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KRITINIŲ SĖKMĖS VEIKSNIŲ ĮTAKOS LYGIO NUSTATYMAS NAUJŲ PROCESŲ DIEGIMUI VERSLO PROCESŲ VALDYMO SRITYJE	**IDENTIFYING THE INFLUENCE LEVEL OF CRITICAL SUCCESS FACTORS ON BUSINESS PROCESS MANAGEMENT IMPLEMENTATION**

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Relevance. Organizations have been increasingly adopting business process management (BPM) as a technique to improve operational efficiency, reduce costs, enhance customer satisfaction, and gain competitive advantage (Ram et al, 2014). However, despite its promise, many BPM initiatives fail to achieve their intended benefits due to challenges faced during implementation (Buh et al., 2015). A key factor influencing the successful execution of BPM projects is the consideration of critical success factors (CSFs) (Lee et al., 2007). Trkman (2010) describes critical success factors as “those few things that must go well to ensure success for a manager or an organization, and, therefore, they represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance.”. Within the context of BPM, several studies have sought to identify the most important CSFs that can help ensure that implementation projects are completed on time, within budget and realize planned outcomes (Aysolmaz et al., 2023; Skarpmoen et al., 2020). However, the existing research does not provide thorough insights into the degree of influence these critical success factors have on a specific stage of business process management lifecycle.

Novelty. This research aims to address an area that has received limited attention in prior work (Buh et al., 2015). Specifically, it will examine the influence level that critical success factors have on a new process implementation. The originality of exploring this topic provides an opportunity to advance theoretical and applied understanding. A better understanding of the level of impact each CSF has could help organizations better prioritize resources and focus efforts during the implementation process.

The level of conducted research. Aysolmaz et al. (2023), Skarpmoen et al. (2020), Kaziano et al. (2019), Bandara et al. (2018), Gabryelczvk (2018), Buha et al. (2015), Lückmann et al. (2017), and Trkman et al. (2013) are the scholars that explored critical success factors associated with the effectiveness of business process management. Although each scholar presented a unique set of critical success factors, they did also identify common CSFs. However, over the past decade, Bai, C. and Sarkis, J. (2013) stand out as the sole researchers who delved into the assessment of the influence levels of critical success factors. Unfortunately, their study was limited to three companies in China, rendering the sample base too narrow for generalization and did not evaluate any specific stage of overall business process management initiatives.

Research problem. What level of influence critical success factors have on new process implementation and how should they be prioritized?

Objective. To determine the level of influence of critical success factors on the successful new process implementation.

Research tasks:

1. Evaluate scientific publications to identify the critical success factors that determine a successful business process management implementation.
2. Determine a methodology for identifying the influence level of critical success factors on the process implementation within business process management.
3. Based on the methodology, evaluate how identified critical success factors influence each other and what level of influence they have on new process implementation within business process management.
4. Interpret empirical data to make conclusions and recommendations.

Methods used in the research:

1. Analysis and synthesis of academic literature.
2. Qualitative methodology by DEMATEL.
3. Descriptive and comparative analysis of empirical research results.

Thesis structure. The thesis consists of three main parts: the theoretical analysis of scientific literature, research methodology and data analysis obtained during the research. In the part of the scientific literature analysis, sources related to a successful business process implementation and the critical success factors determining a successful BPM implementation are analysed. The methodological part of the thesis presents the purpose of the study, the method and briefly presents the research instrument and describes the selection of respondents. The empirical part of the work analyses the data obtained during the empirical research and presents a summary of the research results.

1. THEORETICAL BACKGROUND OF SUCCESSFUL BUSINESS PROCESS MANAGEMENT IMPLEMENTATION AND CRITICAL SUCCESS FACTORS

1.1. Motivation behind business process management implementation

Understanding the motivation behind BPM adoption is essential as it allows to anticipate potential challenges and risks. Consequently, it enables to ensure a smooth implementation. A literature review uncovered several factors that frequently drive organizations to undertake BPM projects.

Transparency and control

Achieving transparency and control over business operations has emerged as a fundamental driver in organizational management (Van Looy et al., 2017). In order to achieve operational consistency and quality, implementing BPM is associated with fewer defects, reworks and errors. The implementation of BPM offers a standardized approach to documenting, monitoring and analysing core business processes comprehensively (Gabryelczyk et al, 2022). Based on Gabryelczyk's study (2022) this standardized approach provides leadership with visibility into bottlenecks, process variations and exceptions that were previously unseen. Unstructured work, on the other hand, risks embedding variability that may hide waste and quality concerns. It seems that organizations nowadays focus on the level of process maturity to base their decisions on data coming from process measurements. Leveraging data-driven insights, process owners can make evidence-based decisions to optimize operations (Rosemann et al, 2015).

Adaptability

In addition to transparency and control, the dynamic nature of markets serves as another driving force for BPM adoption. Early BPM initiatives focused on flexibility and continuous improvement (Van Der Aalst, 2013). Subsequent studies have revealed that process changes occur, on average, every 1-2 years (Rad et al., 2018). Adaptability becomes imperative as customer needs, competitive landscapes, regulatory environments and technologies evolve rapidly (Polyvyanyy et al., 2019). BPM, in this context, supports experimentation through simulation and analysis of hypothetical scenarios before costly rollouts (Mendling et al. 2018).

Customer experience

The customer experience has gained prominence as a focal point, considering that processes increasingly bridge internal and external touchpoints (Rosemann et al., 2015). Within the framework of business process management, customer elements typically operate in a cause-and-effect correlation: an improvement in the process directly results in enhanced customer satisfaction (Rowell, 2018). However, in reality in-depth research on the influence of BPM on customer satisfaction are especially rare (Pavlić, 2019). Gabryelczyk et al. (2022) found that the role of BPM in developing customer orientation and arranging better inter-organizational processes and building relationships with various business partners was recognized more clearly in the evolution of BPM. Similarly, Reis et al. (2018) identified enhancing the customers' experience through BPM as one of the key elements of digital transformation. Since BPM is considered as a trigger of process innovation and digital transformation of an organization (Mendling et al., 2020), organizations may adopt BPM with the goal of improving customer experience through digital means. Researchers argue that shifting from product-centricity to customer-centricity necessitates managing experiences at scale through BPM (Mendling et al, 2018).

Resource efficiency

Organizations are motivated to adopt BPM to also improve resource efficiency. As identified in the literature, one of the main traditional reasons for adopting BPM was to increase the efficiency of organizational processes (Gabryelczyk et al., 2022). Specifically, the first definition of BPM defined one of the main goals as "increasing efficiency and effectiveness at the level of individual processes as well as within an entire organization" (Elzinga et al., 1995). Motivations for BPM adoption extend to resource efficiency particularly in response to escalating cost pressures as about 70% of organizations in TEC research on BPM market trends (2020) say that they are doing process work to reduce costs. Improving efficiency can lead to better utilization of organizational resources like employees, technology, funds and time. When processes are optimized through BPM, tasks can be redistributed and resources better allocated. This allows the organization to achieve more outcomes without increasing the resources used (Hammer, 2015). Mature BPM technologies now go beyond rules-based approaches, facilitating cognitive automation using AI/ML (Dumas et al., 2023). Contemporary research explores the concept of “digital workers,” capable of performing complex knowledge work that previously required human judgment (Le Clair et al., 2019). Therefore, gaining efficiencies through BPM adoption is a key motivation as it allows organizations to do more with the same or fewer resources.

The literature highlights various drivers that make a strong case for adopting BPM. The motivation that lies behind organizations includes potential gains in efficiency, costs, quality, compliance, continuous improvement capabilities, and customer outcomes. Given that business processes form the foundation of how an organization operates, implementing BPM in a disciplined manner provides a way for companies to realize opportunities to enhance their competitive advantage by optimizing operations through process management.

1.2. Advantages of business process management implementation

In the current business environment there is a growing acknowledgment among organizations of the strategic necessity to engage in business process management initiatives. A systematic approach to optimizing business processes, BPM offers the potential to unlock numerous advantages, as evidenced by an exhaustive examination of scholarly literature spanning the past decade. This part of the study delves into the key organizational benefits associated with implemented BPM, shedding light on the transformative potential it holds.

Improved Efficiency and Productivity

A cornerstone benefit of BPM initiatives is the marked improvement in efficiency and productivity within organizational processes. Early studies as indicated by Gartner (2007) underscored that BPM projects resulted in substantial reductions in cycle times, ranging from 20% to 50%. These reductions were achieved through strategic measures such as headcount optimization, outsourcing and the implementation of automation technologies. As technological advancements unfolded, the landscape of BPM expanded beyond basic automation. Emerging technologies such as adaptive case management and robotic process automation, as highlighted by Harmon (2018) and van der Aalst et al. (2018), provided organizations with more sophisticated tools to streamline processes. Scholars suggest that combining standardized structured procedures with these new technologies brings out the best in value creation by making the most of resources (Melenovsky & Sinur, 2019; Le Clair et al., 2020). The fusion of standardized processes and cutting-edge technologies doesn't just make things more efficient; it also encourages a mindset of always getting better. Companies can take advantage of these perks to methodically improve their operations and set themselves up for long-term competitiveness.

Cost Reduction

BPM allows organizations to identify unnecessary costs within their business processes in order to streamline operations and reduce expenses. As Harmon (2010) discusses, effective BPM programs aim to "eliminate bottlenecks, optimize cycle times, reduce variability, and remove redundant activities.". By modelling processes, scrutinizing workflows and standardizing best practices unwanted costs can be cut from all types of operational processes. A prime target for cost reductions through BPM are activities that do not directly add value to the end product or service, such as unnecessary approvals, redundant data entries or wasteful transportation of materials (Rummler et al., 2010). Cutting out non-value-added activities through process analysis and redesign can significantly lower operational costs. Improving processes can also minimize errors and rework, which incur high costs to fix. Well-managed processes enable more predictable outcomes and fewer defects that require costly re-dos. BPM also allows organizations to optimize resource utilization. Process optimization ensures the right people, tools, technology and level of effort are deployed at each step based on rigorous data analysis (Harmon, 2010). Right-sizing resources support major cost cuts while maintaining process efficiency and quality standards. As processes are continuously monitored and improved through a BPM framework, additional opportunities for cost reductions through automation, offshoring, workflow adjustments and more will emerge over time (Rosemann et al., 2005).

Quality and Compliance

BPM initiatives play a pivotal role in fortifying organizational integrity by elevating quality standards and ensuring regulatory compliance. Researchers argue that standardized work and monitoring result in fewer defects and reworks, thereby enhancing overall quality (Trkman, 2013). As Rowell (2018) indicates when reviewing early BPM literature, quality improvements were commonly cited as motivations for adopting BPM. Formalizing and standardizing processes with BPM aims to reduce errors and rework. By monitoring key performance indicators, organizations can also identify processes that are producing defects and take corrective actions. Compliance is another benefit achieved through BPM. With processes documented and controls built in, organizations can more easily ensure work adheres to legal and regulatory requirements (Gabryelczyk et al., 2020). As processes and tasks are automated through BPM tools and technologies like robotic process automation, the risk of human error leading to non-compliance is reduced. Compliance can even be factored directly into automated processes and digital forms through built-in validations and approvals (Gabryelczyk et al., 2022).

Transparency and Continuous Improvement

Transparency facilitated by BPM platforms plays a pivotal role in fostering evidence-based optimization and continuous improvement. These platforms provide capabilities such as process mining and analytics, revealing inefficiencies, exceptions, and variances previously hidden across systems (Gabryelczyk et al, 2022). Baseline metrics and impact modelling empower resources to experiment with adjustments before widespread implementation, thereby maximizing benefits (Mendling, 2018; Rosemann et al., 2015). This evidence-driven approach enables organizations to continuously evolve and adapt to dynamic market conditions. BPM as a facilitator of continuous improvement positions organizations for agility and resilience in the face of changing business landscapes.

Enhanced Customer Satisfaction

The optimization of business processes across the entire customer journey emerges as a distinct advantage of BPM initiatives. As Kerpedzhiev et al. (2021) note in their updated BPM framework, one of the new enhanced capabilities within the combined methods and IT core element is "process context management," which allows organizations to better understand customer needs and requirements. Managing processes with an understanding of customer context can help improve the customer experience. Studies have shown that implementing BPM can lead to improved quality of products and services delivered to customers (Gabryelczyk et al. 2022). By analyzing, optimizing and monitoring business processes, problematic areas that negatively impact customer satisfaction can be identified and addressed. With BPM, organizations also gain the ability to better understand customer journeys and touchpoints (Gabryelczyk et al., 2018). This helps ensure a seamless, consistent experience for customers across all interaction channels.

In conclusion, the literature reveals a compelling case for adopting BPM, substantiated by its potential gains in efficiency, costs, quality, compliance, continuous improvement capabilities, and customer outcomes. As the foundation of organizational operations, business processes, when managed systematically through BPM, offer a pathway for companies to enhance their competitive advantage. The systematic optimization of operations, underpinned by BPM, allows organizations to strategically manage core business activities. This strategic approach positions them dynamically, ensuring strengthened, customer-centric operational execution. As organizations embrace BPM as a strategic imperative, they unlock a myriad of benefits that not only optimize their current operations but also fortify them for sustained success in an ever-evolving business landscape.

1.3. Techniques for measuring the implementation of business process management

In the dynamic landscape of contemporary organizations, the assessment of the success and impact of business process management initiatives is crucial. Organizations strive to optimize their efforts and realize intended benefits through meticulous evaluation. Over the past decade, researchers and practitioners have diligently developed an array of tools and techniques for measuring BPM implementations.

Process Performance Measurement

Process performance measurement is an important tool for organizations to measure the success of their BPM initiatives. Effective performance measurement allows organizations to understand how well their business processes are performing and identify opportunities for improvement (van der Aalst et al., 2016). There are several key reasons why process performance measurement is crucial for BPM success. First, it provides visibility into process performance which can help organizations determine if their BPM efforts are achieving desired outcomes such as increased efficiency, quality or customer satisfaction (McCormack et al., 2009). Performance metrics collected over time also enable organizations to analyze trends and understand how processes are impacting key business objectives (Rosemann et al., 2005). Secondly, process performance measurement helps ensure processes remain aligned with organizational strategy. Changes in business priorities and market conditions may occur over time, requiring processes to adapt. Regular performance reviews allow organizations to evaluate if processes still fit strategic goals or require redesign (McCormack et al., 2009). Thirdly, measuring performance is necessary for process optimization. Poorly performing processes or bottlenecks can be identified and targeted for improvement. The impact of changes from initiatives like process reengineering or automation can also be determined through before-and-after metric comparison (Rosemann et al., 2005). A wide range of quantifiable metrics can be used, such as cycle time, cost per transaction, error rates, customer satisfaction scores and more (van der Aalst et al., 2016). Both financial and non-financial metrics should be considered to gain a holistic view of process effectiveness and efficiency (McCormack et al., 2009). Leading indicators, like customer wait time, as well as lagging metrics of outputs and outcomes must be tracked (Rosemann et al., 2005). By implementing process performance measurement programs, organizations can obtain vital insights for continuous BPM improvement. Regular measurement ensures the objectives of greater operational control, cost-savings and customer value from BPM initiatives are actually attained.

Surveys

Surveys stand out as a common and valuable tool for measuring the success of BPM implementations. They provide organizations with a means to collect both quantitative and qualitative feedback from stakeholders impacted by BPM initiatives (Harmon, 2014). Surveys offer a unique advantage by allowing organizations to understand perceptions, reactions, and the softer, intangible impacts of BPM implementations, such as employee enablement or engagement (Jeston & Nelis, 2014). Surveys are particularly effective at collecting qualitative and perceptual data. They can gauge participant satisfaction with processes, perceived ease of use, and attitude/culture changes resulting from BPM efforts (Rummler et al., 2012). This includes obtaining employee perspective on engagement and optimization of human resources involved in processes (McCormack et al., 2009). Surveys of external stakeholders, such as customers and partners, provide important insights into their experience. Metrics including customer effort, satisfaction, loyalty can be tracked over time (Johnson et al., 2000). This helps evaluate outcomes from BPM initiatives aimed at customer experience transformation (Recker, 2013). When designing process-related surveys, care must be taken to ask the right questions. Both open-ended and closed questions should be used (Alreck et al., 2004). Questions must link to specific processes and collect actionable feedback on pain points and recommendations for improvement (Rummler et al., 2012). Regular surveying, perhaps quarterly or annually, allows longitudinal comparison of perceptions and building of benchmarks. Tracking metrics pre- and post-process changes also helps quantify impact (Johnson et al., 2000).

Case Studies

Case study serve as a robust method for assessing the success of BPM implementations, offering an in-depth examination of contextual factors and outcomes within real-world organizations. Documenting processes both before and after BPM interventions through case studies allows organizations to assess effectiveness and benefits realized (McCormack et al., 2015). These case studies can capture tangible outcomes such as reduced costs, cycle time improvements or increased productivity. Qualitative impacts are also important to measure. Case studies can evaluate intangible outcomes to like elevated customer or employee satisfaction, cultural changes, and strategic alignment gains (Rebuge et al., 2012). They provide rich descriptive detail of how and why BPM efforts succeeded or failed. Analyzing examples from other companies handling similar processes can provide benchmarks for comparison. This helps establish performance expectations and best practices (Rosemann, 2015). Collecting case studies involves interviewing process participants, analyzing documents and observing processes in action. In essence, case studies emerge as a powerful tool for organizations seeking a thorough understanding of the impacts, challenges, and successes associated with their BPM implementations.

Maturity Models

Maturity models serve as a structured tool to assess organizational BPM capabilities, offering insights into progression and success over time (Rosemann et al., 2005). One prominent model, developed by Rosemann and de Bruin (2005), defines five progressive stages of maturity: initial/ad hoc, repeatable, defined, managed, and optimizing. Each stage builds upon the previous one, enhancing process orientation, governance mechanisms, and continuous improvement embedded within the organization. The BPM Maturity Model provides organizations with a standardized framework to assess their current status and capabilities against defined levels of maturity (Rosemann et al., 2005). By evaluating their position in the maturity levels, organizations gain crucial insights into areas of strength and opportunities for improvement. This structured approach facilitates diagnostic assessments, identifying gaps and focusing enhancement efforts on specific levels. Comparing results with peer organizations at different maturity stages offers valuable insights. Benchmarking against industry norms highlights competitive differentiation and areas where industry best practices have yet to be adopted (Rosemann et al., 2005). External evaluations by consultants, employing objective assessment criteria, further validate internal results. Linking maturity levels to expected outcomes emphasizes the business value of advancement, with higher levels typically indicating stronger adherence to standards, more robust governance, and deeper process optimization (Rosemann et al., 2005). Maturity thus serves as a predictor of BPM success and gains as evidence of success over time.

Return on investment calculation

Accurate ROI calculation helps organizations determine if expected financial benefits were indeed realized from BPM projects (Gattiker, 2010). To calculate ROI, organizations must first determine the initial costs associated with the BPM initiative including expenses related to consulting, software, employee training and etc. They must also quantify baseline metrics for factors like cycle times, defect rates and costs pre-implementation (Indulska et al., 2009). Post implementation, organizations assess savings and benefits achieved over time by comparing metrics to baselines. Reduction in operation costs from better utilization of assets, lower defect rates reducing rework, higher employee productivity and decreased cycle times all contribute to tangible benefits (McCormack et al., 2016). Process standardization, as exemplified by Rosemann & vom Brocke (2015), realized a $3.8 million annual ROI for an airline through defect reduction. ROI calculations, with their focus on quantifiable metrics, underscore the financial benefits derived from BPM initiatives. These calculations offer organizations a clear and measurable indicator of the economic impact of their BPM projects.

In conclusion the measurement approaches discussed in this comprehensive exploration draw from diverse yet integrated techniques and technologies available today. Leveraging these tools helps organizations gauge benefits from BPM implementations and guides continuous process improvements. As BPM measurement continues to evolve, it is likely that new and innovative combinations of analytical methods will emerge. These developments may offer fresh opportunities to assess and improve the effectiveness of BPM initiatives. By developing a deeper understanding of various measurement methodologies, organizations can make more informed decisions when implementing BPM initiatives. This can support more effective process optimization and contribute to sustained success in a continuously changing business environment.

1.4. Critical success factors influencing a successful implementation

Business process management has become a central aspect of organizational strategy, emphasizing the need for a comprehensive understanding of critical success factors. Critical success factors are the conditions that can positively influence the performance of a project during its conduct (Bai et al., 2013). As Castro et al. (2019) note, understanding CSFs can provide guidance for organizations on factors they need to pay attention to when implementing BPM. CSFs help observe the areas that require specific attention and manage the project better.

Originating from the work of John F. Rockart in the late 1970s, CSFs aim to streamline complex problems by focusing on a limited number of key areas vital for success. In other words, CSFs are those factors that must go well to ensure success for any activities within organization otherwise the initiative will fail. Rockart was interested in helping executives focus their efforts and believed that identifying a limited number of critical success factors could do this. By concentrating on these few key areas essential for success, managers could allocate limited time and resources best. Rockart did view CSFs as ways to simplify complex problems and identify priority areas that required attention. In 1970 Rockart published one of the most influential articles on CSFs, where he identified the concept and provided guidance on how to identify them through interviews with key executives and managers. He found that by letting executives focus on just two to six most important areas, rather than long lists of goals, tasks and activities, they were able to concentrate their efforts better. This helped address what Rockart saw as a key problem of information overload facing managers at the time.

Further elaboration on the concept came from Bullen and Rockart (1981) who suggested four basic steps in identifying CSFs:

1. Define the business or organizational unit under study in terms of mission, competitive environment, key managers, etc.
2. Identify the key areas of business activity and performance measures relevant to success using metrics like market share, product quality, profitability and etc.
3. Conduct interviews with top and divisional managers to understand their perspectives on success factors.
4. Analyse interview responses to determine 2-6 most important factors that require ongoing measurement and management if objectives are to be attained.

Since Rockart first introduced the concept in the late 1970s, CSFs have been widely applied across both private and public sectors. They have become "one of the most enduring labels to guide executives' attention to key success determinants" (Boynton & Zmud, 1984).

While definitions vary, most scholars conceptualize CSFs similarly to Rockart's original definition. Boynton and Zmud (1984) described CSFs as attributes of an organization's strategy or infrastructure that needed to be present if critical success objectives were to be attained. Chow and

Cao (2008) defined CSFs as "those characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a project or business process".

In summary, even though there might be different definitions of CSFs, they share the following common characteristics:

- Limited in number – Usually between 3 to 10 factors.
- Vital for success – Issues around CSFs must be addressed in order to succeed.
- Strategic importance – Related to key organizational goals and competitive positioning.
- Measurable – CSFs can be operationalized and monitored over time.
- Context-dependent – May differ based on industry, business model, etc.

A review of literature related to CSFs reveals that academics continue to define CSFs consistently with Rockart's original conceptualization as a handful of critical areas that must be addressed to ensure mission success. Rockart's influential work laid the foundation for future research, with researchers consistently defining CSFs as limited in number, vital for success, strategically important, measurable and context-dependent.

The exploration of critical success factors in business process management (BPM) has been a significant focal point within the academic discourse (Buh et al., 2015). Much of the previous research in this area has aimed to identify a standardized list of critical success factors that can facilitate successful business process management efforts in a variety of organizational settings. Researchers have sought to establish a comprehensive set of keys to success (Table 1) applicable to BPM initiatives across diverse company contexts.

Table 1. *Critical success factors*

No.	Source	Identified Critical Success Factors
1.	Aysolmaz, B., Joshi A., and Stubhan, M. (2023). Examining and Comparing the Critical Success Factors Between Business Process Management and Business Process Automation.	Top management support Communication Project methodology Strategic alignment Training and empowerment

2.	Skarpmoen Eriksen, O. And Jensen, J. (2020). Business process management and success factors – Which success factors are the basis for a successful implementation phase of a BPM project.	Collaborative environment Communication People Established processes
3.	Kaziano do Amaral Castro, B., Dresch, A., Rafael Veit, D. (2019). Key critical success factors of BPM implementation: a theoretical and practical view.	Top management support Investment in human capital Structured methodology
4.	Bandara, W., Gable, G., Tate, M., and Rosemann, M. (2019). A validated business process modelling success factors model.	Top management support Project management capabilities Stakeholder input Modeller expertise Modelling tool usage
5.	Gabryelczvk, R. (2018). An exploration of BPM adoption factors: Initial steps for model development.	Top management support Information technology Strategic alignment Governance Methods Project management Performance measurements Measurement and control People Culture Communication
6.	Roztocki, N. and Gabryelczvk, R. (2018). Business process management success framework for transition economies.	Strategic alignment Project and change management Governance Performance management IT

		Method People Culture Communication
7.	Lückmann, P., and Feldmann, C. (2017). Success Factors for Business Process Improvement Projects in Small and Medium Sized Enterprises – Empirical Evidence.	Project integration Monitoring and controlling Risk management Stakeholder management Human resource management Quality management Communication Scope management Organizational culture
8.	Buh, B. , Kovačič, A., and Indihar Štembergera, M. (2015). Critical success factors for different stages of business process management adoption – a case study.	Top management support Strategic alignment People Methods and methodology Communication Information technology Organizational culture Project and change management champion Performance measurement Governance Understanding the BPM concept Continuous improvement optimization Clearly defined process owners
9.	Trkman, P. and Škrinjar, R. (2013). Increasing process orientation with business process management: Critical practices'.	Strategic alignment Performance measurement Organizational changes IS support Employee training

		Employee empowerment
10.	Bai, C. and Sarkis, J. (2013). A grey-based DEMATEL model for evaluating business process management critical success factors.	Strategic alignment Project management Information technology (IT) Performance Measurement Collaborative environment Top management support User focus Culture

Source: Compiled by the author based on literature review, 2024.

Trkman's (2013) literature review serves as a foundational piece identifying a range of critical success factors. Among them are top management support, IT support, strategic alignment, governance, methods, project management, performance measurement, culture and people. The comprehensive nature of this list underscores the varied considerations necessary for successful BPM implementation. These factors, drawn from an extensive analysis of existing literature, provide a broad framework for organizations aiming to optimize their BPM strategies.

Bai and Sarkis (2013) took a different approach by utilizing a Grey-DEMATEL model to evaluate critical success factors. Their findings reinforced the importance of top management support, IT infrastructure, strategic alignment, project management, performance measurement and organizational culture. This methodology-based exploration adds depth to Trkman's insights, offering a nuanced perspective on the factors crucial for successful BPM adoption.

Building on these foundations, Buh, Kovacic, and Stemberger (2015) contributed a valuable case study perspective. Through an in-depth analysis, they identified top management support, IT integration, strategic alignment, governance, methods, project management, performance measurement, organizational culture, and people as critical factors at various stages of BPM adoption. The case study approach lends real-world context to the identified factors, emphasizing their dynamic nature across different phases of implementation.

The alignment among Trkman (2010), Bai and Sarkis (2013), and Buh, Kovacic and Stemberger (2015) is notable. These studies collectively emphasize the consensus on crucial organizational and technological factors that organizations must consider for successful BPM adoption. Top management support, robust IT infrastructure, strategic alignment, effective governance and performance measurement emerge as common factors, forming a solid foundation for organizations working on BPM initiatives.

A broader perspective comes from the systematic literature review conducted by Castro, Dresch, and Veit (2019). Their examination spans 25 articles from 12 countries, unveiling 32 distinct critical success factors. Notable among these are investing in human capital (cited in 15 documents), emphasizing aspects like training and hiring experts, and garnering support from top management (cited in 13 documents). Additionally, the use of a structured methodology, such as project management, emerged as a key factor (cited in 12 documents). This expansive review provides a global view, showcasing diverse experiences and emphasizing the importance of human resources and structured approaches in BPM success.

Alignment of goals and targets to strategic planning emerges as a recurrent theme in both Trkman (2010) and Castro, Dresch, and Veit (2019). Trkman notes that 60-80% of BPM projects fail due to factors such as lack of training and interdepartmental communication, underscoring the importance of strategic alignment. Castro, Dresch, and Veit (2019) reinforce this notion, emphasizing the need for goals and targets to align seamlessly with strategic planning to ensure successful BPM implementation. These collective insights from researchers like Trkman (2010), Bai and Sarkis (2013), Buh, Kovacic, and Stemberger (2015) and Castro, Dresch, and Veit (2019) create a comprehensive understanding of the diverse factors influencing the success of business process management initiatives. This collective wisdom serves as a foundation for organizations considering adopting BPM.

In the pursuit of a more focused exploration, this study aims to outline the influence levels of critical success factors crucial for successful BPM implementation. The initial phase of this study involved a diligent literature review, targeting seminal works addressing critical success factors related to BPM. Using search tools like Google Scholar, online libraries, and researcher platforms such as Emerald Insight, with specific search terms like "critical success factors for BPM" and "successful BPM implementation," helped identify ten influential studies conducted over the last decade (Table 1) to be considered the most important to the topic. Diving deeply into these studies unveiled the most frequently discussed critical success factors.

Top Management Support

Top management support stands out as one of the most frequently identified critical success factors in business process management. Numerous studies, including those by Aysolma et al. (2023), do Amaral Castro et al. (2019) and Bandara et al. (2018) stress the essential role of top management support in promoting project success across all phases of BPM initiatives. The multifaceted nature of top management support is argued to be pivotal for BPM projects' success. Firstly, it involves supporting the decision-making process and mediating disputes as highlighted by Bai et al. (2013) and Hernaus et al. (2016). Secondly, upper management needs extensive knowledge of the ongoing project situation and should be prepared to allocate necessary resources as suggested by Ravesteyn & Batenburg (2010). Study done by Banu Aysolmaz, Anant Joshi, and Maximilian Stubhan (2023) emphasize that management must champion BPM as a priority, drive strategic alignment, provide adequate resources, and remove obstacles. Actively promoting process improvements at the executive level establishes process orientation as a core organizational value (Mala et al., 2016). Alotaibi et al. (2017) further link top leadership involvement to securing necessary funding and personnel. The absence of backing from the C-suite poses the risk of BPM efforts becoming under-resourced, localized initiatives.

Strategic Alignment

Strategic alignment, encompassing the alignment between business and IT strategies, is widely recognized as a critical success factor for BPM implementation. Effective alignment between business and IT is crucial as it promotes collaboration and understanding between the two domains (do Amaral Castro et al., 2019; Gabryelczyk et al., 2018). BPM initiatives often require changes to organizational structures and processes, which may face resistance from employees. Ensuring business-IT alignment helps address such resistance by creating a common understanding of the objectives and priorities between business and IT (Gabryelczyk et al., 2018). It also builds mutual trust that is necessary to overcome cultural barriers between the two domains and facilitate collaboration. Without strong alignment, there is a risk of developing solutions from an IT-centric rather than a business-centric perspective. It also allows an organization to assess how BPM can support business strategies and priorities. Several frameworks highlight the need for alignment between the BPM strategy and function with the overall business strategy (Aysolmaz et al, 2023). Achieving this requires clear communication channels and relationship between business and IT. So effective strategic alignment, which includes shared understanding of goals, priorities and resources between business and IT, is crucial to facilitate collaboration, resources allocation and overall success of complex BPM projects that require changes to existing organizational processes. However, poor alignment can result in the delivery of solutions that fail to meet business requirements.

Communication

Effective communication is crucial to address any challenges, so naturally it is consistently recognized as a critical success factor for BPM in various studies (Bai et al., 2013; Buh et al., 2015; Hernaus et al., 2016). Defined as transparent, two-way interaction between project teams and stakeholders, effective communication is paramount for fostering understanding of goals, resolving disputes, and ensuring continued support (Chong et al., 2010). Regular updates on project progress and impacts serve to keep stakeholders well-informed throughout the BPM journey. Furthermore, addressing concerns openly and engaging in collaborative decision-making fosters transparency and trust in leadership (Bai et al., 2013; Hernaus et al., 2016). BPM projects often involve navigating interdependencies among business processes, individuals, systems and technologies. This interconnectedness highlights the crucial role of effective communication in ensuring successful implementation. Therefore, coordination and cooperation become vital across multiple internal departments and hierarchical levels, working interdependently for process redesign and automation. The absence of effective communication poses risks such as siloed working, reduced coordination and inefficient issue resolution, stemming from stakeholders' lack of awareness regarding interdependencies and project status (Syed et al., 2018). Effective communication fosters collaboration, proactively addresses change and promotes user adoption by ensuring transparency.

Performance measurement

As identified by Bai and Sarkis (2013), measurement is one of the key dimensions that influences BPM success. Using a DEMATEL model they found performance measurement has a significant impact. Measurement allows for continuous process improvement which is a core BPM principle. Trkman (2010) discusses how measurement and control are important BPM activities, noting it is difficult to understand process efficiency without data. It is also emphasized the need for measurement systems to monitor changes over time and enable improvements. Collection and analysis of performance data increases visibility of issues, a key benefit of BPM highlighted by Gabryelczyk et al. (2018). Measurement identifies bottlenecks and problems so organizations can target the right areas for improvements, such as tracing delays (Trkman, 2010). It also provides essential insights for process owners, who rely on visibility into KPIs to manage their areas as discussed in De Bruin and Rosemann (2005). Ongoing measurement is integral to mature BPM practices by supporting insights for improvements, governance through ownership, and benefits tracking. Without measurement, it is difficult for organizations to understand process effectiveness, prioritize actions or demonstrate the impacts of changes. Therefore, the ability to assess performance through metrics is critical to the long-term success of BPM initiatives.

Organizational Culture

As discussed by Hribar and Mendling (2014), organizational culture influences the success of BPM adoption and impacts the resulting increased performance. They analyzed different types of organizational culture and found that certain culture types like adhocracy and clan contribute more towards the success of BPM adoption compared to hierarchy and market culture types. Further, Buh, Kovacic and Stemberger (2015) also identified people and culture as critical success factors for BPM adoption. They stressed that various stages of BPM adoption require different set of critical success factors. For initial stages of BPM adoption, factors like top management support, coordination and readiness are crucial while for later stages, factors related to people and culture become more important. A culture that promotes communication, teamwork and social networks helps in successful BPM adoption. De Bruin and Rosemann (2005) too recognized culture as one of the key dimensions of their proposed BPM Maturity Model. They argued that a culture conducive to organizational changes and continuous process improvement is necessary for higher levels of BPM maturity. Such a culture values employee involvement, empowerment and motivates them for process optimization. Trkman (2010) also identified people and culture as a critical success factor and said that adopting new ways of working requires changing organizational culture, employee mindsets and behaviors. Organizational culture plays a significant role in facilitating BPM adoption and taking it to higher levels of maturity. A culture that embraces organizational changes, communication, teamwork and social networks helps employees adopt new process-oriented ways of working. It motivates them to focus on continuous process improvements. Thus, creating a culture conducive to change management is critical for successful BPM implementation in organizations.

Information Technology

As described in several studies, IT is seen as one of the main critical success factors for BPM (Bai et al., 2013; Bandara et al., 2015; Ravesteyn et al., 2010). Without appropriate IT systems and tools, organizations would find it difficult to model, automate, monitor and improve their business processes (Buh, et al., 2015). IT acts as an enabler for various BPM capabilities like process documentation, execution, control and analysis (Gabryelczyk et al., 2017). Process models created using modeling notations and tools allow organizations to gain strategic insights into how work is performed and how processes can be optimized. IT then facilitates implementation through workflow automation and integration using tools like case management systems, workflow engines and BPMN (Gabryelczyk et al., 2017; Ramdani et al., 2009). Performance data from such systems provides inputs for continuous process improvement. Existing IT landscapes need to support a process-centric way of working. For instance, ERP systems which follow a modular, process-based approach have been shown to aid BPM adoption (Gabryelczyk et al., 2017). On the other hand, satisfaction with existing automated systems may discourage process changes promoted by BPM. System complexity can also negatively impact adoption (He et al., 2014). IT also facilitates improvement through performance measurement, a key adoption factor (Bandara, 2019; Buh et al., 2015). The level of IT support available determines ease and success of BPM adoption.

To summarize, critical success factors discussed provide a foundation for better understanding elements necessary to support successful BPM initiatives. Top management support, strategic alignment, effective communication, performance measurement, organizational culture, and appropriate information technology have all been shown to influence BPM adoption and ongoing success. However, existing literature provides little clarity on the degree of impact that each CSF has. While certain factors like top management support and strategic alignment tend to be highlighted as especially important, the influence of individual CSFs likely varies depending on organizational context and project details. More research is needed to examine the level of influence that different CSFs have on BPM implementation. Understanding the relative significance of each CSF could help practitioners more precisely allocate scarce time and resources during the planning and execution of transformation efforts. With clearer insight into which factors exert the strongest impacts, organizations would be better equipped to maximize their chances of realizing process improvements and anticipated strategic benefits from BPM.

Although a considerable amount of research has focused on critical success factors in business process management overall (Table 2.), there is still a noticeable lack of studies that examine the role of these factors at specific stages of implementation.

Table 2. *Structural analysis of previously conducted studies*

Source	Research object	Method
Aysolmaz, B., Joshi A., and Stubhan, M. (2023).	Critical success factors for BPA with respect to BPM.	Quantitative, using a survey sample of 139 experts.
Skarpmoen Eriksen, O. and Jensen, J. (2020).	Critical success factors in the implementation stage of BPM project.	Qualitative, using a case study with 9 interviewed experts.
Kaziano do Amaral Castro, B., Dresch, A., Rafael Veit, D. (2019).	Critical success factors affecting the success of BPM implementation.	Quantitative, using a survey sample of 113 experts.
Bandara, W., Gable, G., Tate, M., and Rosemann, M. (2019).	BPM project success model.	Quantitative, using a survey sample of 261 experts.
Gabryelczvk, R. (2018).	Factors that create an enviroment for successful BPM adoption.	Qualitative, using Jabareen's methodology.
Roztocki, N. and Gabryelczvk, R. (2018).	Business process management framework for transition economies.	Qualitative, using Jabareen's methodology.
Lückmann, P., and Feldmann, C. (2017).	Success factors for business process improvement projects in small and medium sized enterprises.	Quantitative, using a survey sample of 31 experts.
Buha, B. , Kovačič, A., and Indihar Štembergera, M. (2015).	Critical success factors for different stages of business process management adoption.	Qualitative, using a case study with 6 interviewed experts.
Trkman, P. and Škrinjar, R. (2013).	BPM creating a higher business process orientation.	Blended: qualitative using case study and quantitative method

		using a survey sample of 324 companies.
Bai, C. and Sarkis, J. (2013).	A grey-based DEMATEL model for evaluating business process management critical success factors.	Qualitative, using a field study with 25 interviewed experts.

Source: Compiled by the author based on literature review, 2024.

One stage that appears particularly underexplored is new process implementation - the point at which designed processes are actually put into practice within an organization. This stage is especially important, because it often determines whether the planned changes will succeed or fail in real-world conditions. However, most existing studies tend to look at BPM implementation as a whole, without clearly separating the planning phase from the execution phase, even though each presents different challenges and success requirements. Therefore, this study aims to address this gap by investigating which CSFs have the greatest influence specifically on the new process implementation stage in order to provide useful insights for organizations going through this critical part of the BPM journey.

2. RESEARCH METHODOLOGY OF IDENTIFYING THE INFLUENCE LEVEL OF CRITICAL SUCCESS FACTORS ON NEW PROCESS IMPLEMENTATION

This part of research focuses on six critical success factors — top management support, strategic alignment, communication, performance measurement, organizational culture and information technology — that were chosen based on theoretical research to ensure they are suitable for analysing the influence on new process implementation within business process management. To make sure the data is reliable, expert responses were carefully collected and normalized to reduce individual differences and improve consistency. The DEMATEL method was then used to explore how these factors are connected and how much they influence one another. This helps better understand which factors should be prioritized and how they interact during new process implementation.

2.1.Research objective and tasks

Research objective is to evaluate the influence levels among critical success factors to determine which should be prioritized during new process implementation.

In order achieve the research objective the following **research tasks** are set:

1. Combine and assess the direct influence between each pair of critical success factors using a structured pairwise comparison scale;
2. Apply the DEMATEL methodology to calculate direct, indirect and total influence relationships among the critical success factors including prominence and net influence metrics;
3. Based on the results obtained, identify which critical success factors should be the priority focus areas for new process implementation.
4. Provide conclusion and recommendations.

2.2. Research method

In order to achieve research objective, the DEMATEL (Decision Making Trial and Evaluation Laboratory) methodology was chosen. Originally developed by the Battelle Memorial Institute in the

1970s, this methodology is used to analyse and visualize complicated causal relationships among factors by incorporating qualitative expert judgments and generating cause-effect scores (Bai et al., 2013.). Selecting the DEMATEL methodology for this study is based on theoretical reasoning, mainly due to the following factors:

1. Assessing factor importance: This methodology allows to calculate cause-effect scores, offering a clear indication of how important and influential each factor is within the specific research context (Bai et al., 2013.).
2. Incorporating insights: DEMATEL integrates qualitative expert judgments regarding the strengths of relationships, ensuring that subjective insights play a crucial role in the analysis. (Khan et al., 2022.)
3. Prioritizing factors: By unravelling causal relationships and evaluating their strengths, this methodology assists well in identifying priority focus areas. This is particularly beneficial for determining which factors should be the primary areas of emphasis to ensure the successful implementation of business process management (Bai et al., 2013.).

Based on the DEMATEL methodology, this study will undertake interviews with representatives from diverse organizations using a semi-structured questionnaire. The interview is divided into three question groups (Figure 1). The initial focus is on clarifying the tenure, aiming to facilitate comparative analyses of influence levels in relation to years of experience within the organization. Following this, an evaluation will be undertaken to determine the level of maturity in business process management within the involved organizations. At the core of this research lies a diligent examination of the influence levels attributed to critical success factors, serving as a crucial component for obtaining well-founded conclusions on the prioritization of critical success factors.

Figure 1. *Question groups.*

Source: Compiled by the author, 2024.

By applying the DEMATEL methodology in this structured way, the study aims to reveal the most influential factors driving the success of new process implementations, thereby guiding future efforts in strategic alignment and process improvement within business process management.

2.3. Research plan

This research applies the DEMATEL methodology to evaluate the influence and interdependencies of critical success factors in new process implementation within business process management following the research plan outlined below:

1. Collect expert input using pairwise comparisons to assess the direct influence between each pair of critical success factors on a 0–4 scale.
2. Construct the average direct relation matrix D=[dij] where each element indicates the degree of influence from factor i to factor j.
3. Normalize the matrix D using:

$$N = \frac{D}{\max_i \sum_{j=1}^{n} d_{ij}}$$

4. Calculate the total relation matrix by $T=N(I-N)^{-1}$.
5. Compute the influence degree (row sum) R_i and dependence degree (column sum) C_i for each factor.
6. Derive prominence R+C to measure total involvement and net influence R−C to classify factors as causes or effects.
7. Conduct subgroup analysis by hierarchical level (e.g., director, manager, specialist) and tenure, ensuring consistent normalization across segments.
8. Interpret the findings to recommend CSF prioritization strategies for more effective process implementation in business process management contexts.

2.4. Selection of interviewers

Experts are essential in the DEMATEL methodology, because it is their opinions and assessments that are used to determine the importance of criteria and evaluate alternatives. In this regard, experts should be selected based on the following requirements:

1. Diverse organizational roles - to capture a broad and balanced view of the issue, respondents were intentionally selected from different hierarchical levels within the organization, promoting a multi-level assessment of the critical success factors (Lin et al., 2009);

2. Professional tenure and reliability – to reflect a stable and experienced perspective, experts needed to have at least three years of professional experience in their respective fields (Hsu et al., 2014);
3. Relevant knowledge and experience – participants were required to have a minimum of a bachelor's degree and demonstrated expertise in the subject matter, ensuring informed and meaningful input (Asad et al., 2016).

Table 3. *Criteria for the selection of experts.*

Hierarchical level	Tenure	Education
General Manager/Director	Three years within the organization	Higher education
Manager		
Process specialist		

Source: Compiled by the author, 2024.

In terms of the sample size requirements for DEMATEL, different studies have involved four to twenty experts in general. Based on overall DEMATEL size in previous studies (Table 3), it is believed that 18 experts would ensure reliability of the study.

Table 4. *Sample size of the critical success factor studies based on DEMATEL*

No.	Author	Research title	Sample size
1.	Bai, C. and Sarkis, J. (2013).	A Grey-based DEMATEL Model for Evaluating Business Process Management Critical Success Factors	25
2.	Putri, S. A., & Ardi, R. (2024).	Critical Success Factors of Electric Mobility Transition in Indonesia: A DEMATEL-Based ANP Approach	9
3.	Gupta, P. and Khanna, P. (2023)	Analyzing the interaction of critical success factor for TQM implementation- A grey-DEMATEL approach	4
4.	Orfanidou, V., Dimitriou, D., Rachaniotis, N., & Tsoulfas, G. (2024).	Critical Factors for Green Public Procurement: The Case of Greece	14

5.	Ren, L., & Luo, C. (2018)	Questionnaire survey and DEMATEL method approach for analysis the influent factors of Chinese scientific Principal Investigators.	24
6.	Khan, S., Singh, R., Haleem, A., Dsilva, J., & Ali, S. S. (2022).	Exploration of Critical Success Factors of Logistics 4.0: A DEMATEL Approach	6
7.	Hsieh, Y.-F., Lee, Y.-C., & Lin, S.-B. (2016)	Rebuilding DEMATEL threshold value: an example of a food and beverage information system	17
8.	Wang, X., Zhou, M., & Su, M. (2025).	Critical Success Factors for Enhancing Intelligent Loading and Unloading in Urban Supply Chains: A Comprehensive Approach Based on Fuzzy DEMATEL	16
9.	Chatzifoti, N., Chountalas, P. T., Agoraki, K. K., & Georgakellos, D. A. (2025).	A DEMATEL Based Approach for Evaluating Critical Success Factors for Knowledge Management Implementation: Evidence from the Tourism Accommodation Sector	4
10.	Goodarzi Hosseinabadi, F., Akhavan Anvari, M. R., & Raissifar, K. (2024).	Identification and Prioritizing Critical Success Factors for HR Shared Services Implementation in Multi-Business Firms Using DEMATEL Method	13

Source: Compiled by the author, 2024.

3. ANALYSIS AND SUMMARY OF RESEARCH DATA ON IDENTIFYING THE INFLUENCE LEVEL OF CRITICAL SUCCESS FACTORS ON NEW PROCESS IMPLEMENTATION

The data collection phase of this study was conducted throughout April 2025. During this time a diverse pool of potential subject-matter experts in the filtration manufacturing industry was approached through various channels, including in-person meetings, phone calls and email correspondence. Each expert was provided with an overview of the study's objectives, the methodology and the importance of their contribution to ensuring the reliability and validity of the findings. Guidance on how to complete the questionnaire was also shared to assure consistency and clarity in responses. Experts who consented to participate received a structured electronic questionnaire (refer to Appendix 1). A total of 18 experts took part in the study. To preserve confidentiality, all identifying details—such as participants' positions within organizations, years of experience within organizations and academic credentials—are anonymized.

Table 5. *List of experts*

No.	Position	Tenure	Education
1.	Director	16 years	Master‘s degree
2.	Director	14 years	Master‘s degree
3.	Director	18 years	Master‘s degree
4.	Director	10 years	Master‘s degree
5.	Director	17 years	Master‘s degree
6.	Manager	26 years	Bachelor‘s degree
7.	Manager	25 years	Bachelor‘s degree
8.	Manager	9 years	Master‘s degree
9.	Manager	8 years	Master‘s degree
10.	Manager	17 years	Master‘s degree
11.	Manager	3 years	Bachelor‘s degree
12.	Manager	17 years	Master‘s degree
13.	Manager	20 years	Master‘s degree
14.	Process specialist	8 years	Master‘s degree
15.	Process specialist	4 years	Bachelor‘s degree

16.	Process specialist	7 years	Bachelor‘s degree
17.	Process specialist	6 years	Master‘s degree
18.	Process specialist	17 years	Master‘s degree

Source: Compiled by the author, 2025.

3.1. Analysis and results of combined data from experts

The process of analysis began with the construction of a direct relation matrix (D). In this matrix each row and column represented one of the six CSFs. The matrix values reflect the degree to which each factor influences the others on a scale from 0 (no influence) to 4 (very high influence).

Table 6. *The list of ratings*

Rating	Label	Description
0	No influence	The factor has no noticeable effect on the other factor. There is no interaction or dependency between the two.
1	Low influence	The factor has a minor or weak effect. It contributes slightly, but the impact is limited and not critical.
2	Medium influence	The factor has a moderate effect. It plays a noticeable role in influencing the other factor, but it is not dominant.
3	High influence	The factor has a strong effect. It significantly impacts the other factor and is an important contributor.
4	Very high influence	The factor has a dominant or critical influence. It strongly determines or drives the behavior or performance of the other factor.

For example the value in the cell where TMS intersects SA was 4 which indicates a very strong influence of top management support on strategic alignment.

Table 7. *Direct relation matrix*

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	3	3	3	3
SA	3	0	3	3	3	2
COM	3	3	0	3	3	2
PM	3	3	3	0	3	2
OC	3	3	3	2	0	2

IT	2	2	2	3	2	0

Source: Compiled by the author based on experts' responses, 2025.

Similarly values such as 3 and 2 denoted medium to strong influences among the other factor pairs. The diagonal values were set to zero to reflect that a factor does not influence itself directly in this model.

Once the direct relation matrix was established, it was normalized to bring all values into a comparable scale. The normalization was done by dividing each element by the maximum row sum, ensuring that the highest possible influence a factor could exert was normalized to 1.

Table 8. *Normalized direct relation matrix*

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.25	0.1875	0.1875	0.1875	0.1875
SA	0.1875	0	0.1875	0.1875	0.1875	0.125
COM	0.1875	0.1875	0	0.1875	0.1875	0.125
PM	0.1875	0.1875	0.1875	0	0.1875	0.125
OC	0.1875	0.1875	0.1875	0.125	0	0.125
IT	0.125	0.125	0.125	0.1875	0.125	0

Source: Compiled by the author based on experts' responses, 2025.

The normalized matrix (N) maintained the relative strength of influence but on a scale between 0 and 1. For example, the influence of TMS on SA became 0.25 and the influence of TMS on COM became 0.1875. This matrix captures the direct influence, but does not account for the propagation of influence through the network of relationships.

The next matrix was the identity matrix (I), a standard square matrix with 1s on the diagonal and 0s elsewhere.

Table 9. *Identity matrix*

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0

PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

Source: Compiled by the author based on DEMATEL methodology, 2025.

The identity matrix is critical in matrix algebra as it functions as a multiplicative identity. Subtracting the normalized direct relation matrix from the identity matrix yielded the (I - N) matrix.

Table 10. *Matrix (I - N)*

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.25	-0.1875	-0.1875	-0.1875	-0.1875
SA	-0.1875	1	-0.1875	-0.1875	-0.1875	-0.125
COM	-0.1875	-0.1875	1	-0.1875	-0.1875	-0.125
PM	-0.1875	-0.1875	-0.1875	1	-0.1875	-0.125
OC	-0.1875	-0.1875	-0.1875	-0.125	1	-0.125
IT	-0.125	-0.125	-0.125	-0.1875	-0.125	1

Source: Compiled by the author based on experts' responses, 2025.

This subtraction reveals the residual structure after removing the direct effects from the system and it is a necessary step before calculating the total effects.

The inversion of the (I - N) matrix, noted as $(I - N)^{-1}$, allowed for the capture of both direct and indirect influences among the factors. This step is crucial in DEMATEL because it gathers the influences that a factor has on others through both direct and indirect paths.

Table 11. *Inverse matrix* $(I\text{-}N)^{-1}$

$(\mathbf{I\text{-}N})^{-1}$	TMS	SA	COM	PM	OC	IT
TMS	2.044636	1.3101432	1.2025308	1.1916993	1.2025308	0.9967323
SA	1.0990753	1.9990266	1.0990753	1.0868386	1.0990753	0.8665786
COM	1.0990753	1.1569214	1.9411806	1.0868386	1.0990753	0.8665786
PM	1.0990753	1.1569214	1.0990753	1.9289439	1.0990753	0.8665786
OC	1.0412292	1.0960308	1.0412292	0.9853153	1.8833345	0.8209692
IT	0.8665786	0.912188	0.8665786	0.9055135	0.8665786	1.6063408

Source: Compiled by the author based on experts' responses, 2025.

For example, TMS may influence IT not only directly but also through SA and PM. The resulting inverse matrix showed values such as 2.0446 for TMS influencing itself indirectly, 1.3101 for TMS influencing SA and 0.9967 for TMS influencing IT. These values highlight how influence flows throughout the system, not just in one-step relationships, but also through multiple pathways.

Multiplying the normalized matrix (N) with the inverted matrix $(I - N)^{-1}$ produced the total relation matrix $(T) = N(I-N)^{-1}$. Each value in this matrix reflects the total influence (direct + indirect) that one factor exerts on another.

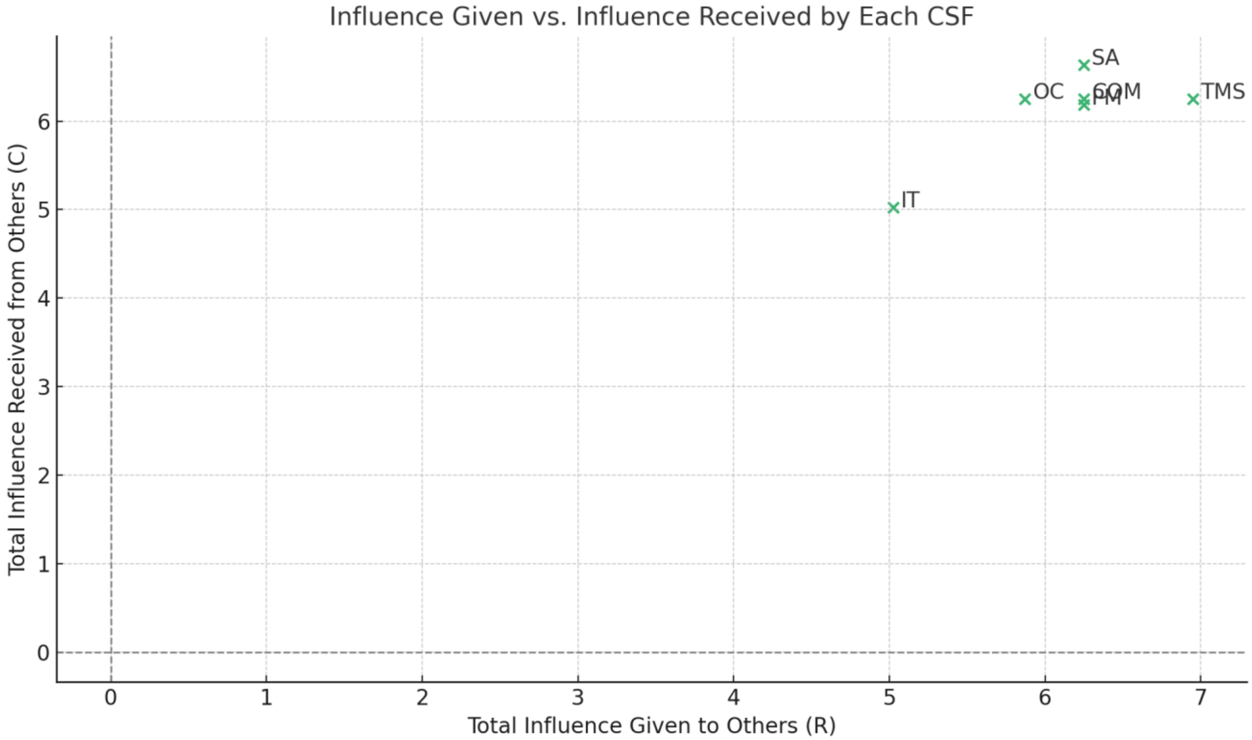
Table 12. *Total relation matrix*

T	TMS	SA	COM	PM	OC	IT
TMS	1.044636	1.3101432	1.2025308	1.1916993	1.2025308	0.9967323
SA	1.0990753	0.9990266	1.0990753	1.0868386	1.0990753	0.8665786
COM	1.0990753	1.1569214	0.9411806	1.0868386	1.0990753	0.8665786
PM	1.0990753	1.1569214	1.0990753	0.9289439	1.0990753	0.8665786
OC	1.0412292	1.0960308	1.0412292	0.9853153	0.8833345	0.8209692
IT	0.8665786	0.912188	0.8665786	0.9055135	0.8665786	0.6063408

Source: Compiled by the author based on experts' responses, 2025.

To interpret these findings, the sum of each row (R) and each column (C) in the total relation matrix was calculated. The row sum (R) represents the total influence a factor exerts on the system, while the column sum (C) indicates the total influence a factor receives from the system. These values provide insight into each factor's role within the network.

Figure 2. *Scatter plot of influence given vs influence received*



Source: Compiled by the author based on experts' responses, 2025.

For example, TMS had the highest R value (6.9483), meaning it was the most influential factor overall. IT had the lowest R value (5.0238), indicating it exerted the least influence.

Table 13. *Influence - prominence matrix*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	6.948272266	6.249669749	13.19794201	0.698602517
SA	6.249669749	6.631231315	12.88090106	-0.381561566
COM	6.249669749	6.249669749	12.4993395	0
PM	6.249669749	6.185149134	12.43481888	0.064520615
OC	5.868108183	6.249669749	12.11777793	-0.381561566
IT	5.023778071	5.023778071	10.04755614	0

Source: Compiled by the author based on experts' responses, 2025.

The combination of R and C (R+C) was calculated to show how important each factor is in the whole system. TMS again emerged as the most prominent factor with a value of 13.1980, followed by SA (12.8809), COM (12.4993), PM (12.4348), OC (12.1178) and IT (10.0476). This metric identifies which factors are most connected to the system, either by influencing or being influenced.

The difference between R and C (R-C) was computed to determine the net influence of each factor. A positive R-C indicates a net cause factor, one that influences others more than it is influenced. A negative R-C denotes an effect factor, influenced more than it influences. TMS had the highest positive net influence (0.6986), categorizing it as a strong cause factor. PM had a small positive net influence (0.0645) while SA and OC both had negative net influences (-0.3816), suggesting that they are primarily effect factors.

Interpreting these results in the context of new process implementation reveals several critical insights. The strong influence of top management support confirms that leadership plays a decisive role in driving process change. To ensure successful implementation, organizations must involve top management visibly through resource allocation, active sponsorship and clear communication of the change vision. TMS emerges as a key enabler within the system of critical success factors, triggering improvements in strategic alignment, employee motivation and interdepartmental coordination. Its high R and R–C scores reflect its cascading impact on other CSFs, reinforcing the notion that without leadership backing, process initiatives risk stagnation. In addition, top management support helps minimize resistance to change by giving legitimacy to new process initiatives and ensuring that incentives, responsibilities and performance expectations are clearly aligned from senior leadership downward.

Strategic alignment, though heavily influenced by others, notably by TMS and COM, shows a negative net influence. This indicates that alignment with organizational strategy is an outcome of upstream support and communication. Companies must ensure that strategic priorities are communicated clearly and integrated with new process goals. This alignment can only be realized when foundational factors like management support and internal communication are strong.

Communication emerged as a central and balanced factor with equal influence received and exerted (R=C=6.2497). This balance indicates that communication plays a dual role in the network of critical success factors as it both sends and receives influence. Moreover, 63% of the experts identified communication as the most important critical success factor, emphasizing its fundamental role in facilitating understanding, coordination and alignment throughout process implementation. Effective communication enables the smooth flow of strategy, training, change efforts and coordination across the organization. Its pivotal role highlights the need to invest in clear, two-way communication throughout the rollout of new processes.

Performance measurement shows a slightly higher influence (R = 6.25) than dependence (C = 6.19) which indicates that it plays a proactive role in shaping outcomes while remaining moderately affected by other factors. Its near-neutral net influence (R–C = 0.065) suggests that PM functions as a stabilizing element within the system meaning guiding, monitoring and reinforcing behaviors. Well-designed KPIs and review cycles allow PM to influence other CSFs indirectly such as communication and culture. This makes PM not just a reporting tool, but a strategic asset that helps sustain momentum and focus. When integrated properly, PM enhances coordination and contributes meaningfully to the success of business process initiatives.

Organizational culture had a lower influence score (R = 5.87) and a higher dependence score (C = 6.25), resulting in a negative net influence (R−C = –0.38) which positions it clearly as an effect factor within the system. This means OC is more shaped by external inputs, especially leadership direction, communication practices and strategic alignment, than it is a driver of change itself. Despite its reactive nature, culture plays a crucial role in determining how well new processes are adopted as it influences mindset and openness to change. Aligning organizational values with BPM objectives through dialogue and recognition can help build a culture that supports long-term transformation.

Information technology, the least influential and most isolated factor in terms of net influence (R=C=5.0238, R−C=0), functions more as a supportive enabler than a primary driver in the context of new process implementation. This neutral position in the system suggests that IT neither strongly influences nor is heavily influenced by the other critical success factors. Instead, its role is largely contingent meaning it provides the technical backbone that allows well-structured processes to operate efficiently but does not, on its own, initiate or direct change.

From a practical application standpoint, this DEMATEL-based analysis provides a clear roadmap for prioritizing critical success factors. Change initiatives should start with reinforcing top management support. This includes ensuring executives are not only sponsors but also champions of process changes. Leadership's attitude towards new processes sets the tone for the rest of the organization.

Next, organizations should focus on strengthening communication channels. Effectively conveying the purpose and direction of change through various channels and incorporating feedback can strengthen team cohesion and alignment. Communication should be bidirectional, enabling employees at all levels to contribute insights and raise concerns.

Strategic alignment efforts should ensure that every process implementation is connected to broader organizational objectives. BPM teams must work closely with strategy teams to map goals and ensure tactical steps align with long-term vision. This also involves cascading strategic goals into operational plans.

Performance measurement systems must be revisited to reflect new processes. KPIs should be designed to track process adoption, efficiency, error reduction and employee engagement. Reviewing real-time dashboards and mechanisms can help monitor progress and intervene early when issues arise.

To shape a supportive culture, organizations must invest in training, recognition systems and symbolic actions that reinforce desired behaviors. Leaders should model process-oriented thinking, cross-functional collaboration and openness to feedback. Cultural shifts often lag behind structural changes, so patience and persistence are needed.

Lastly, information technology investments must be strategically timed. IT solutions should follow or accompany well-defined process designs. Tools such as workflow automation, process modelling software and data analytics platforms can support new process implementation, but they must be integrated with the human and strategic dimensions.

All in all, the resulting insights reveal the foundational importance of top management support and communication, the reactive nature of strategic alignment and organizational culture and the enabling but secondary role of IT. For organizations embarking on new process implementations, the results of analysis indicate a practical framework to guide planning, resource allocation and change management strategies. By aligning efforts around the most influential CSFs companies can significantly increase the likelihood of successful new process implementation outcomes and long-term organizational resilience.

3.2. Comparative analysis of expert responses by hierarchical level

To gain a more nuanced understanding of the dynamics among critical success factors in new process implementation, it is necessary to move beyond the generalized understanding and examine how perceptions vary across different hierarchical levels. The earlier analysis which combined input from all 18 experts into a single dataset treated the organizations as a whole. Although helpful for spotting overall trends, this approach can overlook important differences in how individuals at the director, manager and specialist levels perceive priorities, influences and dependencies. These differences often arise from their distinct roles, responsibilities and daily experiences within the organization.

This next phase of analysis focuses on three distinct hierarchical levels by separating the data into director, manager and specialist groups. By analyzing these groups separately, the aim is to determine whether interpretations of the influence structure are consistent across levels or if discrepancies exist that may signal misalignments in understanding, communication or implementation readiness.

Table 14. *Influence-prominence matrix based on director level responses*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	9.909241587	9.342402023	19.25164361	0.566839564
SA	9.913703502	8.859048992	18.77275249	1.05465451
COM	9.288212033	10.34151789	19.62972992	-1.053305853
PM	8.213714189	8.667060638	16.88077483	-0.453346449
OC	8.313115722	8.911634037	17.22474976	-0.598518315
IT	8.124475905	7.640799363	15.76527527	0.483676542

Source: Compiled by the author, 2025.

Starting with the directors' analysis, TMS, SA and COM emerged as the most prominent factors based on their R+C values. TMS and SA both showed high influence scores (R values of 9.91 and 9.91 respectively) indicating that senior leaders see themselves as critical drivers of new process success. However, while SA also scored high in influence, it had a notably lower dependence score (C=8.86) that results in the highest net influence value among all CSFs (R−C = 1.05). This suggests that strategic alignment is perceived as a top-down outcome driven by leadership rather than collaborative input. Interesting enough, COM received the highest dependence score among all CSFs (C = 10.34) reflecting a belief that effective communication relies on the broader network of factors being aligned and active. This aligns with the interview findings suggesting that communication is shaped by leadership behavior, organizational culture and the way systems are coordinated.

Table 15. *Influence-prominence matrix based on managerial level responses*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	6.37836859	5.695093758	12.07346235	0.683274832
SA	6.00945016	5.695093758	11.70454392	0.314356402

COM	5.715643463	5.344721295	11.06036476	0.370922168
PM	5.362188544	5.657076805	11.01926535	-0.294888261
OC	5.011873005	5.695093758	10.70696676	-0.683220753
IT	4.582327254	4.972771641	9.555098895	-0.390444387

Source: Compiled by the author, 2025.

Managerial perspectives presented a different pattern reflecting their intermediary role between strategic leadership and operational execution. Although top management support and strategic alignment remained influential with R values of 6.38 and 6.01 respectively, their impact was noticeably weaker compared to the director group. This suggests that while managers acknowledge the importance of leadership direction and alignment with strategic goals, they also recognize the limitations of relying solely on top-down influence for successful implementation. Instead, managers appear to adopt a more integrative and operationally grounded viewpoint, placing balanced emphasis across all six critical success factors.

One of the most telling indicators of this shift is the role of communication which in the managerial data shows a relatively high net influence score of +0.37. This suggests that managers see communication not just as a means of passing down decisions from upper levels, but as a proactive and empowering tool for facilitating implementation. It may be that for them effective communication facilitates coordination, fosters mutual understanding across departments, helps resolve conflicts and ensures that the intended purpose of process changes is clearly understood and accepted throughout the organization.

Moreover, the relatively balanced R−C scores across all factors suggest that managers view the critical success factors as part of an interconnected system rather than seeing any one factor as dominant or entirely reactive. This perspective likely reflects the manager's role within the organization as someone who bridges strategic vision and day-to-day operations, coordinates across functions and ensures alignment. From this standpoint, successful process implementation relies less on the strength of a single factor and more on the effective coordination and interaction among all six CSFs.

This interconnected view also suggests that managers experience firsthand the dynamic nature of implementation: challenges in one area (e.g., weak IT support or unclear performance metrics) often have ripple effects across other areas. Thus, they are likely to perceive each CSF not as an isolated input but as part of a system that must function cohesively for change efforts to succeed. In practical terms this implies that managers may be well-positioned to identify misalignments early and advocate for alternative strategies. It also underscores the importance of providing them with the authority, resources and support needed to respond effectively when challenges emerge.

Table 16. *Influence-prominence matrix based on specialist level responses*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	10.13734991	10.05249174	20.18984165	0.084858171
SA	9.611171817	9.640905181	19.252077	-0.029733364
COM	9.523561907	9.640905181	19.16446709	-0.117343274
PM	9.492444101	8.933536588	18.42598069	0.558907512
OC	8.472761606	9.61924273	18.09200434	-1.146481124
IT	7.881523294	7.231731215	15.11325451	0.649792079

Source: Compiled by the author, 2025.

The process specialists offered yet another distinctive perspective, one deeply grounded in the realities of day-to-day execution. Although top management support remained the most prominent factor overall based on R+C, the patterns of influence revealed some notable and nuanced shifts in how other factors are perceived at the execution level. Notably, performance measurement and information technology emerged as the most influential factors in terms of net influence with R−C values of +0.56 and +0.64. This shift suggests that for those directly responsible for carrying out new processes the tools that measure, guide and support their work are more critical to success than high-level strategic alignment or even leadership advocacy alone.

Similarly, the high net influence of IT reflects the increasing dependency of modern processes on reliable, efficient and user-friendly digital tools. For process specialists IT systems are the platforms through which work is conducted: from accessing documentation and submitting reports to managing workflows and communicating with cross-functional teams. When IT systems are robust and intuitive, they can streamline tasks, reduce error rates and minimize frustration. Conversely, if systems are outdated, misaligned with the workflow or poorly implemented, they can become significant barriers to success. The elevated importance of IT in this group's perspective reinforces the idea that successful new process implementation must prioritize IT tools when deploying new technologies.

Perhaps the most concerning finding in the process specialists' data is the significantly negative net influence score for organizational culture with a value of −1.15 which is the most extreme of any CSF across all hierarchical levels. This strongly suggests that specialists feel disconnected from the cultural shifts intended by senior leadership or that they experience culture as something static and externally imposed. Instead of being seen as co-creators of culture, they may feel like passive recipients of policies, slogans or values that do not reflect the reality of their work environment.

According to the feedback from specialists, new process implementation efforts need to match the real-life needs of those doing the work. Leaders and managers should make sure that performance measurement tools are easy to understand, clearly show what success looks like and actually help people improve. When introducing IT systems, it is important that they are user-friendly and come with proper training and support. Most importantly building a positive workplace culture should not be something only leaders talk about as it should involve everyone. Specialists need to feel that their voices matter and that they can help shape the culture they work in.

Comparing these three hierarchical levels reveals a meaningful shift in how CSFs are perceived as one moves down the organizational pyramid. Directors emphasize factors such as TMS and SA, managers show a more distributed view emphasizing communication and operational balance and specialists focus on tools and structures needed to execute processes successfully.

These differences underscore the need for differentiated communication and engagement strategies during new process implementation. What resonates with senior leadership may not align with frontline needs. Therefore, organizations should consider a tiered CSF engagement model — starting from leadership advocacy, through managerial coordination, down to resource and infrastructure enablement for specialists.

In practice this means organizations should ensure that senior leaders are visible and vocal in process initiatives to establish legitimacy and alignment. Managers should be trained and empowered as communicators and translators of strategy. Meanwhile specialists must be provided with robust training, intuitive IT systems and clear measurement frameworks that enable day-to-day process execution. Only by understanding and addressing these layered perspectives can organizations effectively implement new processes that are embraced at all levels and sustained over time.

In terms of implementation strategy, this comparative understanding offers several concrete directions. First, any new process implementation initiative should begin with a multi-level needs assessment, collecting input not only from decision-makers, but also from those who execute and monitor the process. Second, communication and training plans must be designed with audience segmentation in mind tailoring content, format and frequency by level. Third, strategic KPIs should be translated into process KPIs that teams can act on, understand and track regularly. Finally, IT tools should not only be functional, but intuitive and supportive of daily tasks.

3.3. Comparative analysis of expert responses by tenure

In addition to analysing differences by hierarchical level, this analysis also explores whether an expert's tenure within the organization influences their perception of critical success factors in new process implementation. Experts were divided into three distinct categories based on their tenure within the organization: those with 3 to 9 years of experience, those with 10 to 17 years, and those with more than 18 years. By comparing responses across different tenure groups, this section aims to uncover whether experience level impacts the way CSFs are evaluated and prioritized offering further nuance for tailoring implementation strategies.

Initially, each group's direct-relation matrix was processed using the standard DEMATEL procedure, which involves normalizing the matrix by dividing all entries by the maximum row sum within that specific matrix. This method helps keep the calculations stable and consistent when creating the total relation matrix. However, it introduces a methodological limitation when comparing results across groups. Because each matrix is normalized with a different denominator, the resulting influence (R), dependence (C), prominence (R+C), and net influence (R−C) values are scaled differently making direct cross-group comparisons invalid.

To overcome this issue, a unified normalization approach was adopted. All three direct-relation matrices were re-normalized using a single common denominator, the maximum row sum observed across one of the three matrices valued 17. This standardization made sure all values were adjusted using the same maximum reference point allowing for fair and accurate comparisons between three different tenure groups.

This recalibration is consistent with best practices in comparative DEMATEL studies, especially those seeking to evaluate perceptual differences among multiple stakeholder groups (Tseng, et al., 2007). The same scale across all groups is applied to ensure that the differences in influence scores reflected real variations in expert opinions rather than inconsistencies caused by different normalization factors. This step helped make the results more reliable and directly comparable.

Table 17. *Influence-prominence matrix based on 3 to 9 years of tenure*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	4.800850185	4.772532785	9.57338297	0.028317399
SA	4.524619224	4.829240286	9.35385951	-0.304621063
COM	4.524619224	4.540613647	9.065232871	-0.015994423
PM	4.772532785	4.495502103	9.268034888	0.277030682
OC	4.235992584	4.540613647	8.776606231	-0.304621063
IT	3.958271234	3.638382767	7.596654001	0.319888467

Source: Compiled by the author, 2025.

Beginning with the experts who have between 3 to 9 years of tenure within their organizations, the results reveal a relatively balanced perception of influence and dependence across the factors. TMS shows the highest total prominence (R+C = 9.573) indicating that respondents view it as highly central to the process of implementing new initiatives. However, its net influence (R–C = 0.028) is nearly neutral indicating that while TMS plays an active role in both shaping and being shaped by other factors, it doesn't stand out as a dominant driver in terms of overall directional influence. Performance measurement, on the other hand, has a slightly higher net influence score (0.277), suggesting it plays a more active role as a driver rather than a receiver in the system. Interestingly, information technology, despite having the lowest prominence score (7.597), registers the highest positive net influence (0.320), which could indicate that younger professionals perceive IT as a proactive enabler rather than a reactive component in process implementation. Strategic alignment and organizational culture share a net influence value of -0.305, suggesting they are seen as more dependent elements in the process, especially in the eyes of less tenured professionals.

Table 18. *Influence-prominence matrix based on 10 to 17 years of tenure*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	4.285386991	4.059501278	8.344888269	0.225885712
SA	3.807251718	4.076234353	7.883486071	-0.268982634
COM	4.275326228	4.272736328	8.548062556	0.002589899
PM	3.55423847	3.724839791	7.279078261	-0.170601322

OC	3.807251718	4.086896105	7.894147823	-0.279644387
IT	3.75545373	3.264700999	7.02015473	0.490752731

Source: Compiled by the author, 2025.

In the group of experts with 10 to 17 years of experience a slightly different picture emerges. Here communication is seen as the most prominent factor (R+C = 8.548) closely followed by TMS (R+C = 8.345). This suggests a shift in what is seen as central, from formal leadership elements like TMS to relational aspects such as communication, possibly indicating a more refined perspective that develops with greater experience. Nevertheless, the net influence of COM is nearly neutral (0.003) indicating a balance in its role as both an influencer and a recipient within the system. Notably, IT shows a significant net influence of 0.491 reinforcing the notion that mid-tenure professionals recognize its proactive capacity in enabling process change. SA and OC again appear with negative net influence values reinforcing their perceived dependency. Performance measurement maintains a dependent role (R–C = –0.171) indicating a consistent trend where its capacity to drive change is perceived as limited, particularly among those with longer organizational tenure.

Table 19. *Influence-prominence matrix based on more than 18 years of tenure*

	R (Influence)	C (Dependence)	R+C (Prominence)	R-C (Net influence)
TMS	6.503663004	6.192307692	12.6959707	0.311355311
SA	6.207875458	6.192307692	12.40018315	0.015567766
COM	5.211538462	5.607287449	10.81882591	-0.395748988
PM	5.538461538	5.502327935	11.04078947	0.036133603
OC	5.538461538	5.540182186	11.07864372	-0.001720648
IT	4.884615385	4.850202429	9.734817814	0.034412955

Source: Compiled by the author, 2025.

Finally, among experts with more than 18 years of experience, the data depicts a significantly higher perception of importance across all factors. Top management support stands out as the most influential and prominent factor (R+C = 12.696) reflecting a strong confidence in the strategic direction and leadership provided by senior management. The net influence of TMS is also positive (0.311) affirming its directional significance in initiating and guiding new process implementations. Interestingly, while SA maintains a similar prominence (12.400), its net influence (0.016) suggests that it is perceived almost equally as an influencer and a recipient of influence. Communication emerges clearly as an effect factor in this group, with the most negative net influence score (-0.396).

This may indicate that experienced experts see it more as a response to leadership actions and organizational shifts, rather than a primary driver of change. Performance measurement and organizational culture exhibit nearly neutral net influence scores suggesting they are perceived as moderately influential and shaped by their interaction with other factors - occupying a middle position within the overall system. IT retains its role as a minor cause factor (0.034) suggesting that even with experience it is acknowledged as a steady but not dominant force.

When comparing across the three groups, several themes and shifts emerge. First, TMS remains central in all groups, but its prominence and net influence rise significantly with tenure. This could be attributed to the increasing exposure of senior professionals to strategic decision-making and leadership behaviour reinforcing the belief that executive sponsorship is indispensable for successful process implementation. Conversely, among less experienced employees, the importance of performance metrics and technology as change enablers appears more pronounced, likely reflecting their closer involvement with operational and technological systems.

Communication's perceived role also evolves. While mid-tenure professionals identify it as highly central, possibly due to their bridging roles between upper management and execution teams, senior experts view it as more of a reactive factor. This indicates a more developed understanding that communication is largely shaped by organizational structures and cultural context, rather than functioning as an independent driver.

Strategic alignment and organizational culture consistently emerge as dependent factors across all groups. This consistency implies a general consensus that these elements, while essential, require active support and direction from leadership and systems to manifest effectively. This insight is important for organizations, because it highlights the need to develop alignment and culture strategies together with leadership actions and process planning instead of treating them separately.

IT is another factor whose interpretation shifts notably with tenure. While its net influence is highest among the mid-tenure group suggesting a belief in its enabling power, its role becomes more moderate in the views of senior professionals. This may reflect a more measured view of IT's effectiveness, recognizing that without supportive structures, clear processes and committed leadership, its impact is limited.

These insights have practical implications for organizations pursuing process change. For less experienced professionals empowering initiatives that involve technology and performance metrics can yield quick wins and boost engagement. For mid-tenure professionals efforts should focus on enhancing communication channels and recognizing their role as integrators across hierarchies. For senior professionals the emphasis should be placed on demonstrating visible top management support and ensuring alignment across strategic goals and cultural values.

To conclude, based on the responses gathered it is clear that while certain CSFs such as top management support maintain their central role across experience levels, others like information technology, communication and performance measurement shift in perceived influence and dependence. These differences reflect the evolving nature of organizational understanding and experience. Recognizing and addressing these perceptual shifts allows organizations to design more targeted and effective process implementation strategies that resonate across the experience spectrum, ultimately increasing the likelihood of successful business process management outcomes.

3.4. Applicability of research results

The empirical analysis conducted in this thesis provides an important contribution to the theoretical discourse on critical success factors in BPM by narrowing the focus to the new process implementation stage - an area that has been underexplored in existing literature. Earlier studies such as those by Castro et al. (2019), Buh et al. (2015) and Bai and Sarkis (2013) identified various CSFs often presenting them as universally important across BPM initiatives. However, these studies largely examined BPM from a high-level perspective without separating specific stages. By applying the DEMATEL method to compare influence levels among six CSFs this research offers a more differentiated view of how these factors function specifically during the implementation of the new process within BPM.

The findings revealed that top management support exerts the strongest influence on the success of new process implementation, a result that is consistent with most prior studies. Trkman et al. (2010) emphasized TMS as one of the most critical enablers in BPM success while Bai and Sarkis (2013) ranked it among the highest causal factors in their grey-DEMATEL analysis. This thesis confirms their conclusions, but adds granularity by demonstrating that TMS does not only initiate BPM projects, it also actively shapes other CSFs such as strategic alignment and communication throughout the implementation phase. This suggests that managerial commitment is not just a trigger, but a driving force that pervades the total BPM lifecycle.

Strategic alignment and communication, while traditionally seen as critical (Buh et al., 2015; Gabryelczyk et al., 2018), were shown to be more dependent than causal in nature. Strategic alignment was found to be heavily influenced by TMS reinforcing the argument that alignment between business strategy and process initiatives cannot be achieved in isolation from leadership. This aligns with Rosemann et al. (2005), who stress the need for BPM to be integrated into the broader strategic planning process.

Communication, on the other hand, was uniquely positioned as a balanced factor—exerting and receiving equal influence. This is consistent with Chong et al. (2010), who argued that communication plays a dual role in BPM as both a facilitator of coordination and a receiver of direction from leadership and strategic objectives.

Performance measurement, as highlighted by Trkman (2010), plays an underlying role in BPM by enabling visibility and continuous improvement. In this study it emerged as a moderately influential factor, one that not only supports other CSFs through data, but is also shaped by organizational culture. This nuanced positioning supports the arguments of De Bruin and Rosemann (2005), who propose that performance measurement is critical for BPM maturity and long-term sustainability.

Organizational culture and information technology were both identified as more reactive than proactive factors in the context of new process implementation. While prior studies have emphasized their foundational importance (Hribar & Mendling, 2014; Gabryelczyk et al., 2018), this research indicates that their influence is largely dependent on upstream factors like leadership actions and the organization's strategic alignment. Culture was seen as an outcome of consistent communication and leadership. This marks a shift from perceiving culture as a fixed background element to understanding it as a dynamic factor shaped by other critical success factors. IT, while essential as an enabler of BPM, was not perceived as a major driver during process implementation unless supported by leadership. This complements the findings of Gabryelczyk et al. (2017), who stressed the importance of IT alignment with BPM goals, but acknowledged that it cannot compensate for poor leadership or weak strategic direction.

The comparative analysis by hierarchical level introduced another important layer of insight. Directors emphasized top-down elements like TMS and strategic alignment, which is understandable given their strategic responsibilities. Managers took a more balanced view highlighting the role of communication and operational coordination. Specialists, who are directly involved in execution, prioritized performance measurement and IT tools that they interact with daily. These results show that while all six CSFs are important their perceived relevance and influence vary depending on organizational role. This aligns with the arguments made by McCormack et al. (2009), who suggested that successful BPM requires differentiated engagement strategies across organizational levels.

Similarly, the comparison across tenure groups revealed that professionals with fewer years of experience emphasized IT and performance measurement, reflecting their operational engagement with tools and systems. In contrast, those with over 18 years of experience focused more on leadership and strategic coherence demonstrating how experience shapes one's perception of what drives successful implementation. These findings suggest that employees' views on CSFs evolve over time, possibly reflecting greater awareness of interdependencies and the broader organizational context. This complements earlier studies that treated CSFs as relatively static and universal, showing instead that their perceived importance can shift depending on tenure, perspective and exposure.

Taken together these findings offer a valuable theoretical contribution by refining the understanding of CSFs as not just fixed elements but as interactive, hierarchical and context-dependent constructs. This research confirms some established conclusions (e.g., the importance of TMS), challenges others (e.g., the causality of culture and IT) and enriches the field with empirical evidence on influence levels during a specific BPM stage.

In terms of managerial implications, the study offers actionable insights for those leading new process implementation within BPM initiatives. First and foremost, it highlights the necessity of strong and continuous top management support. Leaders must remain visibly engaged, allocate resources strategically and communicate consistently. Second, communication strategies must be carefully designed to reflect both hierarchical and experiential differences. What resonates with directors may not be sufficient for frontline specialists and vice versa. Third, organizations should not assume that strategic alignment or culture will emerge on their own. These elements must be actively nurtured through cascading goals, consistent reinforcement and employee involvement. Finally, while IT and performance measurement systems are essential, they must follow process design and not lead it. Investing in tools before establishing clear processes and leadership alignment risks creating inefficiencies or resistance. Leveraging these insights enables organizations to allocate resources more effectively, tailor implementation strategies to organizational complexity and enhance the chances of achieving the intended benefits of the new process.

4. CONCLUSIONS AND RECOMMENDATIONS

1. A comprehensive review of academic literature indicated a strong consensus on a set of critical success factors that consistently contribute to the effective implementation of business process management. Key CSFs identified include top management support, strategic alignment, communication, performance measurement, organizational culture and information technology. These factors were consistently cited across studies by Aysolmaz et al. (2023), Buh et al. (2015) and Bai and Sarkis (2013), among others. The literature also suggests that these CSFs do not function in isolation, but are interdependent. Despite the shared recognition of these factors, few studies quantified the degree of influence each CSF exerts on the specific stage of new process implementation. This gap justified the need for empirical analysis, because a deeper understanding of how these CSFs interact could inform more precise resource allocation and strategic planning. The study aimed to bridge this gap by analysing the strength and direction of influence among these critical success factors with a specific focus on the new process implementation phase.

2. To assess the influence level of the selected CSFs on new process implementation, the Decision-making trial and evaluation laboratory (DEMATEL) methodology was applied. This approach was chosen for its strength in uncovering both direct and indirect causal relationships among factors. The use of DEMATEL in the context of BPM, building on the precedent set by Bai and Sarkis (2013), proved methodologically appropriate, because it enabled the study to move beyond simply listing critical factors to revealing how they influence one another. Through expert evaluation and matrix modelling, DEMATEL allowed for the construction of a cause-effect hierarchy among CSFs. This provided an evidence-based foundation for prioritization. The adoption of a unified normalization method ensured comparability of results across subgroups adding robustness to the methodological design. Thus, the methodology not only fulfilled the research objective but also proved valuable for broader BPM applications where prioritizing interrelated factors is essential.

3. Empirical findings from 18 BPM experts revealed a nuanced network of influence among the six CSFs. Top management support emerged as the most influential factor, with the highest net influence score, indicating its crucial role in initiating and sustaining new process implementation. Communication emerged as a closely ranked, exhibiting a balanced dynamic of mutual influence with other CSFs and highlighting its critical role in facilitating cross-functional collaboration and organizational alignment. Strategic alignment and organizational culture appeared as more dependent

variables that are shaped by upstream factors such as leadership and communication dynamics. Performance measurement acted as a stabilizing element within the system, promoting transparency and continuous improvement, even though it did not emerge as a dominant driving force. Information technology, while perceived as essential to execution, showed limited directional influence implying that its value is contingent on clarity in processes and leadership commitment. These findings validate and extend existing literature by confirming known CSFs and offering a clearer view of their interdependencies and roles in implementation efforts.

4. Based on the interpretation of empirical data and their alignment with the theoretical background, the following practical recommendations are proposed to enhance the effectiveness of new process implementation within BPM initiatives.

a. Prioritize top management support: Organizations should begin new process initiatives with strong and visible top management commitment. Leaders should be involved not just in approving projects but in actively shaping vision and communicating goals.
b. Develop multidimensional communication: Effective communication should be embedded throughout the BPM lifecycle. This involves communication flowing both to and from leadership, regular updates across departments, open channels for feedback, and clear reporting on progress.
c. Align strategic objectives early: New processes must be clearly tied to business strategy. Workshops and alignment sessions held early in the project between BPM and strategic planning teams help ensure that process changes are aligned with the organization's overall objectives.
d. Establish performance measurement early: Metrics should be developed alongside process initiatives to ensure they are actionable and aligned with defined success criteria. Dashboards and reporting tools should be integrated into the implementation plan to support monitoring and decision-making.
e. Deploy IT after process clarity is achieved: IT systems should be implemented once the target processes are well-defined. This approach ensures that technology is implemented to enable process changes. IT investments should be strategically aligned with the objectives of BPM initiatives.

5. This study has several limitations that should be acknowledged. First, the sample size of 18 experts limits the extent to which the findings can be generalized. Larger and more diverse samples

across industries and geographies would improve the external validity of the results. Second, the study did not focus on a clearly defined process. While all experts were asked to evaluate critical success factors' influence on a new process implementation, they may have had different types of processes in mind. This variation could have introduced inconsistencies in how influence was perceived. Third, the research concentrated on a specific stage of BPM—new process implementation. While this adds valuable granularity, it also narrows the scope and understanding the success factors for each stage could be important.

6. Future research could extend upon the current study by expanding the diversity of expert samples to represent a broader spectrum of organizational roles, industry sectors and geographic regions. This type of diversification would contribute to improving the generalizability and contextual relevance of the findings across various business settings. Moreover, future studies should explore the role and dynamics of critical success factors across different stages of the business process management lifecycle, including initial adoption, process design, implementation and ongoing optimization. Longitudinal research could also provide valuable insights into how the influence of CSFs changes over time. Given the increasing integration of BPM with digital transformation initiatives, a deeper exploration of emerging success enablers will be essential for organizations aiming to maintain agility, drive innovation and secure competitive advantage in a continuously evolving business environment.

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IDENTIFYING THE INFLUENCE LEVEL OF CRITICAL SUCCESS FACTORS ON NEW PROCESS IMPLEMENTATION WITHIN BUSINESS PROCESS MANAGEMENT

DEIMANTĖ ANOCHINA

Master thesis

Business process management

Vilnius University, Faculty of Economics and Business Administration

Supervisor - Assoc. Prof.Dr. Žilvinas Židonis

Vilnius, 2025

SUMMARY

63 pages, 19 charts, 2 pictures, 54 references.

The aim of this Master's thesis is to identify the influence levels of critical success factors (CSFs) on the successful implementation of new processes within business process management (BPM) and to explore how these factors interact. The research pursued four main tasks:

1. Evaluate scientific publications to identify the critical success factors that determine a successful business process management implementation.
2. Determine a methodology for identifying the influence level of critical success factors on the process implementation within business process management.
3. Based on the methodology, evaluate how identified critical success factors influence each other and what level of influence they have on new process implementation within business process management.
4. Interpret empirical data to make conclusions and recommendations.

The study began with a comprehensive literature review which revealed a core set of CSFs that appear consistently across various BPM studies: top management support, strategic alignment, communication, performance measurement, organizational culture and information technology. Despite being widely cited, prior research has not adequately examined the extent to which these factors influence one another during specific stages of BPM particularly the new process implementation phase. To address this gap, the DEMATEL (Decision-Making Trial and Evaluation

Laboratory) methodology was chosen as it enables the mapping of direct and indirect influence relationships among interrelated variables.

Eighteen experts in new process implementation participated in the empirical study providing pairwise comparisons of the six CSFs. The responses were analyzed using DEMATEL to produce a total relation matrix, allowing each factor's influence and dependence to be quantified. The analysis found that top management support was the most influential factor with a strong net influence over others. Communication was revealed to be a central, balanced factor, both shaping and being shaped by other CSFs. Strategic alignment and organizational culture were more reactive, reflecting the influence of leadership and communication. Performance measurement acted as a stabilizer, promoting transparency and improvement while information technology had a limited directional role, functioning primarily as an enabler once other conditions were met.

Differences emerged in how these CSFs were perceived based on respondents' organizational roles and tenure. Directors emphasized strategic alignment and leadership while specialists placed greater importance on IT and performance metrics. Managers offered a more balanced view, highlighting the importance of communication alongside leadership support. Respondents with longer tenure viewed top management support as increasingly critical whereas less experienced participants highlighted technological and operational factors. These patterns indicate that CSF prioritization should be tailored to roles and experience within the organization.

Based on these insights, several practical recommendations are proposed: organizations should ensure active involvement of top management in shaping and communicating process initiatives; communication strategies must be multidirectional and continuous; strategic alignment should be addressed early through joint planning; performance metrics should be developed in parallel with process design and IT systems should only be deployed once process clarity is achieved.

This research contributes to existing BPM literature by offering a more granular and stage-specific understanding of how CSFs function in practice. While limited by its sample size and scope, the study demonstrates the utility of DEMATEL for examining interdependencies among success factors. Future research should expand the scope across industries and BPM lifecycle stages enabling a more comprehensive understanding of how to successfully manage business process change.

KRITINIŲ SĖKMĖS VEIKSNIŲ ĮTAKOS LYGIO NUSTATYMAS NAUJŲ PROCESŲ DIEGIMUI VERSLO PROCESŲ VALDYMO SRITYJE

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Verslo procesų valdymas

Vilniaus Universitetas, Ekonomikos ir verslo administravimo fakultetas

Darbo vadovas - Assoc. Prof. Dr. Žilvinas Židonis

Vilnius, 2025

SANTRAUKA

63 puslapiai, 19 lentelių, 2 paveikslėliai, 54 literatūros šaltiniai

Šio magistro baigiamojo darbo tikslas – nustatyti kritinių sėkmės veiksnių (KSV) įtakos lygį naujų procesų diegimo sėkmei verslo procesų valdyme (VPV) ir išnagrinėti, kaip šie veiksniai tarpusavyje sąveikauja. Tyrime buvo siekiama įgyvendinti keturias pagrindines užduotis:

1. Įvertinti mokslinę literatūrą ir nustatyti kritinius sėkmės veiksnius, lemiančius sėkmingą VPV įgyvendinimą.
2. Nustatyti metodiką, leidžiančią įvertinti KSV įtakos lygį verslo procesų diegimui VPV kontekste.
3. Remiantis metodika, įvertinti, kaip identifikuoti KSV veikia vieni kitus ir kokią įtaką jie daro naujų procesų diegimui VPV.
4. Interpretuoti empirinius duomenis bei pateikti išvadas ir rekomendacijas.

Tyrimas pradėtas išsamia literatūros apžvalga, kurios metu išryškėjo pagrindinis KSV rinkinys, nuolat minimas įvairiuose VPV tyrimuose: aukščiausio lygmens vadovybės palaikymas, strateginis suderinamumas, komunikacija, veiklos rezultatų vertinimas, organizacinė kultūra ir informacinės technologijos. Nors šie veiksniai dažnai minimi kaip svarbūs, ankstesni tyrimai nepakankamai tyrė jų tarpusavio įtakos stiprumą konkrečiuose VPV etapuose, ypač naujo proceso diegimo fazėje. Siekiant užpildyti šią spragą, buvo pasirinkta DEMATEL (Sprendimų priėmimo

tyrimo ir vertinimo laboratorija) metodika, kuri leidžia identifikuoti tiesioginius ir netiesioginius ryšius tarp tarpusavyje susijusių veiksnių.

Empirinėje studijoje dalyvavo 18 ekspertų, turinčių patirties naujų procesų diegime, kurie vertino šešių KSV porinę įtaką. Remiantis jų atsakymais ir DEMATEL analize, buvo sudaryta bendra įtakų matrica, leidžianti kiekybiškai įvertinti kiekvieno veiksnio daromą ir gaunamą įtaką. Rezultatai parodė, kad aukščiausio lygmens vadovybės palaikymas yra stipriausias ir labiausiai įtaką darantis veiksnys. Komunikacija pasirodė esanti centrinis, subalansuotas veiksnys, įtakojantis ir tuo pačiu įtakojamas kitų KSV. Strateginis suderinamumas ir organizacinė kultūra buvo labiau priklausomi nuo vadovybės ir komunikacijos. Veiklos vertinimas veikė kaip stabilizuojantis elementas, o informacinės technologijos atliko labiau pagalbinį vaidmenį, kurio poveikis priklauso nuo kitų veiksnių brandos.

Pastebėti skirtumai tarp respondentų suvokimo pagal jų organizacinį vaidmenį ir darbo patirtį. Direktoriai akcentavo strateginį suderinamumą ir vadovavimą, tuo tarpu specialistai labiausiai vertino IT ir veiklos matavimo svarbą. Vidurinės grandies vadovai pateikė labiau subalansuotą požiūrį, pabrėždami komunikacijos ir vadovybės palaikymo derinį. Ilgesnę darbo patirtį turintys respondentai didžiausią svarbą skyrė vadovybės įsitraukimui, o mažiau patyrę dalyviai – technologiniams ir operaciniams veiksniams. Šie modeliai rodo, kad KSV prioritetai turėtų būti skirstomi pagal darbuotojo vaidmenį ir patirtį organizacijoje.

Remiantis tyrimo įžvalgomis, pateikiamos šios praktinės rekomendacijos: organizacijos turėtų užtikrinti aktyvų vadovybės dalyvavimą formuojant ir komunikuojant procesų iniciatyvas; komunikacijos strategijos turėtų būti daugiasluoksnės ir nuoseklios; strateginis suderinamumas turi būti užtikrintas projekto pradžioje; veiklos vertinimo rodikliai turi būti kuriami lygiagrečiai su procesų dizainu; IT sprendimai turėtų būti diegiami tik tada, kai procesai yra aiškiai apibrėžti.

Šis tyrimas prisideda prie VPV literatūros, pateikdamas išsamesnį, etapais grįstą supratimą apie KSV funkcionavimą praktikoje. Nepaisant riboto imties dydžio ir tyrimo apimties, darbas įrodo DEMATEL metodo naudą tiriant tarpusavio priklausomybes tarp veiksnių. Ateities tyrimuose siūloma išplėsti tyrimų akiratį bei apimti visą VPV gyvavimo ciklą, siekiant dar išsamesnio supratimo, kaip sėkmingai valdyti organizacinius pokyčius per procesų valdymą.

APPENDIX

Appendix 1. The form of the assessment submitted to the experts

Dear colleague, partner,

Thank you for agreeing to participate in this interview/survey. This discussion is part of a Master's thesis research project for the MSc in Business Process Management program at Vilnius University. The objective of the study is to examine the impact of various critical success factors (CSFs) on the effective impleme ntation of new business processes within organizations.

This study focuses on six key critical success factors: top management support, strategic alignment, communication, performance measurement, organizational culture, and information technology. Using the DEMATEL methodology, the research aims to determine both the direct and indirect influences among these factors, identifying which are the most significant drivers of successful new process implementation.

The goal of this research is to discern which factors exert the strongest impact and how they interact with one another. Your insights will be invaluable in validating and enriching the study by incorporating real-world perspectives from professionals actively engaged in business process management initiatives.

I would like to also inform you that your personal data will be encrypted in the study and it will not be possible to determine your identity. Only summary information and results obtained during the study will be made public.

Section 1

1. Can you briefly describe your role in relation to new process initiatives in your organization?

____

2. How long have you been within the organization/business unit?

____

3. How mature would you say business process management practices are in your organization/business unit? Mark X on one of the maturity levels.

Answer	Maturity	Description
	Initial	The starting point for use of a new or undocumented repeat process.
	Repeatable	The process is at least documented sufficiently.
	Defined	The process is defined/confirmed as a standard business process.
	Managed	The process is deliberately managed in accordance with agreed upon metrics.
	Optimizing	Process management includes deliberate process optimization/improvement.

Section 2

1. You will assess how much Factor A (row) influences Factor B (column).
2. Use the scale below to rate the influence

Rating	Label	Description
0	No influence	The factor has no noticeable effect on the other factor. There is no interaction or dependency between the two.
1	Low influence	The factor has a minor or weak effect. It contributes slightly, but the impact is limited and not critical.
2	Medium influence	The factor has a moderate effect. It plays a noticeable role in influencing the other factor, but it is not dominant.
3	High influence	The factor has a strong effect. It significantly impacts the other factor and is an important contributor.
4	Very high influence	The factor has a dominant or critical influence. It strongly determines or drives the behavior or performance of the other factor.

3. Please review the terminology before rating.

No.	Terminology	Description
1.	Top management support	The factor means that the high-level executives (like CEOs, CFOs, or department heads) are actively involved in and committed to a project, initiative, or organizational change
2.	Strategic alignment	The factor means that a project, process, or initiative is closely aligned with the overall goals, mission, and strategy of the organization.
3.	Communication	The factor means that there is continuous and clear exchange of information between all stakeholders involved.
4.	Performance measurement	The factor means that there is a process of defining, collecting, analyzing, and using metrics to assess how well an organization, process, or project is performing against its goals.
5.	Organizational culture	The factor means the aligned shared values, beliefs, norms, and behaviors that shape how people in an organization interact, make decisions, and get work done.

6.	Information technology	The factor means there are IT systems and tools to enable, support and track processes.

4. Please evaluate all pairwise combinations (excluding self-influence) using the rating above.

	Top management support (TMS)	Strategic alignment (SA)	Communication (COM)	Performance measurement (PM)	Organizational culture (OC)	Information Technology (IT)
Top management support (TMS)	0					
Strategic alignment (SA)		0				
Communication (COM)			0			
Performance measurement (PM)				0		
Organizational culture (OC)					0	
Information Technology (IT)						0

Section 3

1. From your perspective, which of the above factors has the most influence on process implementation success?

____

2. Is there a factor not mentioned here that you believe plays a critical role?

____

3. Please share any additional insights or comments you might have regarding the success of new process implementation:

____

____

Thank you once again for your valuable time and insights.

Yours sincerely,

Deimantė Anochina

Appendix 2. Calculation steps for deriving the total relation matrix from expert input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	3	3	3	3
SA	3	0	3	3	3	2
COM	3	3	0	3	3	2
PM	3	3	3	0	3	2
OC	3	3	3	2	0	2
IT	2	2	2	3	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.25	0.1875	0.1875	0.1875	0.1875
SA	0.1875	0	0.1875	0.1875	0.1875	0.125
COM	0.1875	0.1875	0	0.1875	0.1875	0.125
PM	0.1875	0.1875	0.1875	0	0.1875	0.125
OC	0.1875	0.1875	0.1875	0.125	0	0.125
IT	0.125	0.125	0.125	0.1875	0.125	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.25	-0.1875	-0.1875	-0.1875	-0.1875
SA	-0.1875	1	-0.1875	-0.1875	-0.1875	-0.125
COM	-0.1875	-0.1875	1	-0.1875	-0.1875	-0.125
PM	-0.1875	-0.1875	-0.1875	1	-0.1875	-0.125
OC	-0.1875	-0.1875	-0.1875	-0.125	1	-0.125
IT	-0.125	-0.125	-0.125	-0.1875	-0.125	1

$(I-N)^{-1}$	TMS	SA	COM	PM	OC	IT

TMS	2.044636029	1.3101432	1.202530765	1.191699265	1.2025308	0.9967323
SA	1.099075297	1.9990266	1.099075297	1.086838629	1.0990753	0.8665786
COM	1.099075297	1.1569214	1.94118056	1.086838629	1.0990753	0.8665786
PM	1.099075297	1.1569214	1.099075297	1.928943892	1.0990753	0.8665786
OC	1.041229229	1.0960308	1.041229229	0.985315266	1.8833345	0.8209692
IT	0.8665786	0.912188	0.8665786	0.905513453	0.8665786	1.6063408

$T=N(I-N)^{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	1.044636029	1.3101432	1.202530765	1.191699265	1.2025308	0.9967323
SA	1.099075297	0.9990266	1.099075297	1.086838629	1.0990753	0.8665786
COM	1.099075297	1.1569214	0.94118056	1.086838629	1.0990753	0.8665786
PM	1.099075297	1.1569214	1.099075297	0.928943892	1.0990753	0.8665786
OC	1.041229229	1.0960308	1.041229229	0.985315266	0.8833345	0.8209692
IT	0.8665786	0.912188	0.8665786	0.905513453	0.8665786	0.6063408

	R	C	R+C	R-C
TMS	6.948272266	6.2496697	13.19794201	0.698602517
SA	6.249669749	6.6312313	12.88090106	-0.381561566
COM	6.249669749	6.2496697	12.4993395	0
PM	6.249669749	6.1851491	12.43481888	0.064520615
OC	5.868108183	6.2496697	12.11777793	-0.381561566
IT	5.023778071	5.0237781	10.04755614	0

Appendix 3. Calculation steps for deriving the total relation matrix from directors input

D	TMS	SA	COM	PM	OC	IT

TMS	0	4	4	2	3	3
SA	4	0	4	3	3	2
COM	3	3	0	3	4	2
PM	3	2	3	0	2	3
OC	3	3	3	2	0	2
IT	2	2	3	4	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.25	0.25	0.125	0.1875	0.1875
SA	0.25	0	0.25	0.1875	0.1875	0.125
COM	0.1875	0.1875	0	0.1875	0.25	0.125
PM	0.1875	0.125	0.1875	0	0.125	0.1875
OC	0.1875	0.1875	0.1875	0.125	0	0.125
IT	0.125	0.125	0.1875	0.25	0.125	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.25	-0.25	-0.125	-0.1875	-0.1875
SA	-0.25	1	-0.25	-0.1875	-0.1875	-0.125
COM	-0.1875	-0.1875	1	-0.1875	-0.25	-0.125
PM	-0.1875	-0.125	-0.1875	1	-0.125	-0.1875
OC	-0.1875	-0.1875	-0.1875	-0.125	1	-0.125
IT	-0.125	-0.125	-0.1875	-0.25	-0.125	1

(I-N)$_{-1}$	TMS	SA	COM	PM	OC	IT
TMS	2.578116716	1.6993633	1.947642357	1.575068319	1.66618	1.44287
SA	1.781055824	2.500281102	1.948549865	1.615494438	1.666991	1.401331
COM	1.637211608	1.56107337	2.634890583	1.522764769	1.613583	1.318689
PM	1.461255895	1.350598743	1.602789327	2.213143058	1.358048	1.227879
OC	1.482288233	1.415489764	1.623006588	1.335969378	2.265001	1.191361
IT	1.402473747	1.332242713	1.584639167	1.404620676	1.34183	2.058669

T=N(I-N)$_{-1}$

T	TMS	SA	COM	PM	OC	IT

TMS	1.578116716	1.6993633	1.947642357	1.575068319	1.66618	1.44287
SA	1.781055824	1.500281102	1.948549865	1.615494438	1.666991	1.401331
COM	1.637211608	1.56107337	1.634890583	1.522764769	1.613583	1.318689
PM	1.461255895	1.350598743	1.602789327	1.213143058	1.358048	1.227879
OC	1.482288233	1.415489764	1.623006588	1.335969378	1.265001	1.191361
IT	1.402473747	1.332242713	1.584639167	1.404620676	1.34183	1.058669

	R	C	R+C	R-C
TMS	9.909241587	9.342402023	19.25164361	0.566839564
SA	9.913703502	8.859048992	18.77275249	1.05465451
COM	9.288212033	10.34151789	19.62972992	-1.053305853
PM	8.213714189	8.667060638	16.88077483	-0.453346449
OC	8.313115722	8.911634037	17.22474976	-0.598518315
IT	8.124475905	7.640799363	15.76527527	0.483676542

Appendix 4. Calculation steps for deriving the total relation matrix from managers input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	3	3	3	3
SA	3	0	3	3	3	3
COM	3	3	0	3	3	2
PM	3	3	2	0	3	2
OC	3	2	3	2	0	2
IT	2	2	2	3	2	0

N=D/Row(sum)tota
l

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.25	0.1875	0.1875	0.1875	0.1875
SA	0.1875	0	0.1875	0.1875	0.1875	0.1875
COM	0.1875	0.1875	0	0.1875	0.1875	0.125
PM	0.1875	0.1875	0.125	0	0.1875	0.125
OC	0.1875	0.125	0.1875	0.125	0	0.125
IT	0.125	0.125	0.125	0.1875	0.125	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.25	-0.1875	-0.1875	-0.1875	-0.1875
SA	-0.1875	1	-0.1875	-0.1875	-0.1875	-0.1875
COM	-0.1875	-0.1875	1	-0.1875	-0.1875	-0.125
PM	-0.1875	-0.1875	-0.125	1	-0.1875	-0.125
OC	-0.1875	-0.125	-0.1875	-0.125	1	-0.125
IT	-0.125	-0.125	-0.125	-0.1875	-0.125	1

(I-N)$_{-1}$	TMS	SA	COM	PM	OC	IT
TMS	1.954863228	1.157079295	1.054524315	1.106439358	1.112758	0.992704
SA	1.057120067	1.89922533	1.001798099	1.05111739	1.05712	0.943069
COM	1.015155407	1.015155407	1.804264064	1.006935525	1.015155	0.858978
PM	0.961726175	0.961726175	0.867197534	1.796044182	0.961726	0.813768
OC	0.908900342	0.864579012	0.863790609	0.857084916	1.751006	0.766513
IT	0.797328538	0.797328538	0.753146674	0.839455433	0.797329	1.59774

T=N(I-N)$_{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	0.954863228	1.157079295	1.054524315	1.106439358	1.112758	0.992704
SA	1.057120067	0.89922533	1.001798099	1.05111739	1.05712	0.943069
COM	1.015155407	1.015155407	0.804264064	1.006935525	1.015155	0.858978
PM	0.961726175	0.961726175	0.867197534	0.796044182	0.961726	0.813768
OC	0.908900342	0.864579012	0.863790609	0.857084916	0.751006	0.766513
IT	0.797328538	0.797328538	0.753146674	0.839455433	0.797329	0.59774

	R	C	R+C	R-C
TMS	6.37836859	5.695093758	12.07346235	0.683274832
SA	6.00945016	5.695093758	11.70454392	0.314356402
COM	5.715643463	5.344721295	11.06036476	0.370922168

PM	5.362188544	5.657076805	11.01926535	-0.29488826
OC	5.011873005	5.695093758	10.70696676	-0.68322075
IT	4.582327254	4.972771641	9.555098895	-0.39044439

Appendix 5. Calculation steps for deriving the total relation matrix from specialists input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	4	3	3	2
SA	4	0	3	3	3	2
COM	3	3	0	3	4	2
PM	3	3	3	0	3	3
OC	3	3	3	2	0	2
IT	3	2	2	3	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.25	0.25	0.1875	0.1875	0.125
SA	0.25	0	0.1875	0.1875	0.1875	0.125
COM	0.1875	0.1875	0	0.1875	0.25	0.125
PM	0.1875	0.1875	0.1875	0	0.1875	0.1875
OC	0.1875	0.1875	0.1875	0.125	0	0.125
IT	0.1875	0.125	0.125	0.1875	0.125	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.25	-0.25	-0.1875	-0.1875	-0.125
SA	-0.25	1	-0.1875	-0.1875	-0.1875	-0.125
COM	-0.1875	-0.1875	1	-0.1875	-0.25	-0.125
PM	-0.1875	-0.1875	-0.1875	1	-0.1875	-0.1875
OC	-0.1875	-0.1875	-0.1875	-0.125	1	-0.125
IT	-0.1875	-0.125	-0.125	-0.1875	-0.125	1

(I-N)$_{-1}$	TMS	SA	COM	PM	OC	IT

TMS	2.696975095	1.830477073	1.830477073	1.664588307	1.784872	1.32996
SA	1.809453266	2.546096599	1.703991335	1.586056566	1.698441	1.267133
COM	1.75043659	1.687609482	2.529714745	1.570634821	1.728624	1.256542
PM	1.745130275	1.680142923	1.680142923	2.410558409	1.676723	1.299747
OC	1.575658246	1.519221862	1.519221862	1.371575159	2.358357	1.128728
IT	1.47483827	1.377357242	1.377357242	1.330123327	1.372227	1.949621

$T=N(I-N)^{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	1.696975095	1.830477073	1.830477073	1.664588307	1.784872	1.32996
SA	1.809453266	1.546096599	1.703991335	1.586056566	1.698441	1.267133
COM	1.75043659	1.687609482	1.529714745	1.570634821	1.728624	1.256542
PM	1.745130275	1.680142923	1.680142923	1.410558409	1.676723	1.299747
OC	1.575658246	1.519221862	1.519221862	1.371575159	1.358357	1.128728
IT	1.47483827	1.377357242	1.377357242	1.330123327	1.372227	0.949621

	R	C	R+C	R-C
TMS	10.13734991	10.05249174	20.18984165	0.084858171
SA	9.611171817	9.640905181	19.252077	-0.02973336
COM	9.523561907	9.640905181	19.16446709	-0.11734327
PM	9.492444101	8.933536588	18.42598069	0.558907512
OC	8.472761606	9.61924273	18.09200434	-1.14648112
IT	7.881523294	7.231731215	15.11325451	0.649792079

Appendix 6. Calculation steps for deriving the total relation matrix from 3-9 years tenure input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	3	3	3	2
SA	3	0	3	3	3	2
COM	3	3	0	3	3	2
PM	3	3	3	0	3	3
OC	3	3	3	2	0	2
IT	3	2	2	3	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.235294118	0.176470588	0.176470588	0.176470588	0.117647059
SA	0.176470588	0	0.176470588	0.176470588	0.176470588	0.117647059
COM	0.176470588	0.176470588	0	0.176470588	0.176470588	0.117647059
PM	0.176470588	0.176470588	0.176470588	0	0.176470588	0.176470588
OC	0.176470588	0.176470588	0.176470588	0.117647059	0	0.117647059
IT	0.176470588	0.117647059	0.117647059	0.176470588	0.117647059	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.23529412	-0.176470588	-0.176470588	-0.17647059	-0.117647059
SA	-0.17647059	1	-0.176470588	-0.176470588	-0.17647059	-0.117647059
COM	-0.17647059	-0.17647059	1	-0.176470588	-0.17647059	-0.117647059
PM	-0.17647059	-0.17647059	-0.176470588	1	-0.17647059	-0.176470588
OC	-0.17647059	-0.17647059	-0.176470588	-0.117647059	1	-0.117647059
IT	-0.17647059	-0.11764706	-0.117647059	-0.176470588	-0.11764706	1

$(I\text{-}N)^{-1}$	TMS	SA	COM	PM	OC	IT
TMS	1.720127528	0.923423491	0.837417114	0.828256672	0.837417114	0.654208265
SA	0.828692884	1.688974753	0.797540109	0.788815878	0.797540109	0.623055491
COM	0.828692884	0.838974753	1.647540109	0.788815878	0.797540109	0.623055491
PM	0.865879918	0.874386043	0.831092047	1.674325315	0.831092047	0.695757415
OC	0.785398888	0.795255451	0.755985507	0.705099612	1.605985507	0.58826762
IT	0.743740685	0.708225795	0.671038761	0.710188747	0.671038761	1.454038485

$T=N(I\text{-}N)^{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	0.720127528	0.923423491	0.837417114	0.828256672	0.837417114	0.654208265
SA	0.828692884	0.688974753	0.797540109	0.788815878	0.797540109	0.623055491
COM	0.828692884	0.838974753	0.647540109	0.788815878	0.797540109	0.623055491
PM	0.865879918	0.874386043	0.831092047	0.674325315	0.831092047	0.695757415
OC	0.785398888	0.795255451	0.755985507	0.705099612	0.605985507	0.58826762
IT	0.743740685	0.708225795	0.671038761	0.710188747	0.671038761	0.454038485

	R	C	R+C	R-C
TMS	4.800850185	4.772532785	9.57338297	0.028317399
SA	4.524619224	4.829240286	9.35385951	-0.304621063
COM	4.524619224	4.540613647	9.065232871	-0.015994423
PM	4.772532785	4.495502103	9.268034888	0.277030682
OC	4.235992584	4.540613647	8.776606231	-0.304621063
IT	3.958271234	3.638382767	7.596654001	0.319888467

Appendix 7. Calculation steps for deriving the total relation matrix from 10-17 years tenure input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	3	2	3	3
SA	3	0	3	2	3	2
COM	3	3	0	3	4	2
PM	3	2	3	0	2	2
OC	3	3	3	2	0	2
IT	2	2	3	4	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.235294118	0.176470588	0.117647059	0.176470588	0.176470588
SA	0.176470588	0	0.176470588	0.117647059	0.176470588	0.117647059
COM	0.176470588	0.176470588	0	0.176470588	0.235294118	0.117647059
PM	0.176470588	0.117647059	0.176470588	0	0.117647059	0.117647059
OC	0.176470588	0.176470588	0.176470588	0.117647059	0	0.117647059
IT	0.117647059	0.117647059	0.176470588	0.235294118	0.117647059	0

I	TMS	SA	COM	PM	OC	IT
TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.23529412	-0.176470588	-0.117647059	-0.176470588	-0.176470588
SA	-0.17647059	1	-0.176470588	-0.117647059	-0.176470588	-0.117647059
COM	-0.17647059	-0.17647059	1	-0.176470588	-0.235294118	-0.117647059
PM	-0.17647059	-0.11764706	-0.176470588	1	-0.117647059	-0.117647059
OC	-0.17647059	-0.17647059	-0.176470588	-0.117647059	1	-0.117647059
IT	-0.11764706	-0.11764706	-0.176470588	-0.235294118	-0.117647059	1

(I-N)$_{-1}$	TMS	SA	COM	PM	OC	IT
TMS	1.610751403	0.808010426	0.792808049	0.66557094	0.767113258	0.641132915

SA	0.693960222	1.548603779	0.721087758	0.601089086	0.699960155	0.542550719
COM	0.761530033	0.764388883	1.641298934	0.704353023	0.808377328	0.595378026
PM	0.657436	0.617098317	0.68313577	1.46418966	0.618383305	0.513995418
OC	0.693960222	0.698603779	0.721087758	0.601089086	1.549960155	0.542550719
IT	0.641863399	0.63952917	0.71331806	0.688547996	0.643101903	1.429093203

$T=N(I-N)^{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	0.610751403	0.808010426	0.792808049	0.66557094	0.767113258	0.641132915
SA	0.693960222	0.548603779	0.721087758	0.601089086	0.699960155	0.542550719
COM	0.761530033	0.764388883	0.641298934	0.704353023	0.808377328	0.595378026
PM	0.657436	0.617098317	0.68313577	0.46418966	0.618383305	0.513995418
OC	0.693960222	0.698603779	0.721087758	0.601089086	0.549960155	0.542550719
IT	0.641863399	0.63952917	0.71331806	0.688547996	0.643101903	0.429093203

	R	C	R+C	R-C
TMS	4.285386991	4.059501278	8.344888269	0.225885712
SA	3.807251718	4.076234353	7.883486071	-0.268982634
COM	4.275326228	4.272736328	8.548062556	0.002589899
PM	3.55423847	3.724839791	7.279078261	-0.170601322
OC	3.807251718	4.086896105	7.894147823	-0.279644387
IT	3.75545373	3.264700999	7.02015473	0.490752731

Appendix 8. Calculation steps for deriving the total relation matrix from 18+ years tenure input

D	TMS	SA	COM	PM	OC	IT
TMS	0	4	4	3	3	3
SA	4	0	3	3	3	3
COM	3	3	0	2	3	2
PM	3	3	3	0	3	2
OC	3	3	3	3	0	2
IT	3	3	1	3	2	0

N=D/Row(sum)total

N	TMS	SA	COM	PM	OC	IT
TMS	0	0.235294118	0.235294118	0.176470588	0.176470588	0.176470588
SA	0.235294118	0	0.176470588	0.176470588	0.176470588	0.176470588
COM	0.176470588	0.176470588	0	0.117647059	0.176470588	0.117647059
PM	0.176470588	0.176470588	0.176470588	0	0.176470588	0.117647059
OC	0.176470588	0.176470588	0.176470588	0.176470588	0	0.117647059
IT	0.176470588	0.176470588	0.058823529	0.176470588	0.117647059	0

I	TMS	SA	COM	PM	OC	IT

TMS	1	0	0	0	0	0
SA	0	1	0	0	0	0
COM	0	0	1	0	0	0
PM	0	0	0	1	0	0
OC	0	0	0	0	1	0
IT	0	0	0	0	0	1

I-N	TMS	SA	COM	PM	OC	IT
TMS	1	-0.235294118	-0.235294118	-0.176470588	-0.176470588	-0.176470588
SA	-0.235294118	1	-0.176470588	-0.176470588	-0.176470588	-0.176470588
COM	-0.176470588	-0.176470588	1	-0.117647059	-0.176470588	-0.117647059
PM	-0.176470588	-0.176470588	-0.176470588	1	-0.176470588	-0.117647059
OC	-0.176470588	-0.176470588	-0.176470588	-0.176470588	1	-0.117647059
IT	-0.176470588	-0.176470588	-0.058823529	-0.176470588	-0.117647059	1

$(I-N)^{-1}$	TMS	SA	COM	PM	OC	IT
TMS	2.036919221	1.227395412	1.131228882	1.068988006	1.077466186	0.961665297
SA	1.180692115	1.990215924	1.047654562	1.028798591	1.034900637	0.925613629
COM	0.980769231	0.980769231	1.755060729	0.843977733	0.893876518	0.75708502
PM	1.032388664	1.032388664	0.952695504	1.783134456	0.940922651	0.7969316
OC	1.032388664	1.032388664	0.952695504	0.933134456	1.790922651	0.7969316
IT	0.929149798	0.929149798	0.767952269	0.844294694	0.802093544	1.611975282

$T=N(I-N)^{-1}$

T	TMS	SA	COM	PM	OC	IT
TMS	1.036919221	1.227395412	1.131228882	1.068988006	1.077466186	0.961665297
SA	1.180692115	0.990215924	1.047654562	1.028798591	1.034900637	0.925613629
COM	0.980769231	0.980769231	0.755060729	0.843977733	0.893876518	0.75708502
PM	1.032388664	1.032388664	0.952695504	0.783134456	0.940922651	0.7969316
OC	1.032388664	1.032388664	0.952695504	0.933134456	0.790922651	0.7969316
IT	0.929149798	0.929149798	0.767952269	0.844294694	0.802093544	0.611975282

	R	C	R+C	R-C
TMS	6.503663004	6.192307692	12.6959707	0.311355311
SA	6.207875458	6.192307692	12.40018315	0.015567766
COM	5.211538462	5.607287449	10.81882591	-0.395748988

PM	5.538461538	5.502327935	11.04078947	0.036133603
OC	5.538461538	5.540182186	11.07864372	-0.001720648
IT	4.884615385	4.850202429	9.734817814	0.034412955