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Business process effectiveness - a puzzle of many pieces. The role of knowledge transfer and integration, business process efficiency and business process modelling

Abstract

Research background and purpose: Efficient management of business processes is crucial for operational excellence and customer satisfaction. Organizations employ Business Process Management techniques to design, monitor, optimize and automate these processes effectively. This paper explores the elements that ensure the smooth functioning of business operations and drive organizational success, and is focused on the determinants of business process effectiveness. Based on a literature review, this study aims to examine the role of knowledge transfer and integration, business process efficiency and business process modelling in shaping business process effectiveness.

Design/methodology/approach: Data collected from Polish 300 managers and specialists using the CAWI method was analysed using structural equation modelling.

Findings: The study provides evidence of the direct influence of business process efficiency on business process effectiveness. The study's findings also reveal the direct impact of business process modelling, as well as knowledge transfer and integration, on business process efficiency. It is surprising that the influence of business process modelling, and knowledge transfer and integration on the effectiveness of business processes is not recognized.

Value added and limitations: The contribution of this study is to highlight the importance of business process modelling (as a major factor), as well as knowledge transfer and integration, in business process effectiveness, and the importance of business process efficiency in shaping business process effectiveness. The study is subject to certain limitations, among which are: the use of a single-respondent approach, conducting the survey among managers from different sectors (the specifics of the business can have a significant impact on shaping the constructs we study), conducting the study at a specific point in time, which creates challenges in accurately assessing the effectiveness of business processes.

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1. Introduction

A business process is a sequence of interconnected activities that occur within an organization in order to achieve a specific business goal (Smith & Fingar, 2003). Business processes encompass both manual and automated actions, and utilize organizational resources such as people, technologies, data and other means. As a result, business processes aim to create a specific outcome or deliver certain products or services.

Business processes cover diverse fields and sectors, and their nature can vary significantly depending on the type of business and the organizational goals. They can include everyday management operations as well as more complex strategic or innovative processes (Cadden et al., 2023).

Effective management of business processes is essential for achieving efficiency and operational excellence, and delivering value to customers (Zheng et al., 2010). In this context, organizations often use Business Process Management techniques and tools which assist in designing, monitoring, optimizing and automating business processes.

In the effective functioning of a business process, many elements come together to form a logical whole. Some of the key factors determining such a process are knowledge transfer and integration (Argote & Ingram, 2000; Gera, 2012; Seleim & Khalil, 2011), process efficiency (Kasim et al., 2018; Pradabwong et al., 2017; Schmiedel et al., 2014, 2020) and business process modelling (Aguilar-Savén, 2004; Smith & Fingar, 2003).

Knowledge transfer plays a significant role, as it enables organizations to convey and assimilate information among employees. Knowledge-sharing allows for more effective decision-making and problem-solving, as well as the continuous improvement of processes. Knowledge integration, on the other hand, enables the cohesive combination of information from different domains, facilitating better understanding and optimal utilization of the available knowledge (Jerez-Gómez et al., 2005).

Business process modelling is a tool that helps in understanding, analysing and improving the structure and functioning of processes in an organization. By creating a model, areas requiring improvement can be identified more effectively, and the sequence of activities can be optimized (de Oca et al., 2015). Process modelling introduces clarity and improvements, supporting the effectiveness of organizational activities.

Process efficiency is a crucial element of organizational effectiveness. It involves the efficient use of resources, the elimination of unnecessary steps, and the reduction of task completion time (Zaheer et al., 2008). Business processes should be optimized for efficiency, translating into the achievement of intended goals in a more streamlined manner.

Based on the above considerations, it can be assumed that the effectiveness of a business process is the result of operational process efficiency, application of business process modelling and the seamless knowledge transfer and integration. The latter plays a crucial role as it is closely linked to organizational learning. Organizational learning acts as a lens through which the effectiveness of a business process can be explained in terms of process efficiency and modelling (Crossan et al., 1999).

The aim of the paper is thus to examine the role of knowledge transfer and integration, business process efficiency and business process modelling in shaping business process effectiveness. This article is the result of a broader research project on business process determinants and business process maturity.

The paper is structured as follows. Section 2 provides the theoretical background, characterizing process efficiency and process effectiveness, including the relationship between these terms. The remainder of this section describes such constructs as knowledge transfer and integration and business process modelling, presenting not only their essence, but also their impact on process efficiency and effectiveness. Section 3 contains a description of the research method and the characteristics of the research sample. Section 4 contains a discussion of the results and suggestions for further research directions. The final part of the article contains conclusions and research limitations.

2. Theoretical background

2.1. Efficiency vs. effectiveness

Efficiency and effectiveness are key terms used to measure the performance of organizations. Although these two terms are often used as synonyms or considered to be identical, there are important differences between them (Mouzas, 2006).

According to Low, efficiency defines the relationship between inputs and outputs, that is how successfully the inputs have been transformed into outputs (Low, 2000). Efficiency is not a measure of a company's success in the market, but rather a measure of operational excellence or productivity. It involves minimizing costs and increasing operating margins (Mouzas, 2006).

In turn, effectiveness determines the degree to which an enterprise achieves its goals or how outputs interact with the economic and social environment. Effectiveness-oriented companies pay attention to output, sales, quality, creation of value added, innovation and cost reduction (Zheng et al., 2010). Keilman and Kennedy-Philips maintain that effectiveness makes it possible to determine progress toward an organization's mission and goals. In order to increase organizational effectiveness, management should be improved by providing better communication, interaction, leadership, adaptability and a positive organizational environment (Heilman &

Kennedy-Phillips, 2011). Effectiveness is related to a company's ability to develop a unique model for identifying business opportunities. It refers to how a company generates sustainable growth.

Focusing solely on efficiency and neglecting effectiveness will lead to ephemeral profitability. In contrast, focusing solely on effectiveness and neglecting efficiency will result in unprofitable growth if the opportunity cost of capital is higher than the resulting profits. Adopting an orientation toward both efficiency and effectiveness requires taking an integrated approach to the organization's operations, enabling the creation of higher levels of sustainable profitability (Mouzas, 2006). Organizations characterized by high efficiency and effectiveness are distinguished by high performance. They achieve excellence in their operational performance, as well as in their strategic planning. Their outcome is productive, their costs are in line with the budget, and tasks are completed on time. Employees in such organizations are committed, aware of the indicators used to evaluate them, and their attitudes and behaviour are in line with the company's long-term goals and mission (Barvičienė & Šakalytė, 2013).

Constructs such as efficiency and effectiveness can also be applied to Business Process Management in an organization. They are very difficult to measure due to the fact that they vary depending on the context, process and organization. To measure them precisely, it is necessary to identify all the processes implemented in the company (Schmiedel et al., 2020).

Business process efficiency affects process performance. Various parameters of business process efficiency are defined in the literature, among which process time is the most important. Other parameters include: service process efficiency, cycle time (time needed between business process execution and its completion), process cost (financial resources consumed during process initiation and execution), number of employees involved in the process, and process quality (technologies used in process execution to minimize manual and administrative work) (Zaheer et al., 2008).

Business process effectiveness, like business process efficiency, also affects business process performance. Among the parameters that are used to measure business process effectiveness are: the degree to which desired business process outcomes are achieved, the quality of the output of business processes, the flexibility of adapting business processes to changing environmental conditions, the execution of business processes in a highly customer-oriented manner, and the delivery of business process outcomes on time (Schmiedel et al., 2020).

Applying business process orientation enables different parts of an organization to effectively and efficiently co-create value, and in the end provide satisfaction for the company's customers. The goal of Business Process Management is to increase the efficiency and effectiveness of organizational processes through improvement and innovation (Kasim et al., 2018; Seleim & Khalil, 2011). Inappropriate management, including lack of automation and a comprehensive approach towards business processes,

creates redundant operations, inefficiency and lower competitiveness, which ultimately affects an organization's ability to successfully conduct long- and short-term operations.

Business process efficiency and business process effectiveness are two interrelated constructs that make up and influence business process performance. Efficiency is a much narrower concept and refers to the relationship between inputs and outputs, by which it determines the effectiveness of a process encompassing a broader perspective including such elements as quality, value-added creation, employee satisfaction and the interaction between outputs and the economic and social environment (Barvičienė & Šakalytė, 2013).

With the above considerations in mind, a first hypothesis can be proposed:

H1: Business process efficiency has a positive impact on business process effectiveness.

2.2. "Business process modelling vs. business process efficiency and effectiveness

It is increasingly common to describe organizations as sets of business processes that can be analysed and improved by approaches such as business process modelling. Successful business process modelling relies on an adequate understanding of the nature of business processes, but there is a surprising divergence of opinion about these processes (Melão & Pidd, 2000).

Before starting business process modelling, it is important to determine the purpose for which modelling is being carried out. Process models will vary depending on the reason for which they are created. The primary reason for modelling is to understand the process itself and to check that the people involved in the process understand it in the same way. Process modelling helps to better understand the essence of the process and to identify and prevent bottlenecks (Dumas et al. 2018; Dumas et al. 2013). Modelling is a prerequisite for analysing, redesigning or automating a process (Jerez-Gómez et al., 2005).

A business process is the combination of a set of activities within an enterprise, with a structure describing their logical order and dependence aimed at produce the desired result. An enterprise can be analysed and integrated through its business processes (Aguilar-Savén, 2004). Business process modelling is a graphical representation of a business process or workflow and its related sub-processes. It provides diagrams and flowcharts containing events and activities within a process, responsibilities (who owns and/or initiates events and activities), decision gateways, different workflow paths, devices used in the process, and timelines for the overall process and each activity.

Business process modelling can be used for: assessment of new processes by focusing on implementing and evaluating the design of new processes, analysis of resource usage allowing for resource investment and its returns to be tracked, and improvement of

processes and organizational communication by providing an easy-to-follow graphical model of what is very often a complex bundle of business activities. In this sense it decreases organizational complexity and allows a business process or processes to be isolated as a unit of analysis (Smith & Fingar, 2003).

Many studies, particularly those focusing on large-scale improvement projects such as enterprise system implementation, the digitalization of processes and workflow robotization, emphasize the role of Business process modelling as a success factor in such projects (Aldin & de Cesare, 2011). However, a broad section of the literature on business process modelling focuses on syntactic and semantic aspects such as modelling techniques and the correctness of the resulting process model (de Oca et al., 2015). Business process modelling aims to enhance process efficiency, particularly in areas directly impacting the company's profits. It presents the organization's activities, supports their optimization, and enables the improvement of product and service quality, streamlining work processes for enhanced efficiency.

Business process modelling plays a valuable role in visualizing, analysing and optimizing business processes. Thanks to business process modelling, companies can streamline their processes, eliminate unnecessary steps and ensure that tasks are performed in the most efficient order, contributing to increased operational efficiency (Kasim et al., 2018). Business process modelling also helps align business processes with the goals of the organization, ensuring that actions directly contribute to the overall effectiveness of the organization in achieving its mission (de Oca et al., 2015). The continuous improvement of business process modelling allows for ongoing refinement, providing a structured approach to assessing and improving processes, contributing to the effectiveness of processes and organizational operations by adapting to changing environmental conditions. Business process modelling enables organizations to make rational decisions regarding resource allocation, performance improvement and strategic planning, thereby increasing both process efficiency and effectiveness. Business process modelling provides a framework for adapting business processes to strategic goals. This alignment ensures that processes are not only efficient in day-to-day operations, but also contribute to the overall effectiveness of the organization in achieving long-term goals (Kir & Erdogan, 2021).

In summary, business process modelling is a tool that serves a dual role in improving both the efficiency and effectiveness of business processes. Through the visualization, analysis and optimization of processes, business process modelling contributes to improved operations, better decision-making and overall effectiveness. Continuous improvement facilitated by business process modelling ensures that processes remain efficient and aligned with the strategic goals of the organization.

Based on the above considerations, the following hypotheses can be formulated:

H2: Business process modelling has a positive impact on business process efficiency.

H3: Business process modelling has a positive impact on business process effectiveness.

2.3. Knowledge transfer and integration vs. business process efficiency and effectiveness (performance)

Knowledge transfer and integration are key and at the same time closely related knowledge management processes. Jerez-Gómez et. al. (Jerez-Gómez et al., 2005) state that they occur simultaneously and not successively. Knowledge transfer is a concept that includes a minor construct, i.e. knowledge sharing (Anand et al., 2021), which is its critical element. Knowledge sharing occurs at the individual level (Paulin & Suneson, 2012), and in the literature is viewed from a unidirectional or bidirectional perspective (Tangaraja et al., 2016).

As a more complex phenomenon, knowledge transfer can occur both at the individual level and also at broader levels, including groups, departments or organizations (Tangaraja et al., 2016). Knowledge transfer involves recognizing and accessing existing knowledge, obtaining it and then applying this acquired knowledge to generate new ideas or improve existing ones. This process aims to make a procedure or action more efficient, effective or secure compared to its original state (Gera, 2012).

Joia and Lemos (Joia & Lemos, 2010) suggest that the transfer of knowledge can be accomplished through two approaches: codification and personalization. In the codification strategy, the codification process occurs at a prior point in time, distinct from the actual transfer process. This is because the subject of the transfer is codified material, the so-called explicit knowledge (Guzman, 2008; Shaw & Williams, 2009), thus the actual transfer of knowledge in this approach takes place when the recipient begins to read the material. In turn, in the personalization strategy, face-to-face contact plays a fundamental role as the transfer also refers to tacit knowledge. Therefore, effective communication, opportunities for discussion and a conducive environment for dialogue are essential elements that facilitate the transfer of knowledge within an organization (Jerez-Gómez et al., 2005; Lavan et al., 2025).

Knowledge transfer, as the act of transmitting knowledge from one location, individual or entity to another, is a process through which the experiences of one entity influence and impact another (Argote & Ingram, 2000). Thus, individual entities learn from each other. In developing organizational learning, the main role is played by work teams. Team learning prioritizes the collective over the individual, enabling the transfer, interpretation and integration of knowledge acquired by team members (Jerez-Gómez et al., 2005).

Knowledge integration is associated with building a knowledge-sharing climate (i.e. relationships of trust, openness and learning orientations) and the generation of knowledge by enabling the communication, exchange and ultimate integration of specialized knowledge and expertise among individuals (Yoo, 2017; de Vries et al., 2024;

Fu et al., 2024). When knowledge, especially tacit knowledge, is shared and exchanged effectively among the organizational members it is possessed by, it becomes ingrained in the organization's existing knowledge repository through collective learning and synergistic benefits. This process substantially enhances the organization's collective knowledge stock and capital (Seleim & Khalil, 2011). The integration of knowledge results in the development of a shared body of knowledge embedded in the organizational culture, work processes and other elements comprising the "organizational memory." As a result, the knowledge can be retrieved and applied in diverse situations, ensuring continuous learning for the organization despite the inevitable turnover of its members (Jerez-Gómez et al., 2005).

Knowledge management is perceived as a foundation for successful Business Process Management (Paschek et al., 2018) and may be used to achieve business process improvement (Massingham & Al Holaibi, 2017). However, most research in the area of knowledge transfer and integration is related to business performance (Lombardi, 2019; Trequattrini et al., 2019), growth and innovative processes (Chui et al., 2023; Lubishtani et al., 2022; Ouyang et al., 2023), and competitive advantage (Cadden et al., 2023; De Luca & Cano Rubio, 2019), and does not attempt to examine the direct relationships between knowledge transfer and integration, and business process efficiency and effectiveness.

Lombardi (2019) points out that knowledge transfer within the organization and its business processes is crucial for attaining high business performance, fostering innovative processes and gaining a competitive advantage. The study by Corral de Zubielqui et al. shows (Corral de Zubielqui et al., 2019) that knowledge transfers from customers and suppliers are positively related to innovativeness, significantly impacting business performance. De Lucia and Cano Rubio (De Luca & Cano Rubio, 2019) claim that knowledge transfer is instrumental in enabling a company to establish and sustain a strategic competitive advantage over time. The firm's ability to cultivate an efficient and effective knowledge transfer process enhances internal skills, thereby strengthening its capacity to compete in the business landscape, resulting in positive impacts on performance.

Xie et al. (Xie et al., 2022) report that knowledge integration which takes place thanks to team cooperation is also considered a factor in improving performance in teams. Gao et al. (Gao et al., 2009) explored how combining individual and group knowledge within an organization, known as knowledge integration, influences business performance. Their findings indicate a noteworthy and positive correlation between knowledge integration and business performance. Specifically, they observed a statistically significant positive impact on both operational and financial measures, highlighting the crucial role of coordination capabilities in this relationship. In turn, the study by Parente et al. (Parente et al., 2022) shows that tacit knowledge integration capabilities leads to superior business performance.

Also, Kim et al. (Kim et al., 2012), who explored the effect of entrepreneurship on business performance, found that the effect of entrepreneurial activities on business performance was mediated by knowledge integration capability.

Thus, based on the above studies, we propose the following hypotheses:

H4: Knowledge transfer and integration have a positive impact on business process efficiency.

H5: Knowledge transfer and integration have a positive impact on business process effectiveness.

3. Research method and data acquisition

3.1. Research tools

For all the constructs analysed in the theoretical part of the article, validated research tools developed by other researchers representing the particular research area were used. A 5-point Likert scale was applied to all items comprising each construct.

The knowledge transfer and integration construct was measured using a tool proposed by Jerez-Gomez et al. (Jerez-Gómez et al., 2005). The tool included 4 items: (1) errors and failures are always discussed and analysed in the firm on all levels, (2) employees have the chance to talk among themselves about new ideas, programmes and activities that might be of use to the firm, (3) in the firm, teamwork is not the usual way of working, (4) the firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same.

To measure business efficiency and business process effectiveness in this research we applied the ten-item construct proposed by Schmiedel, Reckerb and Vom Brocke (Schmiedel et al., 2020) based on the procedure formulated by MacKenzie, Podsakoff and Podsakoff (MacKenzie et al., 2011) covering the creation of initial items as a result of literature studies, the selection of suitable items for measuring business process efficiency and effectiveness, and finally revising and pretesting the items with scholars and expert practitioners based on the iterative approach. Each construct (business process efficiency and business process effectiveness) was described by 5 indicators.

In terms of business process modelling, we adopted the proposal by Bandara et al. (Bandara et al., 2005, 2021). This construct consisted of 6 items concerning: (1) top management support, (2) project management capabilities, (3) stakeholder participation, (4) information resources, (5) modeller expertise, and (6) modelling tool usage.

The surveys were collected using the CAWI method. The sampling was random, and a total of 300 employees of Polish companies took part in the survey. Among the

respondents, 62.66% were specialists, 9.00% middle managers, 8.33% line managers, and 7.33% senior managers and other employees. The variables were evaluated using a 5-point Likert scale, where 1 meant "strongly disagree" and 5 meant "strongly agree."

For the purpose of statistical analysis, the Python statsmodels package version 0.13.5 was used (Seabold & Perktold, 2010). In addition, the semopy 2.3.9 (Igolkina & Georgy Meshcheryakov 2020) and FactorAnalyzer 0.5.0 packages were used.

The Likert item scores of the participants were averaged for each Likert scale, providing a pseudo-quantitative portrayal of their views on a particular construct. Two independent experts reviewed the collected data for accuracy before it was coded and analysed.

3.2. Description of the research sample

The composition of the research sample is detailed in the Table 1, encompassing aspects such as size (in terms of total personnel) and company activity (industry). Notably, the majority of the sample consisted of large companies, accounting for 39.66% of the size distribution. Company activities were classified according to the Polish Classification of Activities 2007 with the predominant sector being services, constituting 53% of the total.

Table 1. **Characteristics of the research sample for the year 2022, n=300**

Personnel		Industry (Polish Classification of Activity)	
1-9	11,33%	Agriculture, forestry, hunting and fishing (code A)	39.67%
10-49	27.67%	Manufacturing (code C)	39.00%
50-249	21.33%	Construction (code F)	2.33%
250+	39.67%	Wholesale and retail trade (code G)	5.00%
		Services (codes H-S)	53.00%

Source: own study based on research

4. Research results

In order to construct our models, we embraced a structural approach, guided by the principles of management and organization theory to inform the selection process. Our research team commenced with Factor Analysis (FA), proceeded with Ordinary

Least Squares (OLS) regression analysis, and culminated the investigation by employing a Structural Equation Modelling (SEM) framework.

The scales, as previously detailed in this paper, underwent factor analysis. Embracing the assumption that nearly all variables in the social sciences exhibit some degree of correlation (Meehl, 1990), we employed promax oblique rotation. Subsequently, the scales were distilled based on factor loadings in both the one-factor and two-factor models. Items deemed as outliers were excluded, guided by expert judgment. The following constructs were thus delineated, each accompanied by its corresponding Cronbach's alpha coefficient: Knowledge Transfer and Integration (KTI, α = 0.62), Business Process Modelling (PM, α = 0.79), Business Process Effectiveness (PEffn, α = 0.63), and Business Process Efficiency (PEffc, α = 0.79).

The following justification provides reasonable grounds for item exclusion. On the knowledge transfer and integration scale, the item "The firm has instruments (manuals, databases, files, organizational routines, etc.) that allow what has been learnt in past situations to remain valid, although the employees are no longer the same." is the only question relating to a hard characteristic of knowledge transfer and integration – text books and data bases, which might not be readily available in SMEs. The rest of the items on this scale serve as indicators of soft characteristics such as the adopted philosophy regarding slips and mistakes, and fostering a culture of cooperation. On the business process modelling scale, the item "The availability of information resources such as documentations of procedures, business rules or compliance standards to inform the modelling project" was related to information resources. Lack of awareness about such resource availability may be justifiable for process users, since they act as subject matter experts for process management teams, and do not lead process modelling/optimization projects. On the business process effectiveness scale, the items "In the past year, our organization has realized a desirable input–output ratio for its business processes" and „In the past year, our organization has generated outcomes of its business processes free from any defects" were excluded because the former relates to an absolute economic result that does not align with the remaining items, which are relative in nature (please note that the survey was conducted during the pandemic), while the latter uses strong language (universal quantifier – "free from any defects"). On the business process efficiency scale, the item "In the past year, our organization has been flexible in adapting its business processes to changing external requirements" was excluded due to the context of the research, which was conducted during the COVID-19 pandemic. The ubiquitous breaking of supply chains rendered all economic actors helpless in terms of adapting to the emerging challenges.

In the regression modelling process, the Ordinary Least Squares (OLS) method was applied, incorporating Newey-West (1987) robust standard errors to address issues of heteroscedasticity and autocorrelation. The Bartlett Kernel was utilized when such flaws

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were present in the models. The outcomes of the conducted OLS regression analysis, with Business Process Efficiency (PEffc) as the dependent variable, are detailed in Table 2.

Table 2. **PEffc as a dependent variable**

	Model_1	Model_2	Model_3	Model_4	Model_5	Model_6
Intercept	1.384*** (0.219)	2.472*** (0.177)	1.984*** (0.179)	2.973*** (0.175)	1.550*** (0.212)	1.759*** (0.192)
KTI	0.134*** (0.051)	0.354*** (0.046)				0.152*** (0.051)
PM	0.381*** (0.056)		0.494*** (0.048)		0.461*** (0.048)	0.400*** (0.057)
PEffn	0.165*** (0.048)			0.267*** (0.055)	0.179*** (0.049)	
R-squared	0.318	0.169	0.269	0.075	0.301	0.291
R-squared Adj.	0.311	0.166	0.266	0.072	0.297	0.286
N	293	293	293	293	293	293
Jarque-Bera (p-val)	0.58 (0.75)	3.23 (0.20)	0.06 (0.97)	4.76 (0.09)	0.46 (0.79)	0.04 (0.98)
DW	2.00	1.95	2.00	1.89	1.99	2.00
Breusch-Pagan (p-val)	14.27 (0.00)	4.41 (0.04)	11.18 (0.00)	10.78 (0.00)	13.73 (0.00)	10.4 (0.01)

Standard errors in parentheses (* $p<0.1$, ** $p<0.05$, ***$p<0.01$)
Source: own study based on research

The regression analysis confirms that both knowledge transfer and integration and business process modelling exert an influence on business process efficiency, with the latter serving as the primary driver. The preeminent model (Model 6) stands out with the highest adjusted R^2 coefficient, indicative of a superior fit. However, it is noteworthy that the incremental impact of knowledge transfer and integration on business process modelling results in a marginal enhancement in explained variability. Models incorporating Business Process Effectiveness (PEffn) as an explanatory variable were introduced for comparative analysis.

In response to the diagnostic assessments, particularly the Jarque-Bera (JB) test assessing the normality of residuals, the sample size was adjusted by excluding outliers in the dependent variable using the Interquartile Range (IQR) criterion. Notwithstanding

the presence of heteroscedasticity, robust standard error estimations were employed for modelling purposes.

The results of the performed OLS regression analysis for PEffn as a dependent variable are presented in Table 3.

Table 3. **PEffn as a dependent variable**

	Model_1	Model_2	Model_3	Model_4	Model_5
Intercept	1.890*** (0.235)	2.416*** (0.189)	2.385*** (0.204)	2.073*** (0.200)	1.966*** (0.227)
PEffc	0.221*** (0.063)		0.270*** (0.052)	0.237*** (0.062)	
KTI	0.074 (0.061)	0.179*** (0.050)			
PM	0.025 (0.070)		0.191*** (0.055)		0.063 (0.063)
R-squared	0.090	0.042	0.040	0.082	0.085
R-squared Adj.	0.080	0.039	0.036	0.079	0.079
N Obs	300	300	300	300	300
Jarque-Bera JB (p-val)	1.59 (0.45)	3.11 (0.21)	2.47 (0.29)	1.63 (0.44)	1.41 (0.49)
DW	2.18	2.15	2.19	2.20	2.20
Breusch-Pagan BP (p-val)	5.61 (0.13)	0.05 (0.82)	0.37 (0.54)	5.25 (0.02)	4.87 (0.09)

Standard errors in parentheses (* p<0.1, ** p<0.05, ***p<0.01)
Source: own study based on research

The outcomes of the executed regression analysis establish that business process efficiency serves as the driving force behind business process effectiveness. The leading model (Model 4) distinguishes itself with the highest R^2 value, denoting superior explanatory power. Nonetheless, we acknowledge that business process efficiency does not encompass a substantial portion of the variance in business process effectiveness. This leads us to the conclusion that the dynamic and rapidly evolving environment plays a pivotal role in the transition from business process efficiency to business process effectiveness. The provided data lacks adequacy for the validation of hypotheses H3 and H5. This is attributed to a low model fit level and

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the lack of significance in the influence (see details on Model 2 and Model 5 in the context of Model 4 results above).

The discerned relationships among the refined factors enabled the research team to formulate a Structural Equation Model (SEM) as illustrated in Figure 1. The latent variables, namely Knowledge Transfer and Integration (KTI), Business Process Modelling (PM), Business Process Efficiency (PEffc), and Business Process Effectiveness (PEffn), are gauged through the use of reduced scales.
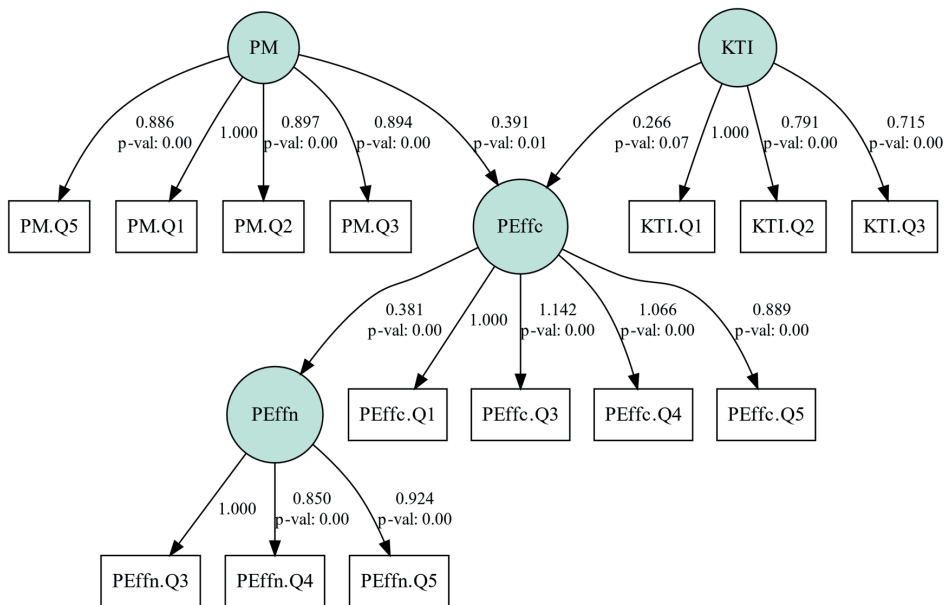

Figure 1. **Proposed SEM Model**

Source: own study based on research

The Comparative Fit Index (CFI) at 0.9851 and the Tucker-Lewis Index (TLI) at 0.9814 both indicate that the model exhibits a good fit, complemented by a Root Mean Square Error of Approximation (RMSEA) value of 0.0278. These values align with the benchmarks established by Hu and Bentler (1990). Moreover, the chi-squared ($\chi2$) test, with a non-rejectable p-value of 0.0879 ($\chi2 = 89.85$), fails to refute the null hypothesis, suggesting concordance between the predicted model and the observed data.

5. Discussion and further research directions

The results of our analysis provide support for hypothesis H4 that knowledge transfer and integration have a positive impact on process efficiency. This is in line with (Gera, 2012), according to which knowledge transfer entails identifying, acquiring and using knowledge to create new solutions or improve existing ones in a particular area of the organization's operation. Relating this to the process view of an organization, knowledge transfer allows for an increase in the efficiency of processes in comparison with the initial state. In turn, Argote and Ingram (Argote & Ingram, 2000) emphasize that knowledge transfer implies the transmission of knowledge from one location to another, which means that the experience of one entity influences the actions of another, thereby increasing its efficiency. Selein and Khalil (Seleim & Khalil, 2011) claim that knowledge integration enables the development of the stock of collective knowledge, which is reflected in work processes providing the organization with continuous learning, including raising efficiency.

The results of the analyses provide a basis for rejecting hypothesis H5, according to which knowledge transfer and integration has a positive impact on process effectiveness. The lack of influence between the analysed constructs is surprising, as the literature highlights the important role of knowledge management in successful business process management (Paschek et al., 2018) and in process improvement translating into an increase in business process efficiency and effectiveness (Massingham & Al Holaibi, 2017). Exploring the reasons for the lack of a direct relationship between knowledge transfer and integration and process effectiveness, it can be noted that knowledge transfer and integration may not directly affect business process effectiveness, as knowledge itself can be worthless if it is not used properly, does not align with business strategy or does not contribute to the organization's goals. Besides, the lack of mechanisms to support the implementation of knowledge can limit its impact on business process effectiveness. In addition, cultural and organizational barriers can discourage knowledge sharing, despite its transfer and integration, and thus limit process effectiveness.

The research justifies the conclusion that not only knowledge transfer and integration, but also influence business process efficiency, with business process modelling acting as the main factor (hypothesis H2). As a graphical representation of business processes or workflows with associated sub-processes, business process modelling allows for an in-depth understanding of the process (Aguilar-Savén, 2004). According to Smith and Fingar (Smith & Fingar, 2003), by presenting the individual activities carried out within the process, as well as the owners, responsible persons and process executors, decision gateways, different workflow paths, and tools and technologies used in the process, it enables process evaluation and improvement. Thus, business process modelling allows for improvement in such parameters as service process efficiency, cycle time, process

cost, process quality and the number of people involved in process execution. Schmiedel et al. (Schmiedel et al., 2020) believe that these are the basic parameters for measuring business process efficiency. This view is supported by Kasim et al. (Kasim et al., 2018), who argues that business process modelling promotes process optimization by eliminating unnecessary steps, providing the most efficient way to implement activities and thus contributing to operational process efficiency.

Interestingly, the research did not reveal a direct impact of business process modelling on business process effectiveness, as assumed in hypothesis H3. Earlier studies by de Oca et al., (de Oca et al., 2015) and (Kir & Erdogan, 2021), prove that business process modelling enables the alignment of business processes with the organization's long-term goals, and affects the overall effectiveness of the organization, including business process effectiveness. Schmiedel et al. (Schmiedel et al., 2020) claim that business process modelling allows rational decisions to be made regarding the planning and allocation of resources, the improvement of business operations and the implementation of strategic planning, thereby affecting both business process efficiency and business process effectiveness. The lack of a direct impact of business process modelling on business process efficiency may result from the scope of business process modelling, which focuses on the operational aspects of the process (use of resources, way of performing tasks), ignoring the strategic aspect (whether the process itself allows the desired results to be achieved). In addition, business process modelling tools and methodologies are designed to analyse and optimize processes in terms of resource allocation, time efficiency and cost reduction, ensuring process improvements from an operational perspective. Besides, the effectiveness of the process requires the use of indicators such as business outcomes, customer satisfaction and alignment with strategic goals, which may not be directly influenced by process modelling itself. This requires factors such as organizational culture, leadership and market dynamics to be taken into account.

Our results also support hypothesis H1, according to which business process efficiency affects business process effectiveness. These results are consistent with the research of Schmiedel et al. (Schmiedel et al., 2014), who argue that business process efficiency and business process effectiveness are interrelated, contributing to business process performance. The authors also maintain that the level of such processes can be increased through improvement and innovation. In turn, Kasim et al. (Kasim et al., 2018) and Pradabwong et al. (Pradabwong et al., 2017) claim that a high level of process efficiency hinders successful long-term operations, thus affecting process effectiveness.

Based on the research, it seems to be important to identify the role of knowledge in process modelling, especially how knowledge transfer and integration and business process modelling are used in practice to improve process efficiency and effectiveness. It is recommended that case studies be conducted in this area to identify best practices and key

success factors. It also seems reasonable to seek answers to the question of whether better knowledge transfer and integration lead to a better understanding and more accurate modelling of processes, which in turn affects their efficiency and effectiveness. Taking into account the high dynamics and complexity of the environment, it is reasonable to explore whether knowledge transfer and integration lead to more effective adaptation of processes to changing conditions, increasing their adaptability. Another cognitively interesting research direction is to consider the aspect of digital transformation in process management by determining how new technologies can support knowledge transfer and integration and business process modelling, and how they affect business process efficiency and effectiveness.

6. Conclusions and research limitations

The purpose of the study, which was to examine the role of knowledge transfer and integration, business process efficiency and business process modelling in shaping business process effectiveness, was achieved through exploration of the relationships among the mentioned constructs and empirical verification of five hypotheses.

In conclusion, this study makes an important contribution to management theory and practice on shaping business process effectiveness. Firstly, our results suggest a direct impact of business process efficiency on business process effectiveness. This fact is not surprising, as literature evidence (Gera, 2012; Schmiedel et al., 2014) confirms that process efficiency and process effectiveness are interrelated constructs that collectively impact the overall performance of a business process. Efficiency looks at input-output correlation in a process and is a measure of operational excellence or productivity, while effectiveness considers a broader scope including quality, value added, employee satisfaction and interaction with the economic and social environment.

Secondly, the results of our research revealed a direct impact of business process modelling, as well as knowledge transfer and integration, on business process efficiency, with the first serving as the primary driver. Business process modelling enables enhancement of service process efficiency, cycle time, cost, quality and the workforce involved in execution; these are considered as fundamental metrics for assessing process efficiency (Smith & Fingar, 2003). In turn, the transfer of knowledge enables a boost in process efficiency compared to the initial state, which is possible by the creation of new solutions or the improvement of existing ones (Gera, 2012). What is more, knowledge integration fosters the buildup of collective knowledge, enhancing work processes for ongoing organizational learning and increased efficiency (Seleim & Khalil, 2011).

Thirdly, the lack of influence of business process modelling and knowledge transfer and integration on business process effectiveness seems surprising. Business process

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modelling may not directly impact efficiency as it primarily focuses on operational aspects, overlooking the strategic dimension crucial for desired outcomes. Modelling tools address resource allocation and cost reduction, but true effectiveness involves broader indicators influenced by organizational culture, leadership and market dynamics. In understanding the absence of a direct link between knowledge transfer and integration and process effectiveness, it is apparent that the value of knowledge relies on its proper use, its alignment with strategy and its contribution to organizational goals. Furthermore, inadequate implementation mechanisms, as well as cultural and organizational barriers, can limit the impact on process effectiveness despite knowledge transfer and integration.

The findings also provide insights for management practitioners by highlighting the importance of such determinants of business process effectiveness as knowledge transfer and integration and business process modelling. Managers should pay attention to the effectiveness of the implementation of the various stages of the knowledge management process, including, in particular, knowledge transfer and integration, as they significantly affect business process efficiency by enabling better use of resources, faster decision-making, continuous improvement and adaptation to changing market conditions. Organizations should also make greater use of business process modelling to improve business process efficiency. By identifying areas for improvement, optimizing processes, standardizing activities and automating tasks, this tool positively impacts business process efficiency. Managers should keep in mind that by properly implementing knowledge transfer and integration and using business process modelling, they influence business process efficiency, thus impacting business process effectiveness.

The study is subject to certain limitations, which also suggest potential avenues for further research. Initially, a single respondent approach was employed. It would be beneficial to broaden the scope by involving managers from diverse areas, each responsible for distinct processes within a studied organization. This would provide more comprehensive exploration of the factors influencing business process effectiveness. Secondly, our survey was conducted among managers from various sectors. The specificity of the activity may have a significant impact on shaping the constructs we studied. Therefore, it would be worth comparing the relationships between individual variables in selected industries and sectors. Additionally, our study was conducted at a particular moment in time, posing challenges in accurately gauging the effectiveness of business processes. A longitudinal study would provide deeper insights into the intricacies of business model effectiveness.

Authors' contribution

K.M.: article conception, theoretical content of the article, analysis and interpretation of results, draft manuscript preparation; **K.M.:** article conception, theoretical content of the article, analysis and interpretation of results; **G.R-K.:** theoretical content of the article; **M.Ch.:** research methods applied, conducting the research, data collection

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