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The Role of Innovative Work Behavior, Teamwork Climate, and Information Sharing in Enhancing the Innovative Performance of Energy Companies

By Nadežda Jankelová[1], Juraj Mišún[2*], Zuzana Joniaková[3]

ABSTRACT:
This paper aims to test a positive relationship between managers' support for innovative work behavior (IWB) and innovative performance (IP) of energy companies (EC), mediated by information sharing (IS) and teamwork climate (TWC).
The sample consisted of 235 EC in Slovakia. Data analysis was carried out using the PLS-SEM method.
The results show that support for IWB can be considered as a predictor of IP, as managerial support for employees' innovative behavior (IB) has a positive effect on firms' IP. However, its effect may be enhanced by the interaction of other factors. Transparency of communication and support for teamwork (TW) have positive effects on overall IP. Sharing information with employees and fostering a climate of TW become important tools for innovative management. Neither the manager's seniority nor the manager's age has a significant effect on the relationship examined.

Keywords: innovative performance of energy companies; innovative work behavior; information sharing; teamwork climate; management of energy companies

1. Introduction

Research on management in the energy sector (ES) is relatively limited compared to other sectors of the economy. The historical perception of the ES as a sector with significant state intervention and a rigid management mode persists. However, its strategic importance for the functioning of the economy is crucial, and it is fundamentally linked to the processes of the Fourth Industrial Revolution, which offer opportunities to innovate and development, but also place higher demands on the preparedness of managers. The energy crisis in the context of the military conflict in Ukraine and the development of the geopolitical situation make this requirement even more important.

The need for innovation and implementation of innovative management approaches is becoming a necessity for all entities, not excluding the ES. Innovation, which is now a source of competitiveness in all sectors, is a function of rapid technological change, to which companies must respond flexibly. At the management level, this raises the need to create the right environment for the generation of innovation by encouraging IB among employees.

EC operate in an environment with specific conditions. These include the specifics of the production process, increasing competitive pressures, rising prices, and the

[1, 2, 3] University of Economics in Bratislava, Department of Management, Faculty of Business Management, Bratislava, Slovak Republic.
*Corresponding Author.

policy decisions of governments and the EU in response to current global events. The ES is significantly affected by technological developments, which EC must keep pace with if they want to succeed in a highly competitive environment. This forces them to pay more attention to research and development activities and creates the need to define indicators that influence the innovation efficiency of EC (Hasan & Burkhardt, 2021; Mikhaylov, 2018). Another common peculiarity of the ES is the labor market in this sector. The nature of the work requires a specific focus of workers, while at the same time there are relatively high demands on their expertise and specialization. Our assumption is that the results from the Slovak ES will be generalizable to other sectors, as well as to developed and developing countries.

The current political situation as well as the Covid-19 pandemic have also highlighted other facts. Namely, that in crisis times, it is essential to look for novel approaches and solutions through innovation, which are both sustainable in the aftermath of the crisis and reflective of new conditions. These include the development of technology (Lezoche et al., 2020; Min et al. 2020), the electronic environment, social media usage (Thakur & Chander, 2018), employee demographics (Chand & Markova, 2019) coupled with a scarce labor pool (Lahdesmaki & Suutari, 2020), their various perspectives and approaches to the world of work, their lifestyles and their efforts to achieve work-life balance (Urbancova & Vrabcova, 2020), and many others. There is currently a significant research gap in this area, as existing studies only partially map managerial innovation processes in the ES. This is a long-standing problem, as already in 2017 Greco, Locatelli & Lisi drew attention to the fact that few scientific studies are dedicated to the topic of innovation in the ES. A search at the beginning of 2023 with the keywords "management" and "energy sector" on the Web of Science, with a restriction to the years 2018-2022 in the relevant categories Business/Management/Economics, yielded 170 papers. While this result may seem sufficient, further analysis shows that the dominant part of the sources is devoted to various subfields and that innovation management in the ES deserves more attention.

Indeed, the ES is currently facing many challenges in the area of R&D. These include, among others, developing energy storage technologies or the decommissioning and decontamination of nuclear facilities (Greco, Locatelli & Lisi, 2017). So-called green innovations enable the creation of a sustainable society and facilitate economic development (Chen et al., 2020; Chen & Lin, 2020; Shen et al., 2020; Liu et al., 2021). The search for new energy sources, the increased use of renewables, and the efficiency of their use will necessarily be central to the sustainability and green transformation of developed and developing economies alike (Kijek et al., 2021). Therefore, innovation is the key to the continuous and sustainable development of EC (Wang, Lu & Sun, 2018). However, Geels (2004) points out that innovation in the ES follows a different trajectory than in other sectors.

The importance of innovation in relation to increasing market share, profitability, and further growth of firms has been well researched (Acemoglu et al., 2018; Lynch & Jin, 2016; Li et al., 2019). Innovation generation is a nonlinear but systematic process (Fagerberg, 2005) that requires reconfiguration of resources to develop novelty and creativity (Lichtenstein & Brush, 2001). However, changes in the environment have created the conditions for a transformation of the innovation process itself, as the unique

internal resources and capabilities of organizations are no longer sufficient to achieve sustainable competitive advantage (Kaya et al., 2020). While individual efforts are sufficient for simple innovations, complex innovations must be generated through TW (Huang & Li; 2009).

Creating the conditions for the development of an innovative environment within the organization by promoting the IB of employees is fundamental for the IP of the company. This can be actively developed under conditions of access to information and sufficient information saturation. Formalized knowledge is the basis for innovation, but tacit knowledge is also crucial (Vinding, 2006). Openness to external knowledge is a key driver of innovation due to the combination of knowledge from various sources (Lacerda & Van Den Bergh, 2020). Successful innovation depends on the creation and integration of new knowledge, both technological, strategic and market knowledge. According to Garrone et al. (2014), international knowledge sharing is central to innovation processes in the ES.

IWB and its effect on the IP of companies through the IS on objectives, policies, mission and innovational shifts with staff is the research gap that is the starting point for designing the research model of this study. This can be actively developed in conditions of TW, supported by the implementation of appropriate management tools. This study aims to investigate the impact of the fostering of innovative activities in EC on their IP.

2. Theoretical Background and Hypothesis Development

This section of the paper is divided into theoretical knowledge of individual variables, their interrelationships, studies of specific variables specifically in the ES, and then hypothesis formation.

2.1 Innovative performance

Although the IP of firms has been studied relatively extensively, the debate on its generally accepted indicator or common set of indicators is still ongoing. Jiang & Li (2009) define IP as the contribution made by product and process innovation to the performance of the firm. In general, firms are involved in three types of innovation activities. Specifically, research and development, patents (numbers and citations), and the creation of new products and services (new within the firm or new on the market) are all regarded as indicators of firm IP (Hagedoorn & Cloodt, 2003). The latter is then reflected in the launch of technologically new products developed by the firm, the frequency with which old products are replaced by others that have undergone significant changes, and also the share of technologically new or enhanced products in the firm's sales (Cabello et al., 2011). It is also appropriate to monitor the speed of introduction of new products, the operating costs of new products, the revenue generated from the sale of new products, and to compare the company's market share of new products with its competitors over the past three years (Han & Li, 2015; Roberts & Grover, 2012; Wu et al., 2007).

A well-established measure of innovation activity is patent data, which has advantages over alternative measures such as the number of R&D employees (Griliches, 1990; Braun et al., 2011). However, there are limitations because not all innovations are patentable. At the same time, not all patented inventions are actually applied in the market,

so they do not fully reflect the value of innovation (Albino et al., 2014). As the number of patents only reflects the quantitative aspect of innovation, Jiang & Li (2009) also consider patent citations or the number of new product announcements as appropriate indicators.

In the context of the ES, Braun et al. (2011) point out that methodological issues and questions remain regarding the appropriate way to measure innovation in green or climate change mitigation technologies. Hu et al. (2018) attempt a general breakdown of the types of energy innovation indicators. They recommend assessing inputs (the tangible and intangible resources put into the energy technology innovation process), outputs (the desired outcomes generated from the inputs at different stages of the innovation chain), and outcomes (the broader socioeconomic and environmental impacts of these energy technology innovation outputs). In the context of achieving IP, Corchuelo Martinez-Azúa et al. (2020) draw attention to the role of business management along with the need for it to react dynamically to environmental changes.

2.2 Innovative work behavior

The innovative activity of individuals is crucial for the IP of an organization. According to Kanter (1988), it refers to the production or adoption of useful ideas and their implementation; later, the definition was extended to include not only employee behaviors aimed at generating ideas, but also management behaviors related to supporting their implementation (De Spiegelaere et al., 2014; De Jong & Den Hartog, 2010). Problem exploration, idea generation, idea pursuit and implementation of innovative ideas are all part of IB (Niesen et al., 2018; Bos-Nehles et al., 2017). Employees work beyond the routine performance of tasks, search for the latest solutions, pursue new ways to achieve goals, and secure resources to support their original ideas. IWB involves thinking more holistically, seeking opportunities, exploring potential risks, and looking for ways to eliminate them (Masyhuri, Pardiman & Siswanto, 2021; Afsar, 2016).

IWB involves multidimensional and multistep activities (Shipton et al., 2005) that help organizations address new challenges in complex environments (Scott & Bruce, 1998) and play a critical role in the long-term survival and competitive advantage of all types of organizations (Negassi et al., 2019). High-performing organizations therefore value and strongly encourage IWB among their employees (Hirst, Van Knippenberg & Zhou, 2009). Conducted studies show that there are several tools for the organization to support IWB by management, including motivation (Radaelli et al., 2014), IS (Radaelli et al., 2014), work autonomy (De Spiegelaere, Van Gyes & Van Hootegem, 2016), self-efficacy (Nisula & Kianto, 2016), work ethic (Mussner et al., 2017), as well as culture (Tsegaye, Su & Malik, 2019).

The study of factors directly related to IWB in the corporate environment has been the subject of much research. Its impact on firm performance (Almaududi Ausat et al., 2022; Shanker et al., 2017), product and service quality (Exposito & Sanchis-Llopis, 2019), and sustainability (Lin et al., 2020) has been demonstrated. The results suggest that employees' innovation activities, in various forms, directly affect the performance outcomes of the firm. On the other hand, the results of previous studies confirm that a firm's IP is related to the way it uses human capital (Cabello et al., 2011), intellectual capital (Han & Li, 2015), structural and relational capital (Ur Rehman, Aslam & Iqbal, 2021), and its approach to human resource management (Cabello et al., 2011). Thus, it is directly

influenced by the employees themselves and the way the employer harnesses their potential.

Unfortunately, IWB in the ES has received little attention in academic literature, often because of the assumption that EC tend to be less innovative (Kastner & Rudolph, 2022). One of the few examples is a study by Piwowar-Sulej, Austen & Iqbal (2023), where the authors found that environmental management support positively moderates the relationships between green human resource management and green extra-role behaviors and IWB.

Based on the above relationships, we hypothesize that IWB is related to IP and formulate the main hypothesis as follows:

Hypothesis 1 (H1). We hypothesize that the promotion of IWB will be positively related to the IP of the ES companies.

2.3 Information sharing

IS refers to the extent to which an organization communicates information about its financial situation, policies, goals, and changes to its employees (Aragon-Correa, Martin-Tapia & Hurtado-Torres, 2013). It is a tool that promotes individual and team performance through timely and regular communication of current issues and facts relevant to the organization, and the exchange of ideas, suggestions, and expertise with each other (Vos & Buckner, 2015). According to the findings of Radaelli et al. (2014), there are three mechanisms that link an individual's IS behavior to his or her own IWB. The first is the direct effect, where knowledge recombination occurs during IS, which facilitates innovation. For the indirect effect, IS creates social conditions for innovation, and the distal effect, where the antecedents of knowledge sharing also promote innovation.

Gibson et al. (2007) highlight the significant impact of IS on firm performance, which, according to Aragon-Correa, Martin-Tapia & Hurtado-Torres (2013) is more pronounced in uncertain environments and in environmentally oriented firms. IS is a crucial activity in the firm since, if knowledge sharing between teams is insufficient, individuals' cognitive resources are not fully utilized. This, in turn, is associated with the danger of declining individual and team performance (Srivastava, Bartol & Locke, 2006).

Implementing changes associated with introducing of innovation in the firm is conditioned by employee awareness (Pfeffer, 2010). Hu et al. (2018) and Aragon-Correa, Martin-Tapia & Hurtado-Torres (2013) highlight a direct link between IS promoting practices and business innovation. Yasir et al. (2021) find that IS has a significant positive relationship with IWB, with functional flexibility and psychological empowerment acting as mediators in their relationship. When the willingness to share information and knowledge becomes part of the organizational culture, it has a significant impact on the innovation capabilities of both teams (Akhavan & Hosseini, 2015) and organizations (Podrug, Filipovic & Kovac, 2017).

In the ES, research on IS is very scarce. When authors have addressed the topic, the term is used more in the context of cybersecurity (e.g., Wallis & Leszczyna, 2022 or Kaufmann et al., 2015).

Since previous research, general or focused on industries other than energy, has confirmed that IS directly supports firm performance and is also directly related to IB, we assume that IS plays a mediating role in the relationship between IWB and IP.

Hypothesis 2 (H2). We hypothesize that fostering IWB is related to the IP of energy firms through IS.

2.4 Teamwork climate

TWC is a perceptual measure that reflects employees' perceptions of collaboration (Weng, Kim & Wu, 2017). TWC is useful for measuring TW culture, which is otherwise difficult to quantify (Zohar & Hofmann, 2012; Ginsburg & Bain, 2017), and as a tool it is the source of several positive effects (Zaheer et al., 2018). It contributes to both employee performance (Bogan & Dedeoglu, 2017) and organizational performance (Ali, Lei & Wei, 2018; Cizmaş et al., 2020). It is also an important predictor of safety outcomes (Zaheer et al., 2018).

TWC promotes communication and mutual trust in the workplace (Nedkovski et al., 2017), is positively related to job satisfaction (Abdolshah et al., 2018; Proudfoot et al., 2007), loyalty (Guillon & Cezanne, 2014), employee burnout (Bowers et al., 2010) and turnover rates (de la Torre-Ruiz et al., 2017; Schreurs et al., 2015). According to Yoo, Chung & Oh (2021), TWC can be influenced by communication climate and horizontal informal communication, showing its link to information flow.

The extent to which TWC is related to innovation is still a subject of research (Fay et al., 2014) and is often associated with innovation at the firm level as a whole (Jiang et al., 2012).

In the ES, the TWC is still understudied, and the Web of Science Core Collection database does not contain any papers of the article, review article, or early access type, regardless of the year of publication.

Given the research conducted on the effect of TWC in supporting the implementation of different changes in a firm and its ability to positively influence overall performance (Hong et al., 2019; Chen et al., 2019; Lamberti et al., 2020), we tend to believe that TWC can positively influence the effect of IWB on IP.

Hypothesis 3 (H3). We hypothesize that fostering IWB through a climate of TW is positively related to the IP of energy firms.

Since our selected variables do not operate independently in the social system of the firm, we also assume and investigate their joint action in the relationship between IWB and IP.

Hypothesis 4 (H4). We hypothesize that fostering IWB is positively related to the IP of EC through a TWC and IS.

Thus, the objective of our research is to verify a positive association among managerial commitment to IWB and the IP of EC, mediated by IS with employees in the

firm and the TWC. Figure 1 shows the model used to test the relationships between the variables.

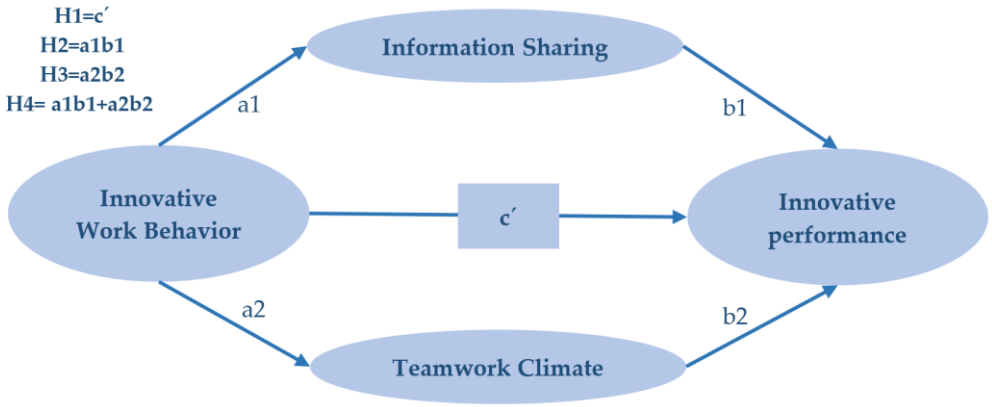

Figure 1: The mediation model and the four tested hypotheses

3. Materials and Methods

The data were collected by means of a questionnaire survey among companies operating in the ES in Slovakia in the period from May 1 to July 7, 2022. The companies for the research were selected from the FINSTAT database on the basis of their business activity in the ES (at the beginning of 2023, the total number of companies in the sector was 1601). Managers of more than 1,200 companies were contacted by e-mail to take part in our research. The email explained the purpose and provided a link to a questionnaire created in Google Forms. By filling out and returning the questionnaire, they consented to the use of their data. The response rate was 19.58%.

A total of 235 responses were received from managers at different levels of management (mean=0.238, SD=0.586, min=0-lower management, max=2-top management) in with a mean age of 45.24 years (min=28, max=64, SD=9.89), mean experience in management position of 9.05 years (min=1 year, max=16 years, SD=10.51). Of the 235 managers, 77% were male and 23% female, 81.5% of respondents had a university degree. The enterprises in which the research was conducted were both joint-stock companies/Inc. (60.4%), limited liability companies/Ltd. (34%) and other forms (5.6%-contributory organizations, budget organizations, state-owned companies, cooperatives). The companies were evenly distributed geographically in the individual regions of Slovakia.

3.1 Measurements

In addition to identification data, a set of 24 indicator variables were included in the questionnaire (Table 1). It was presented to the respondents in Slovak language. Since the standardized measurement instruments used are not available in this language, we checked the semantic equivalence by reverse translation prior to instrument administration. Experts in both languages translated the questionnaire into Slovak and

back into English. We rephrased the items for which semantic inconsistency was found. The statements were formulated in short and simple sentences. In order to avoid general methodological bias, which is a very frequent and critical problem in surveys, the scales of some of the responses were randomly shuffled, mixed, or reversed, and the questionnaire was divided and each section was presented in a different context so that respondents would not be influenced by their previous answers and their perception of the results. An indicator of contamination of the model by common method bias is also the VIF indicator, for which the collinearity statistic was used. For all variables, the VIF value was equal to or less than 3.3, from which we conclude that our model can be regarded as free from the usual method bias.

A variable created by Cabello et al. (2011) was used to measure IP (innovative performance). It includes 3 items focusing at 1) the launching of (fully or partially) technologically new products designed by the firm, 2) the frequency of replacing outdated products with new ones that have been significantly modified, and 3) the share of technologically new or improved products in the firm's sales. We used a five-point scale ranging from a minimum of one (less than the competition) to a maximum of five (more than the competition).

IWB has been measured by a 10-item measure adapted from the study by de Jong & den Hartog (2010). Respondents were requested to report the frequency with which they engage in the behaviors listed in the questionnaire. There were items for all three dimensions - generating ideas, championing ideas, and implementing ideas. A 5-point scale was used (1=never; 5=very often).

IS was measured by a 5-item construct adapted from Ketokivi & Castaner's (2004) study. Participants expressed their agreement or disagreement with items about sharing general information and communicating company priorities to employees. We used a five-point scale (1-5) ranging from strongly disagree to strongly agree.

TWC has been measured using a 6-item scale abstracted from the Safety Attitudes Questionnaire (Sexton et al., 2006). Participants expressed their agreement or disagreement with items about the perceived quality of cooperation among employees. A 5-point scale was used (1=strongly disagree; 5=strongly agree).

Table 1: Latent variable categories and descriptors

Innovative performance	**Innovative work behavior**
IP1 – Launching technologically new products developed (wholly or partially) by the firm. IP2 – Frequency with which old products are replaced by new ones that undergo significant changes. IP3 – Share of technologically new or improved products in firm sales.	IWB1 – Do your subordinates often give attention to problems outside the scope of their everyday work? IWB2 – How frequently do your subordinates have questions about how things can be done better? IWB3 – How frequently do your subordinates seek out new techniques, work methods, or tools? IWB4 – How frequently do your subordinates come up with original solutions to issues? IWB5 – How frequently do your subordinates find new ways to accomplish tasks?
Team work climate	
TWC1 – If they don't understand something, all team members are welcome to ask questions. TWC2 – Employees get the support they need from other employees to perform. TWC3 – In our company, employee contributions are perceived positively.	

TWC4 – Disagreements within the team are handled appropriately, not about who is right or wrong, but about doing the best job possible. TWC5 – Regardless their functional position, team members collaborate as a cohesive team. TWC6 – Being critical when employees perceive performance problems is not difficult in our business.	IWB6 – How frequently do your subordinates get key organizational members excited about innovative ideas? IWB7 – How frequently do your subordinates try to persuade others to back an innovative proposal? IWB8 – How frequently do your subordinates systematically incorporate innovative proposals into the way they work? IWB9 – How frequently do your subordinates participate in implementing new ideas? IWB10 – How often do your subordinates make an effort to develop new things?
Information sharing	
IS1 – Management regularly communicates important changes to employees. IS2 – Management keeps subordinates regularly informed of general policies and goals. IS3 – Management communicates regularly with subordinates about how the firm's performance is measured, and the results achieved. IS4 – Management informs subordinates regularly about the department's plans. IS5 – Management informs subordinates regularly of the standards required to perform their jobs.	

3.2 Data analysis

Data were analyzed using partial least squares structural equation modeling (PLS-SEM) (Hair et al., 2014) conducted in SmartPLS 3.0 software. It is an effective tool for measuring relationships between selected constructs and for testing multiple hypotheses concurrently under both indirect and direct effects in systems that are complex (Ringle et al., 2018). Reasons for choosing this method include the relatively small sample size (235), the study's focus on the prediction of dependent variables, and the utilization of latent variable scores for the purpose of prediction.

4. Results

The results are divided into two parts. The first is the verification of the measurement model's reliability and validity, and the second is the analysis of individual paths and hypothesis testing in the structural model.

4.1 Measurement model

The results of reliability and validity of the model are presented in Table 2. The reliability requirement is met. To ensure that the standardized loadings were all greater as 0.70 (Chin, 2009), we excluded the variables TWC1, TWC4, IWB1, IWB2, IWB6, IWB7 from consideration. The internal construct reliability requirement was met because the Cronbach's alpha values were above 0.70 and below 0.95 (Hair et al., 2017), the composite reliability (CR) values were greater than 0.70 and less than 0.95 (Ringle et al., 2018), and the rho_A variable was also satisfactory because it was between the Cronbach's alpha and CR values (Ringle et al., 2018).

Convergent validity is met. The AVE (average variance extracted) value in our model exceeds the 0.5 level (Chin, 2009) for two constructs. This means that, on average,

the construct explains at least 50% of the variance of its item. It is very close to 0.5 for two constructs (IWB and TWC).

The requirement of discriminant validity is met. We measured it using three instruments, namely the traditional Fornell-Larcker criterion, the HTMT criterion, and cross-loadings (Ringle et al., 2018).

Table 2: Loadings, reliability, and validity

	Construct/ Indicator	Factor loading	CR	rho_A	Cronbach´s alpha	AVE
IP	IP1	0.891	0.905	0.849	0.843	0.761
	IP2	0.875				
	IP3	0.850				
IS	IS1	0.824	0.917	0.905	0.888	0.688
	IS2	0.833				
	IS3	0.868				
	IS4	0.812				
	IS5	0.808				
IWB	IWB1	0.326	0.891	0.884	0.865	0.459
	IWB2	0.658				
	IWB3	0.723				
	IWB4	0.749				
	IWB5	0.719				
	IWB6	0.646				
	IWB7	0.648				
	IWB8	0.751				
	IWB9	0.706				
	IWB10	0.739				
TWC	TWC1	0.515	0.852	0.819	0.796	0.494
	TWC2	0.732				
	TWC3	0.749				
	TWC4	0.671				
	TWC5	0.762				
	TWC6	0.758				

Fornell-Larcker criterion was used to assess discriminant validity. Square root of the AVE for the construct was greater than the interconstruct correlation. The heterotrait-monotrait ratio of the correlations was also used to assess discriminant validity. All values are below the threshold value of 0.90 (Henseler, Ringle & Sarstedt, 2015). We also performed cross-loading, in which we checked the loading factors on the parent constructs. We find that discriminant validity is established (see Table 3). We do not report cross-loading values due to the large amount of data.

Table 3: Discriminant validity

Fornell-Lacker criteria					HTMT Ratio				
	IP	**IS**	**IWB**	**TWC**		**IP**	**IS**	**IWB**	**TWC**
IP	0.872				**IP**				
IS	0.375	0.829			**IS**	0.418			
IWB	0.277	0.154	0.677		**IWB**	0.312	0.159		
TWC	0.309	0.679	0.221	0.703	**TWC**	0.357	0.787	0.265	

4.2 Structural model

The structural model used to test the hypotheses is evaluated on the basis of predictive ability and predictive relevance. Model goodness is assessed by the strength of every structural path, which is determined by the value of R2 of the dependent variable, and the value of R2 shall be greater than or equal to 0.1 (Bernal-Conesa, Briones-Penalver & Nieves-Nieto, 2017). The predictive relevance of the endogenous constructs is assessed by the value of Q2, and a value greater than 0 indicates predictive relevance of the model. Table 4 shows that predictive ability and predictive relevance are established. Model fit was evaluated by SRMR and its value was 0.065. The values of SRMR are supposed to be equal to or less than 0.100 in order to indicate an acceptable model fit.

Table 4: Predictive capability, predictive relevance, SRMR

R Square			Model Fit		Construct Cross validated Redundancy			
	R Square	R Square Adjusted		Saturated Model		SSO	SSE	Q^2 (=1-SSE/SSO)
IP	0.192	0.181	SRMR	0.065	IP	705.000	609.527	0.135
IS	0.024	0.020	d_ULS	1.250	IS	1175.000	1167.246	0.007
TWC	0.049	0.045	d_G	0.388	IWB	2350.000	2350.000	
			Chi-Square	517.351	TWC	1410.000	1381.961	0.020
			NFI	0.802				

The direct and indirect effects, path coefficients, and other related values (STDev, T-statistics, p-values) are listed in Table 5, and the empirical model is shown in Figure 2.

Table 5: Path coefficients, total, direct and indirect effects

direct effect – H1: supported					
	Original Sample (β)	**Sample Mean (β)**	**Standard Deviation**	**T Statistics**	**P Values**
IWB -> IP	0.297	0.315	0.047	6.272	0.000
mediation of IS between IWB and IP – H2: supported					
	Original Sample (β)	**Sample Mean (β)**	**Standard Deviation**	**T Statistics**	**P Values**
IWB -> IP (total effect)	0.292	0.304	0.053	5.458	0.000
IWB -> IP (direct effect)	0.239	0.249	0.056	4.282	0.000

IWB -> IS -> IP (indirect effect)	0.052	0.055	0.025	2.096	0.037
IS -> IP	0.338	0.337	0.063	5.374	0.000
IWB -> IS	0.155	0.167	0.075	2.073	0.039

mediation of TWC between IWB and IP – H3: supported

	Original Sample (β)	Sample Mean (β)	Standard Deviation	T Statistics	P Values
IWB -> IP (total effect)	0.286	0.297	0.053	5.394	0.000
IWB -> IP (direct effect)	0.238	0.248	0.057	4.150	0.000
IWB -> TWC -> IP (indirect effect)	0.048	0.049	0.021	2.274	0.023
IWB -> TWC	0.180	0.187	0.073	2.463	0.014
TWC -> IP	0.267	0.269	0.070	3.802	0.000

mediation of IS and TWC between IWB and IP – H4: supported

	Original Sample (β)	Sample Mean (β)	Standard Deviation	T Statistics	P Values
IWB -> IP (total effect)	0.285	0.299	0.056	5.059	0.000
IWB -> IP (direct effect)	0.227	0.237	0.062	3.639	0.000
IWB -> IP (total indirect effect)	0.058	0.063	0.026	2.262	0.024
IWB -> TWC -> IP (indirect effect)	0.014	0.014	0.020	0.709	0.479
IWB -> IS -> IP (indirect effect)	0.044	0.048	0.025	1.737	0.083
IS -> IP	0.288	0.287	0.083	3.465	0.001
IWB -> IS	0.152	0.167	0.069	2.201	0.028
IWB -> TWC	0.180	0.192	0.077	2.355	0.019
TWC -> IP	0.078	0.085	0.095	0.827	0.409

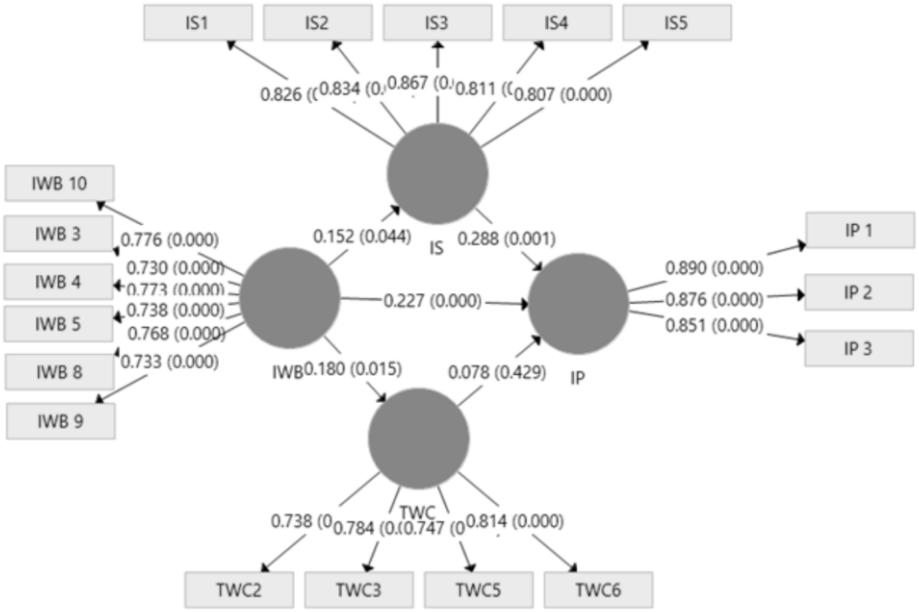

Figure 2: The empirical model of the study

Hypothesis 1 was that there is a positive relationship between IWB and IP. Hypothesis 1 is supported by the findings of a positive relationship and statistical significance. The direct effect was significant (β=0.297, t=6.272, p<0.05). Support for IB of employees is directly related to the growth of IP of the firm.

Next, we focused on examining the mediating effects of IS and TWC variables in the relationship. All three hypotheses (H2, H3, and H4) were supported. The mediation effects are presented in Figure 3.

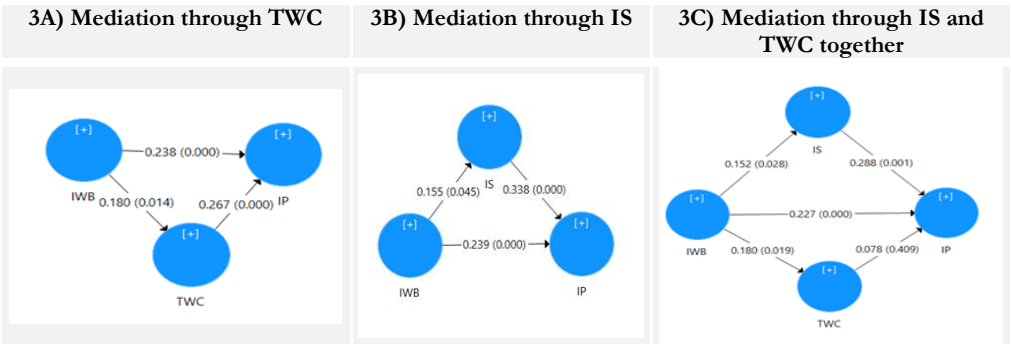

Figure 3: Mediation effects

The direct effect is β=0.239 and the indirect effect is β=0.052 (in percentage terms, the direct effect is 82% and the indirect effect is 18% of the total effect) in Hypothesis 2, which is based on the effect of IS as a mediator. In Hypothesis 3, where the

mediator is TWC, the situation is almost identical: the direct effect is β=0.238 (thus comparable to IS) and the indirect effect is β=0.048. In percentages, the direct and indirect (17%) effects of TWC mediation account for 83% and 17% of the total effect, respectively.

There is equal support for Hypothesis 4 regarding the effect of both mediators (IS and TWC). With a total effect (0.285), their indirect effect is significant. The direct effect share (0.227) is 80% and the indirect effect share (0.058) is only 20% (of which 76% is due to the transmission through the mediator IS and 24% to the transmission through the TWC).

4.3 Moderation effects

We included the criteria of length of management experience and age of the manager in the moderation. The moderation effects were negative for both criteria, but not statistically significant. This means that neither management experience nor age has a significant moderating effect on the relationship between IWB and IP. The results are reported in Table 6.

Table 6: Moderating effects in the relationship between IWB and IP

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
IWB -> IP	0.287	0.307	0.050	5.708	0.000
experience -> IP	-0.013	-0.016	0.063	0.211	0.833
age -> IP	-0.134	-0.136	0.067	1.993	0.047
Moderating Effect experience -> IP	-0.102	-0.099	0.056	1.842	0.066
Moderating Effect age -> IP	-0.010	-0.008	0.060	0.160	0.873

We then included the control variables in the model using multigroup analysis (MGA). Prior to this, we confirmed the measurement invariance of composite models (MICOM) (Henseler Ringle & Sarstedt, 2016) through three steps, namely configural invariance, compositional invariance, and equality of composite means and variances. Multi-group analysis (MGA) was conducted for the criteria of gender, management level, legal form, and region. Table 7 presents the results of the multi-group parametric tests according to the segmentation variables.

Table 7: PLS-SEM/multigroup analysis for managers by gender and management level

Paths	Path Coeff. (male–female)	p-Value	Path Coeff. (Bratislava region–other)	p-Value		
IS -> IP	-0.082	0.626	0.518	0.362		
IWB -> IP	0.200	0.287	-0.177	0.633		
IWB -> IS	0.094	0.694	0.666	0.525		
IWB -> TWC	-0.024	0.736	0.672	0.419		

TWC -> IP	-0.245	0.276	-0.490	0.272		
	Path Coeff. (Inc.–Ltd.)	**p-Value**	**Path Coeff. (Inc.–other)**	**p-Value**	**Path Coeff. (Ltd.–other)**	**p-Value**
IS -> IP	0.607*	-0.001	0.002	0.957	-0.608	0.226
IWB -> IP	-0.166	-0.085	0.200	0.690	0.081	0.944
IWB -> IS	-0.146	-0.646	0.395*	0.032	-0.500*	0.038
IWB -> TWC	-0.039	-0.523	0.736*	0.044	-0.484	0.061
TWC -> IP	-0.100	0.198	0.677	0.932	0.299	0.794
	Path Coeff. (lower–middle management)	**p-Value**	**Path Coeff. (lower–top management)**	**p-Value**	**Path Coeff. (middle–top management)**	**p-Value**
IS -> IP	0.115	0.631	0.193	0.590	0.078	0.854
IWB -> IP	-0.628*	0.034	-0.395	0.199	0.233	0.508
IWB -> IS	0.073	0.833	0.203	0.823	0.130	0.859
IWB -> TWC	-0.221	0.253	0.056	0.788	0.277	0.661
TWC -> IP	0.083	0.841	-0.456	0.441	-0.538	0.383

*Significant difference between path coefficients

In terms of gender and regional influences, no significant differences were found in the relationships examined. Some differences were found for legal form and management level (Table 7). IS has a more significant impact on IP in companies with the legal form Ltd. compared to Inc. Managers at the middle management level perceive a stronger impact of supporting their employees' IWB on the IP of the company compared to managers at the first management level.

5. Discussion

Energy firms are in a challenging period, facing many challenges to which they need to adapt flexibly. This implies continuous innovation at all levels of the transformation process, as innovation is currently recognized as the key to continuous and sustainable development of EC (Wang, Lu & Sun, 2018). Innovative firms can create new markets, modify customer preferences, and even change underlying consumer behavior, all of which can lead to higher profits (Zhou, 2006). According to Hj Musneh et al. (2021), innovation efforts are considered as a source of economic competitiveness. We agree with Corchuelo Martinez-Azúa et al. (2020) that an important role is played by the management of these companies, which can increase their success in this direction through effective management and the incorporation of appropriate management tools and approaches.

In our study, we examined the factors that may influence the IP of EC. We examined both the impact of employee-level IB on the overall IP of energy firms and the role of IS and TWC in this relationship.

Access to information plays an important role in fostering IWB (Yasir et al., 2021). The generation of new ideas is more effective in an open environment that encourages the sharing and exchange of ideas. We agree with Radaelli et al. (2014) that it is the IS that can promote employees' innovation activities and create a climate that intensifies IWB. This fact is also confirmed by our results. The results of testing Hypothesis 2, which is based on the effect of IS as a mediator in the relationship between IWB and IP, show an 82% direct effect (β=0.239) and an 18% indirect effect (β=0.052) on the overall effect. This suggests that although the vast majority of the effect is realized directly, IS plays a role in this relationship and can be used to improve firms' IP.

In addition, we sought to examine the impact of TWC on the relationship between IWBs and IP in the ES. Previous research suggests that employee collaboration supports firm IP (Jiang et al., 2012), especially when innovation is complex (Huang & Li; 2009). In a situation where team members can work together to generate new ideas, discuss them, ask questions together, and support each other, the entire process of generating and implementing innovations is facilitated. In the case of Hypothesis 3, where the mediator between IWB and IP is TWC, the situation is almost identical to Hypothesis 2. The direct effect is comparable (β=0.238), accounting for 83% of the relationship examined, and the indirect effect of TWC reaches β=0.048, accounting for 17% of the total effect. Thus, this confirms the fact that TW can be appropriately used as a supportive tool for increasing the innovation activity of the company.

The results of our study show that the effect of IS and TWC on the relationship between IWB and IP is comparable when considered in isolation. However, the importance of IS increases significantly when both mediators are acting together compared to TWC. The share of the indirect effect here is 20%, so equally complementary, but 76% of the indirect effect is transmitted through IS compared to 24% of the indirect effect of TWC. Thus, if an innovation activity takes place in a TW environment, open communication and IS is a crucial tool supporting its success.

This suggests that direct support of employees' IWB by managers has a significant direct impact on the IP of the firm as a whole, but its effect can be demonstrably supported by building a TWC and open IS in teams. Thus, the integration of these tools into the management of EC significantly supports their IP. It is therefore advisable to use these tools in an integrated way, in synergy with each other, which can lead to a demonstrable increase in IP.

We also examined the moderating effects of the age of energy managers and their length of management experience on the relationships examined. However, these were not found. The moderating effects were negative for both criteria, but not statistically significant. Thus, the relationship between management support for IWB and firm IP is not influenced by age or management experience, suggesting that awareness of the importance of this support and knowledge of its tools are sufficient factors in their own right for their successful application.

Similarly, no significant differences were found for the gender of the manager and regional influences. Some differences were found for legal form and level of management.

IS has a more significant impact on IP for companies with the legal form Ltd. than for companies with the legal form Inc. Since the legal form of Ltd. is chosen more by small and medium-sized enterprises than by Inc., it can be assumed that IS is more effective in an environment with closer working relationships. In the case of large companies with high organizational structures and a high degree of formalization, the positive effect is likely to be weakened. However, this finding would require further verification.

Our study has several theoretical and practical implications for the management of energy firms. At the theoretical level, it enriches the existing knowledge and broadens the discourse on the currently topical issue of promoting firms' IP. In particular, by discussing the role of management support for employees' innovative activity. It helps to better understand the impact that a manager can have on the generation and implementation of innovations in a team, and also their impact on the overall IP of the firm. The results of the study add to the existing understanding of the dynamics of this relationship and also the role of open communication and TW in it. Our study was conducted in Slovak conditions and although the issue of energy innovation is a global one and EC as employers have some comparable characteristics, at least in the European environment, the generalization of the findings should be approached with caution. The cultural, political and economic context may play an important role.

On a practical level, our study has several implications for the management of EC. Their constant need for innovation, coupled with rapid technological development and climate challenges, places high demands on managers. They need to activate internal resources and make the most of the intellectual capital that companies have at their disposal. Having the right management tools and knowing how to use them effectively is a great advantage for a company. Employees need the right conditions to be able to put their innovation into practice. The results of our study show that managers have an important role to play if they can support the innovative work of their subordinates and create an environment where information can be shared openly and where teams can work together to create and implement innovative solutions. It is the combination of the above that seems to be an appropriate strategy for EC. When management transparently communicates goals, strategies, and results to employees, it fosters employee engagement and interest. Open communication about the changes needed and how results will be measured and evaluated gives employees a sense of security. When employees feel free to ask questions and their input is valued, they are more likely to become active innovators. A positive finding is that such an approach is not limited by the seniority of the manager, but it does appear that lower managers have some leeway in this respect compared to managers at higher levels. Companies should therefore focus on training and supporting their lower managers, which can further enhance the IP of the company.

While our study provides new insights, it also has some limitations. An important one is the use of a cross-sectional research design. Our results show the existence of relationships between the variables studied, but do not confirm the cause-and-effect relationship. We collected data using self-administered surveys and collected data from managers of EC. Response bias may have partially distorted the responses, although we took several steps to mitigate common methodological biases. We have collected data from the managers themselves, although we are aware that collecting data from multiple sources, i.e., asking not only managers but also employees, could increase the objectivity

of the research. There is a risk that respondents will provide socially desirable answers, which may lead to overestimation of relationships between variables. A limitation of the research may also be the failure to use a pilot survey, one of the best practices for verifying the validity and methodological soundness of the constructs used. However, we considered other recommendations that we felt were appropriate and sufficient. A limitation may also be the research sample itself, which includes EC operating on the territory of Slovakia and is thus regionally limited. Future research can therefore address these limitations by conducting cross-cultural studies and also by using multiple sources of research data or different methods of data collection.

6. Conclusion

The results of our study have shown that fostering IB among EC employees is directly related to the growth of their IP. When employees feel supported by their managers to innovate and are encouraged to develop and implement new ideas, tools, and methods, this has a positive effect on increasing the overall IP of the organization. This relationship was found to be significant, demonstrating the impact of IWB not only on overall firm performance, as reported by Almaududi Ausat et al. (2022) and Shanker et al. (2017), but also directly on innovation production performance. Therefore, it is interesting to explore how managers can further enhance this impact.

The results of the study also suggest that middle managers perceive a stronger impact of their employees' support for IWB on the firm's IP than do lower-level managers. This may be due to the fact that they are more aware of the importance of innovation and have a wider range of information due to their more complex view of business processes compared to lower-level management. Therefore, top management needs to increase the involvement of lower-level managers in innovation processes and strengthen communication with them. As a result, they may have a better understanding of the principles, tools and implications of promoting IWBs, which will have a positive impact on the IP of the whole organization.

Given the topicality of the issue, it would be useful in follow-up research to extend the research to include the impact of some other potentially relevant variables that could affect innovation performance. These include, for example, the role of leadership styles, organizational culture, or external collaboration, as well as attention to the specific tools used to support IWB employees. These were not considered in the current study. Their inclusion in future studies could provide a more comprehensive understanding of the topic under investigation. The current study mainly examines the impact of internal factors that influence IWB from within the organization, while potential external influences such as legal regulations, industry-specific market conditions, or global economic factors were not considered. Future research could also explore the interaction between internal and external factors.

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References

Abdolshah, M., Khatibi, S. A., & Moghimi, M. (2018). Factors influencing job satisfaction of banking sector employees. *Journal of Central Banking Theory and Practice*, *7*(1), 207–222. https://doi.org/10.2478/jcbtp-2018-0009

Acemoglu, D., Akcigit, U., Alp, H., Bloom, N., & Kerr, W. (2013). *Innovation, Reallocation and Growth*, *108*(11), 3450–3491. https://doi.org/10.3386/w18993

Afsar, B., Cheema, S., & Bin Saeed, B. (2018). Do nurses display innovative work behavior when their values match with hospitals' values? *European Journal of Innovation Management*, *21*(1), 157–171. https://doi.org/10.1108/ejim-01-2017-0007

Akhavan, P., & Mahdi Hosseini, S. (2015). Social Capital, knowledge sharing, and innovation capability: An empirical study of R&D teams in Iran. *Technology Analysis & Strategic Management*, *28*(1), 96–113. https://doi.org/10.1080/09537325.2015.1072622

Albino, V., Ardito, L., Dangelico, R. M., & Messeni Petruzzelli, A. (2014). Understanding the development trends of low-carbon energy technologies: A patent analysis. *Applied Energy*, *135*, 836–854. https://doi.org/10.1016/j.apenergy.2014.08.012

Ali, M., Lei, S., & Wei, X.-Y. (2018). The mediating role of the employee relations climate in the relationship between strategic HRM and organizational performance in Chinese banks. *Journal of Innovation & Knowledge*, *3*(3), 115–122. https://doi.org/10.1016/j.jik.2016.12.003

Almaududi Ausat, A. M., Widayani, A., Rachmawati, I., Latifah, N., & Suherlan, S. (2022). The effect of intellectual capital and innovative work behavior on business performance. *Journal of Economics, Business, & Accountancy Ventura*, *24*(3), 363. https://doi.org/10.14414/jebav.v24i3.2809

Aragon-Correa, J. A., Martin-Tapia, I., & Hurtado-Torres, N. E. (2013). Proactive Environmental Strategies and employee inclusion. *Organization & Environment*, *26*(2), 139–161. https://doi.org/10.1177/1086026613489034

Bernal-Conesa, J. A., Briones-Peñalver, A. J., & Nieves-Nieto, C. de. (2017). Impacts of the CSR strategies of technology companies on performance and competitiveness. *Tourism & Management Studies*, *13*(4), 73–81. https://doi.org/10.18089/tms.2017.13408

Bos-Nehles, A., Renkema, M., & Janssen, M. (2017). HRM and Innovative Work Behaviour: A Systematic Literature Review. *Personnel Review*, *46*(7), 1228–1253. https://doi.org/10.1108/pr-09-2016-0257

Bowers, L., Nijman, H., Simpson, A., & Jones, J. (2010). The relationship between leadership, teamworking, structure, burnout and attitude to patients on acute psychiatric wards. *Social Psychiatry and Psychiatric Epidemiology*, *46*(2), 143–148. https://doi.org/10.1007/s00127-010-0180-8

Bogan, E., & Dedeoglu, B. B. (2017). The effects of perceived behavioral integrity of supervisors on employee outcomes: Moderating effects of tenure. *Journal of Hospitality Marketing & Management*, *26*(5), 511–531. https://doi.org/10.1080/19368623.2017.1269711

Braun, F. G., Hooper, E., Wand, R., & Zloczysti, P. (2011). Holding a candle to innovation in concentrating solar power technologies: A study drawing on Patent Data. *Energy Policy*, *39*(5), 2441–2456. https://doi.org/10.1016/j.enpol.2011.02.008

Cabello-Medina, C., Lopez-Cabrales, A., & Valle-Cabrera, R. (2011). Leveraging the innovative performance of human capital through HRM and social capital in Spanish firms. *The International Journal of Human Resource Management*, *22*(4), 807–828. https://doi.org/10.1080/09585192.2011.555125

Chand, M., & Markova, G. (2018). The European Union's Aging Population: Challenges for Human Resource Management. *Thunderbird International Business Review*, *61*(3), 519–529. https://doi.org/10.1002/tie.22023

Chen, S., Fan, Y., Zhang, G., & Zhang, Y. (2019). Collectivism-oriented human resource management on team creativity: Effects of interpersonal harmony and human resource management strength. *The International Journal of Human Resource Management*, *32*(18), 3805–3832. https://doi.org/10.1080/09585192.2019.1640765

Chen, W., Wang, X., Peng, N., Wei, X., & Lin, C. (2020). Evaluation of the green innovation efficiency of Chinese Industrial Enterprises: Research based on the three-stage chain network SBM model. *Mathematical Problems in Engineering*, *2020*, 1–11. https://doi.org/10.1155/2020/3143651

Chen, Y., & Lin, B. (2020). Decomposition analysis of patenting in renewable energy technologies: From an extended LMDI approach perspective based on three five-year plan periods in China. *Journal of Cleaner Production*, *269*, 122402. https://doi.org/10.1016/j.jclepro.2020.122402

Chin, W. W. (2009). How to Write Up and Report PLS Analyses. In V. E. Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of Partial Least Squares Concepts, methods and applications* (pp. 655–690). essay, Springer Berlin Heidelberg.

Cizmaş, E., Feder, E.-S., Maticiuc, M.-D., & Vlad-Anghel, S. (2020). Team Management, diversity, and performance as key influencing factors of organizational sustainable performance. *Sustainability*, *12*(18), 7414. https://doi.org/10.3390/su12187414

Corchuelo Martinez-Azúa, B., Lopez-Salazar, P. E., & Sama-Berrocal, C. (2020). Determining factors of innovative performance: Case studies in Extremaduran Agri-Food Companies. *Sustainability*, *12*(21), 9098. https://doi.org/10.3390/su12219098

de Jong, J., & den Hartog, D. (2010). Measuring innovative work behaviour. *Creativity and Innovation Management*, *19*(1), 23–36. https://doi.org/10.1111/j.1467-8691.2010.00547.x

de la Torre-Ruiz, J. M., Vidal-Salazar, M. D., & Cordon-Pozo, E. (2017). Employees are satisfied with their benefits, but so what? the consequences of benefit satisfaction on employees' organizational commitment and turnover intentions. *The International Journal of Human Resource Management*, *30*(13), 2097–2120. https://doi.org/10.1080/09585192.2017.1314315

De Spiegelaere, S., Van Gyes, G., & Van Hootegem, G. (2016). Not all autonomy is the same. different dimensions of job autonomy and their relation to Work Engagement & Innovative Work Behavior. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *26*(4), 515–527. https://doi.org/10.1002/hfm.20666

Exposito, A., & Sanchis-Llopis, J. A. (2019). The relationship between types of innovation and SMEs' performance: A multi-dimensional empirical assessment. *Eurasian Business Review*, *9*(2), 115–135. https://doi.org/10.1007/s40821-018-00116-3

Fagerberg, J. (2005). Innovation: a guide to the literature. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *Handbook of Innovation* (pp. 1–27). essay, Oxford University Press New York.

Fay, D., Shipton, H., West, M. A., & Patterson, M. (2014). Teamwork and organizational innovation: The moderating role of the HRM Context. *Creativity and Innovation Management*, *24*(2), 261–277. https://doi.org/10.1111/caim.12100

Garrone, P., Piscitello, L., & Wang, Y. (2014). Innovation Performance and International Knowledge Spillovers: Evidence from the Renewable Energy Sector in OECD countries. *Industry and Innovation*, *21*(7–8), 574–598. https://doi.org/10.1080/13662716.2015.1011913

Geels, F. (2004). From sectoral systems of innovation to Socio-Technical Systems. *Research Policy*, *33*(6–7), 897–920. https://doi.org/10.1016/j.respol.2004.01.015

Gibson, C. B., Porath, C. L., Benson, G. S., & Lawler, E. E. (2007). What results when firms implement practices: The differential relationship between specific practices, firm financial performance, Customer Service, and quality. *Journal of Applied Psychology*, *92*(6), 1467–1480. https://doi.org/10.1037/0021-9010.92.6.1467

Ginsburg, L., & Bain, L. (2017). The evaluation of a multifaceted intervention to promote "speaking up" and strengthen interprofessional teamwork climate perceptions. *Journal of Interprofessional Care*, *31*(2), 207–217. https://doi.org/10.1080/13561820.2016.1249280

Greco, M., Locatelli, G., & Lisi, S. (2017). Open innovation in the Power & Energy Sector: Bringing together government policies, companies' interests, and academic essence. *Energy Policy*, *104*, 316–324. https://doi.org/10.1016/j.enpol.2017.01.049

Griliches, Z. (1990). Patent statistics as economic indicators: A survey. *Journal of Economic Literature*, *28*(4), 1661–1707.

Guillon, O., & Cezanne, C. (2014). Employee loyalty and organizational performance: A critical survey. *Journal of Organizational Change Management*, *27*(5), 839–850. https://doi.org/10.1108/jocm-02-2014-0025

Hagedoorn, J., & Cloodt, M. (2003). Measuring innovative performance: Is there an advantage in using multiple indicators? *Research Policy*, *32*(8), 1365–1379. https://doi.org/10.1016/s0048-7333(02)00137-3

Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. (2017). An updated and expanded assessment of PLS-SEM in Information Systems Research. *Industrial Management & Data Systems*, *117*(3), 442–458. https://doi.org/10.1108/imds-04-2016-0130

Hair, J., Sarstedt, M., Hopkins, L., & G. Kuppelwieser, V. (2014). Partial least squares structural equation modeling (PLS-SEM). *European Business Review*, *26*(2), 106–121. https://doi.org/10.1108/ebr-10-2013-0128

Han, Y., & Li, D. (2015). Effects of intellectual capital on Innovative Performance. *Management Decision*, *53*(1), 40–56. https://doi.org/10.1108/md-08-2013-0411

Hasan, D., & Burkhardt, T. (2021). Innovative Work Behavior in the Energy Sector by Fuzzy VIKOR Method. In S. Yuksel & H. Dincer (Eds.), *Handbook of Research on Strategic Management for Current Energy Investments* (pp. 50–70). essay, IGI Global.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Henseler, J., Ringle, C. M., & Sarstedt, M. (2016). Testing measurement invariance of composites using partial least squares. *International Marketing Review*, *33*(3), 405–431. https://doi.org/10.1108/imr-09-2014-0304

Hirst, G., Van Knippenberg, D., & Zhou, J. (2009). A cross-level perspective on employee creativity: Goal orientation, team learning behavior, and individual creativity. *Academy of Management Journal*, *52*(2), 280–293. https://doi.org/10.5465/amj.2009.37308035

Hj Musneh, S. N., Ambad, S., & Mohd Roslin, R. (2021). The effect of innovative work behaviour on the performance of service sector SMEs in Sabah. *Journal of International Business, Economics and Entrepreneurship*, *6*(1), 20. https://doi.org/10.24191/jibe.v6i1.14204

Hong, J. F., Zhao, X., & Stanley Snell, R. (2018). Collaborative-based HRM practices and Open innovation: A conceptual review. *The International Journal of Human Resource Management*, *30*(1), 31–62. https://doi.org/10.1080/09585192.2018.1511616

Hu, J., Erdogan, B., Jiang, K., Bauer, T. N., & Liu, S. (2018). Leader humility and team creativity: The role of Team Information Sharing, psychological safety, and power distance. *Journal of Applied Psychology*, *103*(3), 313–323. https://doi.org/10.1037/apl0000277

Huang, J., & Li, Y. (2009). The mediating effect of knowledge management on social interaction and Innovation Performance. *International Journal of Manpower*, *30*(3), 285–301. https://doi.org/10.1108/01437720910956772

Jiang, J., Wang, S., & Zhao, S. (2012). Does HRM facilitate employee creativity and organizational innovation? A study of Chinese firms. *The International Journal of Human Resource Management*, *23*(19), 4025–4047. https://doi.org/10.1080/09585192.2012.690567

Jiang, X., & Li, Y. (2009). An empirical investigation of Knowledge Management and innovative performance: The case of alliances. *Research Policy*, *38*(2), 358–368. https://doi.org/10.1016/j.respol.2008.11.002

Kanter, R. M. (1988). Three Tiers for Innovation Research. *Communication Research*, *15*(5), 509–523. https://doi.org/10.1177/009365088015005001

Kaufmann, H., Hutter, R., Skopik, F., & Mantere, M. (2015). A structural design for a pan-European early warning system for critical infrastructures. *E & i Elektrotechnik Und Informationstechnik*, *132*(2), 117–121. https://doi.org/10.1007/s00502-015-0286-5

Kaya, B., Abubakar, A. M., Behravesh, E., Yildiz, H., & Mert, I. S. (2020). Antecedents of innovative performance: Findings from PLS-SEM and fuzzy sets (fsQCA). *Journal of Business Research*, *114*, 278–289. https://doi.org/10.1016/j.jbusres.2020.04.016

Ketokivi, M., & Castaner, X. (2004). Strategic planning as an integrative device. *Administrative Science Quarterly*, *49*(3), 337–365. https://doi.org/10.2307/4131439

Kijek, T., Kijek, A., Bolibok, P., & Matras-Bolibok, A. (2021). The patterns of Energy Innovation Convergence across European countries. *Energies*, *14*(10), 2755. https://doi.org/10.3390/en14102755

Kastner, E., & Rudolph, K. (2022). Die jungen Wilden Brauchen Führung: Treiber von Innovativität und Zufriedenheit im Arbeitsumfeld Innovationsferner Branchen. *Gruppe. Interaktion. Organisation. (GIO)*, *53*(1), 109–123. https://doi.org/10.1007/s11612-022-00618-9

Lacerda, J. S., & van den Bergh, J. C. J. M. (2020). Effectiveness of an 'open innovation' approach in renewable energy: Empirical evidence from a survey on solar and wind power. *Renewable and Sustainable Energy Reviews*, *118*, 109505. https://doi.org/10.1016/j.rser.2019.109505

Lamberti, G., Aluja Banet, T., & Rialp Criado, J. (2020). Work climate drivers and employee heterogeneity. *The International Journal of Human Resource Management*, *33*(3), 472–504. https://doi.org/10.1080/09585192.2020.1711798

Lezoche, M., Hernandez, J. E., Alemany Diaz, M. del, Panetto, H., & Kacprzyk, J. (2020). Agri-Food 4.0: A survey of the supply chains and technologies for the Future Agriculture. *Computers in Industry*, *117*, 103187. https://doi.org/10.1016/j.compind.2020.103187

Li, R., Du, Y.-F., Tang, H.-J., Boadu, F., & Xue, M. (2019). MNEs' subsidiary HRM practices and firm innovative performance: A tacit knowledge approach. *Sustainability*, *11*(5), 1388. https://doi.org/10.3390/su11051388

Lichtenstein, B. M., & Brush, C. G. (2001). How do "resource bundles" develop and change in new ventures? A dynamic model and longitudinal exploration. *Entrepreneurship Theory and Practice*, *25*(3), 37–58. https://doi.org/10.1177/104225870102500303

Lin, H., Zeng, S., Liu, H., & Li, C. (2020). Bridging the gaps or fecklessness? A moderated mediating examination of intermediaries' effects on corporate innovation. *Technovation*, *94–95*, 102018. https://doi.org/10.1016/j.technovation.2018.02.006

Liu, S., Yu, Q., Zhang, L., Xu, J., & Jin, Z. (2021). Does Intellectual Capital Investment Improve Financial Competitiveness and Green Innovation Performance? evidence from renewable energy companies in China. *Mathematical Problems in Engineering*, *2021*, 1–13. https://doi.org/10.1155/2021/9929202

Lynch, R., & Jin, Z. (2016). Knowledge and innovation in emerging market multinationals: The expansion paradox. *Journal of Business Research*, *69*(5), 1593–1597. https://doi.org/10.1016/j.jbusres.2015.10.023

Lahdesmaki, M., & Suutari, T. (2020). Good workers, good firms? Rural SMEs legitimising immigrant workforce. *Journal of Rural Studies*, *77*, 1–10. https://doi.org/10.1016/j.jrurstud.2020.04.035

Masyhuri, M., Pardiman, P., & Siswanto, S. (2021). The effect of workplace spirituality, perceived organizational support, and innovative work behavior: The mediating role of psychological well-being. *Journal of Economics, Business, & Accountancy Ventura*, *24*(1), 63–77. https://doi.org/10.14414/jebav.v24i1.2477

Mikhaylov, A. Y. (2018). Volatility spillover effect between stock and exchange rate in oil exporting countries. *International Journal of Energy Economics and Policy*, *8*(3), 321.

Min, J., Kim, Y., Lee, S., Jang, T.-W., Kim, I., & Song, J. (2019). The Fourth Industrial Revolution and its impact on occupational health and safety, Worker's compensation and labor conditions. *Safety and Health at Work*, *10*(4), 400–408. https://doi.org/10.1016/j.shaw.2019.09.005

Mussner, T., Strobl, A., Veider, V., & Matzler, K. (2017). The effect of work ethic on employees' individual innovation behavior. *Creativity and Innovation Management*, *26*(4), 391–406. https://doi.org/10.1111/caim.12243

Nedkovski, V., Guerci, M., De Battisti, F., & Siletti, E. (2017). Organizational ethical climates and employee's trust in colleagues, the supervisor, and the organization. *Journal of Business Research*, *71*, 19–26. https://doi.org/10.1016/j.jbusres.2016.11.004

Negassi, S., Lhuillery, S., Sattin, J.-F., Hung, T.-Y., & Pratlong, F. (2018). Does the relationship between innovation and competition vary across industries? Comparison of public and private research enterprises. *Economics of Innovation and New Technology*, *28*(5), 465–482. https://doi.org/10.1080/10438599.2018.1527552

Niesen, W., Van Hootegem, A., Vander Elst, T., Battistelli, A., & De Witte, H. (2018). Job Insecurity and Innovative Work Behaviour: A Psychological Contract Perspective. *Psychologica Belgica*, *57*(4), 174–189. https://doi.org/10.5334/pb.381

Nisula, A.-M., & Kianto, A. (2015). The Antecedents of Individual Innovative Behaviour in Temporary Group Innovation. *Creativity and Innovation Management*, *25*(4), 431–444. https://doi.org/10.1111/caim.12163

Pfeffer, J. (2010). Building Sustainable Organizations: The Human Factor. *Academy of Management Perspectives*, *24*(1), 34–45. https://doi.org/10.5465/amp.2010.50304415

Piwowar-Sulej, K., Austen, A., & Iqbal, Q. (2023). Fostering three types of green behavior through green HRM in the energy sector: the conditional role of environmental managerial support. *Baltic Journal of Management*, *18*(4), 509–524. https://doi.org/10.1108/bjm-03-2023-0089

Podrug, N., Filipovic, D., & Kovac, M. (2017). Knowledge sharing and firm innovation capability in Croatian ICT companies. *International Journal of Manpower*, *38*(4), 632–644. https://doi.org/10.1108/ijm-04-2016-0077

Proudfoot, J., Jayasinghe, U. W., Holton, C., Grimm, J., Bubner, T., Amoroso, C., Beilby, J., & Harris, M. F. (2007). Team climate for innovation: what difference does it make in general practice? *International Journal for Quality in Health Care*, *19*(3), 164–169. https://doi.org/10.1093/intqhc/mzm005

Radaelli, G., Lettieri, E., Mura, M., & Spiller, N. (2014). Knowledge Sharing and Innovative Work Behaviour in Healthcare: A Micro-Level Investigation of Direct and Indirect Effects. *Creativity and Innovation Management*, *23*(4), 400–414. https://doi.org/10.1111/caim.12084

Ringle, C. M., Sarstedt, M., Mitchell, R., & Gudergan, S. P. (2018). Partial least squares structural equation modeling in HRM research. *The International Journal of Human Resource Management*, *31*(12), 1617–1643. https://doi.org/10.1080/09585192.2017.1416655

Roberts, N., & Grover, V. (2012). Investigating firm's customer agility and firm performance: The importance of aligning sense and respond capabilities. *Journal of Business Research*, *65*(5), 579–585. https://doi.org/10.1016/j.jbusres.2011.02.009

Schreurs, B., Guenter, H., van Emmerik, I. J. H., Notelaers, G., & Schumacher, D. (2014). Pay level satisfaction and employee outcomes: the moderating effect of autonomy and support climates. *The International Journal of Human Resource Management*, *26*(12), 1523–1546. https://doi.org/10.1080/09585192.2014.940992

Scott, S. G., & Bruce, R. A. (1998). Following the leader in R&D: the joint effect of subordinate problem-solving style and leader-member relations on innovative behavior. *IEEE Transactions on Engineering Management*, *45*(1), 3–10. https://doi.org/10.1109/17.658656

Sexton, J. B., Helmreich, R. L., Neilands, T. B., Rowan, K., Vella, K., Boyden, J., Roberts, P. R., & Thomas, E. J. (2006). The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Services Research*, *6*(1), 1–10. https://doi.org/10.1186/1472-6963-6-44

Shanker, R., Bhanugopan, R., van der Heijden, B. I. J. M., & Farrell, M. (2017). Organizational climate for innovation and organizational performance: The mediating effect of innovative work behavior. *Journal of Vocational Behavior*, *100*, 67–77. https://doi.org/10.1016/j.jvb.2017.02.004

Shen, N., Wang, Y., Peng, H., & Hou, Z. (2020). Renewable Energy Green Innovation, Fossil Energy Consumption, and Air Pollution—Spatial Empirical Analysis Based on China. *Sustainability*, *12*(16), 6397. https://doi.org/10.3390/su12166397

Shipton, H., Fay, D., West, M., Patterson, M., & Birdi, K. (2005). Managing People to Promote Innovation. *Creativity and Innovation Management*, *14*(2), 118–128. https://doi.org/10.1111/j.1467-8691.2005.00332.x

Srivastava, A., Bartol, K. M., & Locke, E. A. (2006). Empowering Leadership in Management Teams: Effects on Knowledge Sharing, Efficacy, And Performance. *Academy of Management Journal*, *49*(6), 1239–1251. https://doi.org/10.5465/amj.2006.23478718

Thakur, D., & Chander, M. (2018). Use of Social Media in Agricultural Extension: Some Evidences from India. *International Journal of Science, Environment and Technology*, *7*(4), 1334–1346.

Tsegaye, W. K., Su, Q., & Malik, M. (2019). Expatriate cultural values alignment: The mediating effect of cross-cultural adjustment level on innovative behaviour. *Creativity and Innovation Management*, *28*(2), 218–229. https://doi.org/10.1111/caim.12308

Ur Rehman, A., Aslam, E., & Iqbal, A. (2022). Intellectual capital efficiency and bank performance: Evidence from Islamic banks. *Borsa Istanbul Review*, *22*(1), 113–121. https://doi.org/10.1016/j.bir.2021.02.004

Urbancova, H., & Vrabcova, P. (2020). Age management as a human resources management strategy with a focus on the primary sector of the Czech Republic. *Agricultural Economics (Zemědělská Ekonomika)*, *66*(6), 251–259. https://doi.org/10.17221/11/2020-agricecon

Vinding, A. L. (2006). Absorptive capacity and innovative performance: A human capital approach. *Economics of Innovation and New Technology*, *15*(4–5), 507–517. https://doi.org/10.1080/10438590500513057

Vos, S. C., & Buckner, M. M. (2015). Social Media Messages in an Emerging Health Crisis: Tweeting Bird Flu. *Journal of Health Communication*, *21*(3), 301–308. https://doi.org/10.1080/10810730.2015.1064495

Wallis, T., & Leszczyna, R. (2022). EE-ISAC—Practical Cybersecurity Solution for the Energy Sector. *Energies*, *15*(6), 2170. https://doi.org/10.3390/en15062170

Wang, P., Lu, Z., & Sun, J. (2018). Influential Effects of Intrinsic-Extrinsic Incentive Factors on Management Performance in New Energy Enterprises. *International Journal of Environmental Research and Public Health*, *15*(2), 292. https://doi.org/10.3390/ijerph15020292

Weng, S.-J., Kim, S.-H., & Wu, C.-L. (2016). Underlying influence of perception of management leadership on patient safety climate in healthcare organizations – A mediation analysis approach. *International Journal for Quality in Health Care*. https://doi.org/10.1093/intqhc/mzw145

Wu, S. H., Lin, L. Y., & Hsu, M. Y. (2007). Intellectual capital, dynamic capabilities and innovative performance of organisations. *International Journal of Technology Management*, *39*(3/4), 279. https://doi.org/10.1504/ijtm.2007.013496

Yasir, M., Majid, A., Yousaf, Z., Nassani, A. A., & Haffar, M. (2021). An integrative framework of innovative work behavior for employees in SMEs linking knowledge sharing, functional flexibility and psychological empowerment. *European Journal of Innovation Management*, *26*(2), 289–308. https://doi.org/10.1108/ejim-02-2021-0091

Yoo, J., Chung, S. E., & Oh, J. (2021). Safety Climate and Organizational Communication Satisfaction Among Korean Perianesthesia Care Unit Nurses. *Journal of PeriAnesthesia Nursing*, *36*(1), 24–29. https://doi.org/10.1016/j.jopan.2020.04.009

Zaheer, S., Ginsburg, L. R., Wong, H. J., Thomson, K., & Bain, L. (2018). Importance of safety climate, teamwork climate and demographics: understanding nurses, allied health professionals and clerical staff perceptions of patient safety. *BMJ Open Quality*, *7*(4), e000433. https://doi.org/10.1136/bmjoq-2018-000433

Zheng Zhou, K. (2006). Innovation, imitation, and new product performance: The case of China. *Industrial Marketing Management*, *35*(3), 394–402. https://doi.org/10.1016/j.indmarman.2005.10.006

Zohar, D., & Hofmann, D. A. (2012). Organizational Culture and Climate. In S. W. J. Kozlowski (Ed.), *The Oxford Handbook of Organizational Psychology* (Vol. 1, pp. 643–666). essay, Oxford University Press New York.