inclusion is a reflection of the generally accepted idea that leisure is an essential human need (Leversen et al., 2012, and Veal, 2015). Thus, a

genuinely holistic poverty threshold should certainly include leisure-related items in the essential non-food items.

3. Alternative Measures of Poverty

Poverty thresholds should always include thresholds on essential non-food needs of the people. Poor citizens are those whose incomes are below the real cost of living. To help present a better view of real poverty rates in the country, the current researchers made an updated (and still very conservative) estimate of the government's categories of non-food items based on actual Metro Manila prices:

Table 2. Detailed Monthly Cost Estimate of Non-Food Items for A Family of 5 In the Philippines (2018)

Non-Food Item	**Cost for a Family of 5**	**Assumption/Explanation**	**Source of Data**
Clothing and footwear	192 pesos	Assuming the family needs only two sets of clothes and footwear per year and costs are spread per month Cheapest price for t-shirt, blouse, skirt, shorts and jeans (only for the father) in the popular Divisoria Market Cheapest price for shoes (only for mother and father) and slippers (for the whole family) in the popular Divisoria Market	Price watch of the government TV Channel, People's Television/PTV (2016a and 2016b)
Housing or rental of occupied dwelling units	9,000 pesos	Cheapest monthly rent for unfurnished studio unit in Manila (apartment prices are definitely higher)	Researchers' own canvassing of April 2018 rent prices in Manila (listed prices in online rent advertisements are higher)
Fuel	415 pesos (LPG)	7-kg. LPG tank	Department of Energy (2018)

Light	1,255 pesos (light and basic applicances)	3-hour daily use of one florescent lamp; daily use of small refrigerator; 15-hour/day use of ceiling fan; 8-hour/day use of small TV	Manila Electric Company (MERALCO) online app (2018)
Water	122 pesos (water, not for drinking) 140 pesos (drinking water)	10 cubic meters of water 20 gallons of drinking water/month (common brands)	Maynilad Bill Calculator (2018) Researchers' own canvassing of April 2018 prices in Manila
Maintenance and minor repairs	250 pesos	Monthly cost of low-cost plumbing repair service (assuming repair is only done once a year)	Gawin Group (2017)
Medical care	375 pesos	Monthly cost of QualiMed AKcess Card for the family, "an affordable primary care health card used to avail of free healthcare service inclusions and discounts on outpatient or ambulatory care needs"	QualiMed (c.2018)
Education	3,000 pesos	Covers only cheap school lunches for 3 children per month (assuming that children study in public schools where tuition is free and books are provided for by the government)	Researchers' own canvassing of April 2018 prices in Manila
Transportation and communication	480 pesos 700 pesos	Covers only minimum jeepney fares per month for 1 person (assuming that the family lives in the town center and only the father commutes daily to work) Covers only cellphone	Fare price set by the government Smart (2018)

		load for two people (one-month unlimited calls to the same network and unlimited text to all networks)	
Non-durable furnishings	0	Prices of covered tems are difficult to estimate; hence no estimates are given	N/A
Household operations	2,000 pesos	Cheap laundry expenses (for 80 kilos of laundry/month) Actual costs for household operations are higher as prices of other covered items and services are difficult to estimate; hence only estimates for laundry	Researchers' own canvassing of April 2018 prices in Manila
Personal care & effects	162 pesos	Bath soap (family size) at 4 bars per month	Department of Trade and Industry (2018)
TOTAL	**18,091 pesos (US $ 347)**		

The researchers' figures for a conservative but reliable poverty threshold is thus pegged at 24,420 pesos per month for a family of five. Such amount is more than double the government's official poverty threshold, and a bit comparable with the 33,570-peso monthly living wage for a family of six as computed (albeit without available details on costs) by Ibon Databank (2017), an independent think tank. Websites such as numbeo.com that produce statistics through crowdsourcing, can also help set the poverty threshold. As of April 2018, in what could be dubbed as the upper limit of cost of living in Manila for a four-person family, numbeo.com pegs the figure at 90,858.11 pesos without rent, while monthly rents for one-bedroom apartments range from 12,005.95 to 23,076.92 pesos. Such estimates are actually closer to another government agency's statistics.

The National Economic Development Authority (NEDA) did release its own statistics on what income is needed for a family of four to be able to live comfortably in the Philippines. Its 120,000-peso monthly figure impressively goes beyond the official poverty threshold, but the same agency downplayed the possibility of the government working towards the concretization of such ideal, emphasizing in its launch that it is just a "vision" and "not meant to be prescriptive. This is just saying where Filipinos want to go..." (Dela Paz, 2016). Nevertheless, NEDA also whimsically claims that the Philippines can attain upper middle-income status as early as 2019 (Leyco, 2018), despite the fact that the government is actually still in denial with regard to the breadth and depth of poverty in the Philippines.

Countless life stories of globalization's discontents, life stories of marginalized citizens whose lives are not documented by the government's limited statistics, life stories of poor citizens in one of Southeast Asia's worst countries with regard to outward migration, poverty, and unemployment rates, could serve as counterpoints to the official narrative and reveal the hidden faces of poverty in the country.

4. Life Stories of Globalization's Discontents

The current researchers have interviewed – using the indigenous approach "pagtatanong-tanong" or an "improvised informal, unstructured interview" and "pakikipagkuwentuhan" or "story telling" or "informal conversations" (Pe-Pua and Protacio-Marcelino, 2000) – an ambulant vendor, a mall personnel, a fast food worker, a cleaner, and a security guard: typical faces of poverty in the Philippines' macro-economically rich capital region whose life stories weave a collective tale that challenge the official government narrative and reveal aspects of poverty that are rarely discussed in official documents. They were specifically chosen as they were already encountered by the researchers, a number of times even before they were interviewed for this article.
Citations from interviewees were translated from Filipino. All of them have incomes below NEDA's definition of a comfortable family income, below the researchers' own computed poverty threshold, and below IBON Databank's family living wage threshold. Conversations with them were held from December 2017 to March 2018, during their free time. Interviewees' first names were stated as authorized by them (unless otherwise stated, in which case researchers have used a knick name).

Most of the interviewees are also part of the dominant sector in the Philippine labor force – the service sector. According to the Philippine Statistics Authority (2017), "56.3 percent of the total employed in 2017" are from the services sector. San Juan (2016) described how the Philippines' service sector-driven economy is rooted in the country's dependence on developed/First World economies, a system that "…is more favorable to developed/ capital-rich countries because 1) developed nations' investments in developing countries earn profits which the former typically repatriate, rather than reinvest in the latter; 2) developed countries control multilateral financial institutions such as the IMF, World Bank, and even the biggest private banks that are capable of bankrolling or frustrating any effort towards industrialization contemplated by progressive developing countries' governments; 3) technology transfers on a massive scale seldom happens, hence developed countries tend to retain a monopoly on innovations vital to the growth of the manufacturing sector; 4) the bulk price of the developing countries' main exports (raw materials and semi-manufactured goods) is lower than the bulk price of their typical imports from developed countries (technology/ machinery and high-value products); 5) the migration of workers and professionals from developing countries to the developed countries depletes the former's human resources which they need to free themselves from poverty and dependency; and 6) the education system of developing countries is aligned with the needs of developed/capital-rich countries which are also typical destinations of migrant workers from the developing nations." Hence, the featured life stories are also stories of the so-called globalization's discontents (Stiglitz, 2002), people who were unable to benefit from and/or left behind by the bonanza that neoliberal

globalization brought to capitalist clans and corporations.

Emilia: The Ambulant Vendor

Emilia or "Miling" as others call her, is an elderly ambulant vendor, with very visible creases in her face burnt by daily exposure to the tropical sun in a not-so green city, Manila. As an elderly person (a "senior citizen" in the Filipino context), Miling is qualified to avail of the government's Social Pension Program for Indigent Senior Citizens (SPISC), a "government assistance in the amount of five hundred pesos monthly stipend," according to the Department of Social Welfare and Development website, but she tells the researchers she's not aware that such a program exists. She's not alone as "(s)ome 40% of Filipino senior citizens are still left behind in government efforts to provide social protection for the sector, based on estimates of the Coalition of Services of the Elderly (COSE)" (Pasion, 2017). Miling has been selling cigarettes, candies, snacks etc. as an ambulant vendor since 1995 – a 23-year experience of "hard work with no improvement" in her words. She's a co-breadwinner of her family of 6: her sick husband, their only daughter (a part-time waitress) who's a single parent to their three grandchildren. In one of our conversations, Miling rails against tax hikes. She still remembers the time when the value-added tax (VAT) was expanded from 10 to 12% under the Macapagal-Arroyo regime and is disappointed when she learned that the Duterte administration's tax reform scheme made the price of major commodities – including her wares – soar. She complains: "at times, noodles is all we can afford to eat. Or bread even in dinner time. Rice is expensive. Viands are expensive." Other Filipinos eat *pagpag* or recycled left-over food.

Miling reveals she voted for Duterte but is now not optimistic of the future, saying "they're all the same, no concern for the poor" (referring to various Philippine governments). She's especially incensed that life seems to be getting more miserable every year because of constant price hikes narrating: "When I started out in this job, commodities were still cheap. You can buy many things with just one peso. Now, 1,000 pesos feels like loose change." Like other ambulant vendors, she has suffered from the informality (or, as per the government's perspective, "illegality") of her occupation: "One time, the MMDA (Metro Manila Development Authority) personnel confiscated my wares. Yes, I know it's really illegal to sell things in the streets. But this is the only occupation I know. This is better than stealing or doing something bad." Miling's situation reflects the lives of many Filipino elderly citizens who are poor.

Josephine: The "Saleslady"

Josephine is a permanent "saleslady" and minimum wage earner in a popular Metro Manila mall owned by one of the country's richest clans. As a minimum wage earner, she is with 1/3 of the country's labor force (Habito, 2017). She remains single but "in a relationship" at 32. Somehow, Jo – as she calls herself – is lucky because many mall personnel are casuals or under zero-hour contracts. She got social and health insurance (SSS and Philhealth) but also dreams of paid vacations (few companies offer such benefits in the Philippines. Jo is a credit card pawner, a "Loandoner" (a play of words: from Londoner + loan = Loandoner) as she says in local parlance, despite receiving a stable minimum wage: "what I earn is enough for our needs but I always pray that nobody in our family gets sick. Getting sick is a no-no. Be absent on just a day and you'll

have deductions from your salary. My salary will then be not enough to cover our living expense." She belongs to the proverbial "isang kahig, isang tuka" (literally "one scratch, one peck") class – people who live through "hand-to-mouth existence." Not even retirement can offer her bliss. Her future SSS pension (pension fund for private employees in the Philippines) is very meager as the maximum pension at this point is just 10,900 pesos (De Vera, 2017). Jo works in a firm that will benefit from the government's prospective corporate tax cut from 30% to 25% this year. Despite such possible tax cut and stable profits, corporations fail to share profits to workers. A relatively conservative profit-sharing bill languishes in Congress. For now, Jo will have to make do with what she has for herself and for her elderly parents too. Forced "overtime" during holidays and "sales" (discounts) periods do pad her pay but she admits: "I hate OT (overtime). Our hard work is not well compensated. It's not worth it but I can't complain." Even her typical hours seems to be unbearable: "I have to stand up all the time and I'm expected to greet customers and urge them to buy, buy and buy…"

Mike: The Fastfood Worker

Mike (not his real name as he refused to give his real first name) is a contractual worker in a major fastfood firm in the Philippines. He is a beneficiary of the Philippine Department of Labor and Employment's (DOLE) order to grant permanent status to 6,500 fastfood workers (Leonen, 2018). He is a minimum wage earner though he still considers himself "luckier than other workers" as his company provides free food (limited choices from the firm's own menu) during his shifts. Researchers' conversations with him veered towards food, owing to his job, and at one point, Mike casually remarks that fruits and vegetables are not part of his regular diet. He complains: "one starts to get sick of fastfood if its taken daily. Thus, I choose to bring my own food sometimes. Me and my co-workers share food when we bring some home-cooked meals." He expresses high hopes for the future: "I hope we really become regularized. May that DOLE order be implemented. I hope our salary gets hiked too." As of this writing, the DOLE ruling still stands and the fastfood firm affected by the order promises compliance, but the Philippine President – more than a week before the International Day of Labor this year – announced that he would no longer sign an executive order to end contractualization in the Philippines (a convenient campaign promise which has been rendered superfluous when Duterte is already in power, hobnobbing with capitalists, both local and foreign), claiming that it's up to Congress to ban the said hated policy which many firms utilize to save on costs at labor's expense. Mike is a young, 20-something "bedspacer" (one who co-rents a room with two or more persons) in Manila, renting at a rate of 2,000 per month. The said rent may sound cheap for expatriates but such "bedspace" is literally living in a small box, occupying space in double-decked beds, rather than living in a spacious home. To help him make both ends meet, he claims to have a "sideline" ("raket" is the Filipino word he used, which in the Filipino context generally refers to a legal "sideline," though it can also be used to refer to shadier occupations), but he declined to give details. Mike is originally from the Oriental Mindoro, where his peasant parents still reside. As the eldest child in a brood of 4, he sends money to his parents whenever he can, to help support the needs of his younger siblings. Mike did not mention if his parents own the land that they till but many farmers in the Philippines are landless and the country's land reform program has been criticized for its hosts of failures

(Sawchencko, 2000; Philippine Center for Investigative Journalism, 2015; Tadem, 2015; Manahan, 2011; Carranza, 2015). As a result, migration from rural to urban areas is still very common, as Mike's story illustrates.

Nora: The Freelance Cleaner

Nora is a middle-aged freelance cleaner in condominium units, who is married to a jeepney driver. She spreads word about her services through word of mouth, impressively earning an income above the minimum wage but nevertheless describes herself as "still poor," narrating: "My income is okay because my customers pay big tips. Sometimes, they double my rate. But somehow, my income is not enough because prices keep going up. I have medicines to take, maintenance medicine for high blood pressure. And we still pay for our children's education." Despite her complaints on rising prices and other tribulations common to the Filipino poor, she praiase her more generous customers, whom she says even treat her to free movie tickets: "Whenever I receive free tickets, my family goes to the cinema. We can't afford it if it's not free." They have two sons and one daughter. One just finished college and is now looking for a job, in a country where unemployment is generally worst in Southeast Asia. Two of their children are still in high school. At least, tuition in college would no longer be a problem because of the government's recently passed free tuition legislation, though various student groups warn that its implementation should be monitored to ensure that the poor benefits from it. Nora and her husband now only need to save for other university-related expenses. Their relatively secure situation could be unfortunately reversed by the fact that the government would soon phase out jeepneys (Bautista and Lema, 2018), possibly putting Nora's husband into unemployment, and Nora obviously can't be a cleaner forever. She admits with a hint of sadness: "my job is difficult. I suffer from arthritis at times. My joints ache but I need to be industrious always for our family."

Ramon: The Security Guard

Ramon is a security guard in a Manila midrise, approaching 40 years old, and married to a bank teller. He has two young children. He earns the minimum wage and resides in a rented apartment in Caloocan – one train ride and a jeepney ride away from his work place. He clocks in nearly 12 hours per day to earn overtime pay and make both ends meet, complaining that: "coffee no longer works in my case. I do some exercise, some stretching when I am sleepy. You can't be sleep, you can't be sleepy in our job." The old labor slogan "8 hours of work, 8 hours of rest, and 8 hours of recreation" has been overtaken by workers' poverty in the Philippines, and some German workers' successful fight for a 28-hour week is still the exception, rather than the rule, these days. Ramon makes sure he still got time for his family despite his long work hours: "I always make time for them. We eat out, in the nearest mall, when it's my day of rest and when I have extra money." He dreams of buying their own house. He says commercial bank loans are definitely out of his options because of the high interest rates and the shorter loan terms. The Philippine government has the so-called Pag-ibig Fund, which provides loans for Filipino workers who want to buy their own houses, but his and his wife's combined income and their choice of house (a detached, non-socialized housing unit) are making things difficult for them, but Ramon says they're going to try again this year.

5. Plan for Sustainable Development in the Philippines

Sustainable development means development that is holistic, broad-based and egalitarian: development that will write better stories for the countless faces of poverty under the current system. The relationship between egalitarianism and sustainability is strong because the precisely inegalitarian nature of the current dominant economic system allows a tiny global elite to seemingly endlessly accumulate wealth at the expense of the environment and everyone else. Centuries of wealth accumulation of the elites worldwide have caused massive destruction in may parts of the globe, the effects of which are still being felt today through global warming and the extreme climate change that it brings. A world where a small group of clans and corporations are allowed to accumulate wealth without limitations for their equally endless luxuries and/or in pursuit of absurd goals such as growth for growth's sake, is a world without space for the needs of the poor majority – a ticking time bomb that is unsustainable and bound for collapse, if not already now on the verge of imminent apocalypse.

In the Philippines, the economic system can only become egalitarian if sweeping reforms towards broad-based development such as land reform, agricultural modernization, and industrialization are enacted. Such reforms are necessary for a Third World country to leapfrog into First World status, while ensuring environmental sustainability. To ensure that economic development and environmental sustainability are achieved together, full-blast research on and utilization of renewable energy is necessary. As a tropical archipelago surrounded by water, the Philippines is a prospective role model and leader in the field of renewable energy harnessed from the sun and the seas.

These sweeping reforms should be coupled with progressive tax reform – along the lines advocated by Karl Marx and Friedrich Engels in the *Communist Manifesto* and also advocated now even by non-Marxists like Thomas Piketty (2014) and Joseph Stiglitz (2013) – as only an egalitarian system will enable the government to lead initiatives in ensuring that accumulated wealth from ecnomic development is utilized for the people's essential needs and holistic enjoyment of life. Progressive taxation is a preliminary step towards a radically more holistic paradigm shift – from profit motive to people- and Earth-centeredness, from endless macroeconomic growth and elite wealth accumulation to sustainable development and wealth redistribution, from strengthening corporations to empowering communities – a shift that will genuinely precipitate sustainable development for current and future generations.

References

Alston, P. (2017). Statement on Visit to the USA by the United Nations Special Rapporteur on extreme poverty and human rights. http://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=22533&LangID=E

Bautista, R. and K. Lema. (2018). Philippines to phase out its beloved cheap but rickety jeepneys. Reuters. https://www.reuters.com/article/us-philippines-transport-jeepneys/philippines-to-phase-out-its-beloved-cheap-but-rickety-jeepneys-idUSKBN1FI0IJ

Carranza, D. (2015). Agrarian reform and the difficult road to peace in the Philippine countryside. https://reliefweb.int/sites/reliefweb.int/files/resources/Carranza_NOREF_Agrarian%20reform%20and%20the%20difficult%20road%20to%20peace%20in%20the%20Philippine%20countryside_Dec2015_FINAL.pdf

Chandy, L. and H. Kharas. (2012). The Contradictions in Global Poverty Numbers. Brookings. https://www.brookings.edu/opinions/the-contradictions-in-global-poverty-numbers/.

Chossudovsky, M. (2018). Poverty in the Philippines: The Official Figures Have Been Manipulated. https://www.globalresearch.ca/world-bank-on-philippines-economy/5628035.

De Vera, B. (2017). SSS: Proposed hike in monthly salary credit cap will raise pension payments. Inquirer. http://business.inquirer.net/238685/sss-proposed-hike-monthly-salary-credit-cap-will-raise-pension-payments

Dela Paz, C. (2016). What's ideal monthly income for family of 4?. https://www.rappler.com/business/economy-watch/137891-ideal-monthly-income-neda-2040-vision.

Department of Energy. (2018). HOUSEHOLD LPG PICK-UP PRICES IN METRO MANILA. https://www.doe.gov.ph/sites/default/files/pdf/price_watch/lpg_mm_2018_march_09.pdf

Department of Trade and Industry. (2017). Weekly Prevailing Report. http://opms.dti.gov.ph/consumer/weekly-prevailing

Eurostat. (2015). Quality of life indicators - leisure and social interactions. http://ec.europa.eu/eurostat/statistics-explained/index.php/Quality_of_life_indicators_-_leisure_and_social_interactions.

Food and Nutrition Research Institute. (c. 2018). Daily Nutritional Guide Pyramid for Adults. http://www.fnri.dost.gov.ph/index.php/tools-and-standard/nutritional-guide-pyramid#adults-20-39yrs-old

Gawin Group. (2017). How Much Does Plumbing Repair Cost?. http://direct.gawin.ph/price-estimates/plumbing-and-pipe-leaks-repair-pricing/

Habito, C. (2017). Profile of the Filipino worker. Inquirer. http://opinion.inquirer.net/103546/profile-filipino-worker

Hickel, J. (2016). The true extent of global poverty and hunger: questioning the good news narrative of the Millennium Development Goals. Third World Quarterly 37:5, 749-767, DOI: 10.1080/01436597.2015.1109439

Ibon Databank. (2017). Substantially increase wages. http://ibon.org/2017/01/substantially-increase-wages/

Human rights, leisure and leisure studies

Leonen, J. (2018). Jollibee to appeal Dole's order to regularize about 6,500 workers. Inquirer. http://business.inquirer.net/248588/jollibee-appeal-doles-order-regularize-6500-workers#ixzz5DT500G4s

Leversen, I. (2012). Basic Psychological Need Satisfaction in Leisure Activities and Adolescents' Life Satisfaction. Journal of Youth and Adolescence, 41: 12, 1588–1599, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492701/

Leyco, C. (2018). PH to attain status of upper middle-income in 2019 — NEDA. Manila Bulletin. https://business.mb.com.ph/2018/04/03/ph-to-attain-status-of-upper-middle-income-in-2019-neda/.

Manahan, M. A. (2011). Banking on the Rural Poor?: Critical Insights and Policy Questions on Foreign Aid And Agrarian Reform in the Philippines. Kasarinlan: Philippine Journal of Third World Studies, 26:1–2, 312-323, journals.upd.edu.ph/index.php/kasarinlan/article/download/3502/pdf_140

Mangahas, M. (2011a). The lowering of the official poverty line. http://www.sws.org.ph/social_climate/2011/PDI%2011-06%20Feb%2012%20The%20lowering%20of%20the%20official%20poverty%20line.pdf

Mangahas, M. (2011b). No meat allowed for the poor. Inquirer. http://opinion.inquirer.net/14829/no-meat-allowed-for-the-poor

Manila Electric Company. (2018). Meralco Appliance Calculator. http://apps.meralcwo.com.ph/appcal/mac.jsp.

Maynilad. (2018). Bill Calculator. http://www.mayniladwater.com.ph/customers-bill_calculator.php

Moatsos, M. (2017). Global Absolute Poverty: Behind the Veil of Dollars. Journal of Globalization and Development, 7:2, 1-28, https://doi.org/10.1515/jgd-2016-0033.

National Statistical Coordination Board. 2007. NSCB Resolution No. 2 Series of 2007 APPROVING AND ADOPTING THE OFFICIAL CONCEPTS AND DEFINITIONS FOR STATISTICAL PURPOSES FOR THE POVERTY SECTOR. http://nap.psa.gov.ph/resolutions/2007/2Annexb.asp.

Numbeo. (2018). Cost of Living in Manila. https://www.numbeo.com/cost-of-living/in/Manila

Ostry, J. et al. (2016). Neoliberalism: Oversold?. Finance & Development, Vol. 53, No. 2. International Monetary Fund. http://www.imf.org/external/pubs/ft/fandd/2016/06/ostry.htm.

Pasion, P. (2017). 4 in 10 senior citizens still have no access to pension – COSE. Rappler. https://www.rappler.com/nation/184363-philippines-senior-citizens-no-access-pension-cose

Pe-Pua, R. and E. Protacio-Marcelino. (2000). Sikolohiyang Pilipino (Filipino psychology): A legacy of Virgilio G. Enriquez. Asian Journal of Social Psychology, 3: 49-71, https://onlinelibrary.wiley.com/doi/pdf/10.1111/1467-839X.00054

Philippine Center for Investigative Journalism. (2015). CARP, CARPER: Failing, falling, dead?. http://pcij.org/blog/2015/06/11/carp-carper-failing-falling-dead

Philippine Statistics Authority. (2015). 2015 POVERTY IN THE PHILIPPINES. https://psa.gov.ph/sites/default/files/2015_povstat_FINAL.pdf

Philippine Statistics Authority. (2017). Preliminary Results of the 2017 Annual Estimates of Labor Force Survey (LFS). https://psa.gov.ph/content/2017-annual-labor-and-employment-status

People's Television. 2016a. Price watch sa Divisoria. https://www.youtube.com/watch?v=WmLaTy8rSwE.

People's Television. 2016b. Price Watch: Footwear prices sa Divisoria. https://www.youtube.com/watch?v=KplN7hkNRsM.

Piketty, T. (2014). Capital in the twenty-first century. Massachusetts: Belknap Press.

Reddy, S. & R. Lahoti. (2016). $1.90 A DAY: WHAT DOES IT SAY?. New Left Review, 97, January-February, 106-127. https://newleftreview.org/II/97/sanjay-reddy-rahul-lahoti-1-90-a-day-what-does-it-say

QualiMed. (c.2018). Health Cards. http://qualimed.com.ph/products-and-services/membership-cards-3/

San Juan, D.M. (2016). Neoliberal Restructuring of Education in the Philippines: Dependency, Labor, Privatization, Critical Pedagogy, and the K to 12 System. Asia-Pacific Social Science Review. 16: 1, 80-110, https://ejournals.ph/article.php?id=9857

San Juan, D.M. (2017). Why Marx Was Right: Third World Edition. Journal of Developing Societies, 33:1, 1–26, http://journals.sagepub.com/doi/pdf/10.1177/0169796X16653333

Saunders, P. (2018). Monitoring and addressing global poverty: A new approach and implications for Australia. The Economic and Labour Relations Review, 29:1, 9-23, http://journals.sagepub.com/doi/abs/10.1177/1035304618756208

Sawchenko, A. (2000). Choosing a Mechanism for Land Redistribution in the Philippines. Pacific Rim Law and Policy Journal, 9:3, 681-720, https://digital.lib.washington.edu/dspace-law/bitstream/handle/1773.1/822/9PacRimLPolyJ681.pdf?sequence=1&isAllowed=y

Smart. (2018). 30 to 60 Days Call, Text, Data Promos. https://smart.com.ph/Prepaid/promos/validity/30-60-days

Stiglitz, J. (2002). Globalization's and its discontents. New York: W. W. Norton & Company.

Stiglitz, J. (2013). The price of inequality: How today's divided society endangers our future. New York: W. W. Norton & Company.

Tadem, E. (2015). Philippine Agrarian Reform in the 21st Century. https://www.iss.nl/sites/corporate/files/CMCP_D2-Tadem.pdf

Veal, A.J. (2015). Human rights, leisure and leisure studies. World Leisure Journal, 57: 4, 249-272, DOI: 10.1080/16078055.2015.1081271

World Bank. (2013). US Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population). https://data.worldbank.org/topic/poverty?locations=US&view=chart.