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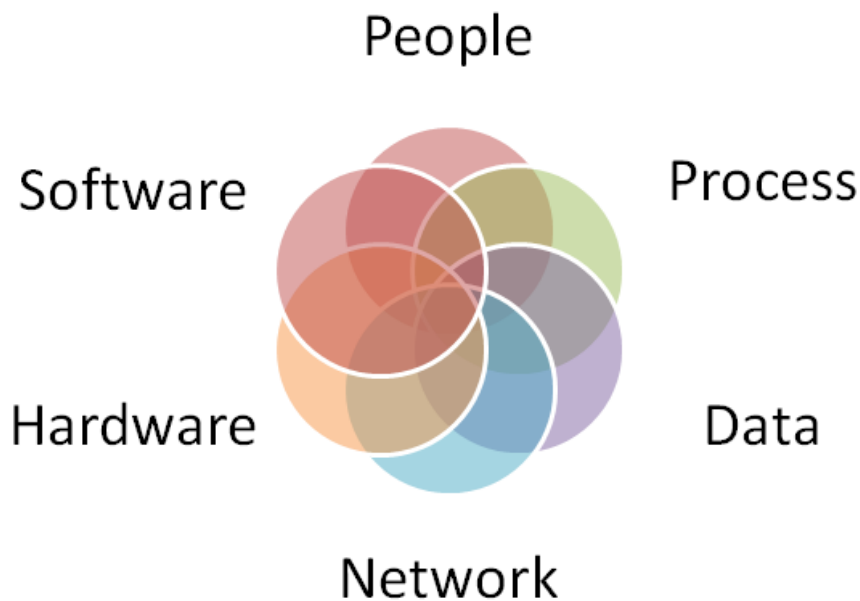
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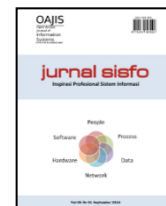
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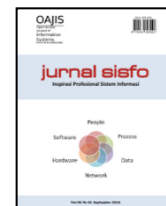
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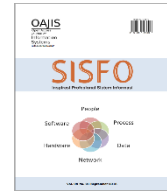
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Economic Impact of IT-based Business Process Management Improvement Projects: A Systematic Literature Review

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Abstract

Business Process Management (BPM) is an essential element in the evolving field of computer science, management, and information systems. While BPM falls under the category of Enterprise Systems or IT enterprise, it still needs to be widely used in organizations due to a lack of understanding of its working principles. Although BPM has been implemented in the financial sector, its relationship with finance itself needs to be adequately explored. Many studies have emphasized the importance of BPM concepts for organizations, but only some have explored its connection to finance, particularly in Indonesia. The researcher gathered information from various journals related to BPM and its economic impact. After obtaining the journals, a rapid assessment was conducted by thoroughly reading and analyzing their contents to gain a deeper understanding of the research topic or problem formulation. The evaluation resulted in 21 relevant journals that were used to write a systematic literature review. Based on the sub-cost type identified in each studied BPM project, the most influential cost impacts are indirect costs. Thus, based on the conducted research, there is a lack of discussion among organizations regarding the cost impacts of implementing BPM in their enterprise projects. This highlights the need for greater attention to cost aspects when utilizing BPM in ERP projects or other automation information systems.

Keywords: Business Process Management, IT Enterprise, Economic Impact, Systematic Literature Review, Enterprise Project

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1. Introduction

BPM is an important element in information systems that continues to grow as a discipline in the fields of computers, management, and information systems. BPM is included in the Enterprise System category. However, it is rarely used in companies because many still need to understand how the system works, especially if it is related to costs or accounting [1]. An IT-based improvement project is a project carried out

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to improve the performance and efficiency of an organization using information technology (IT) as a solution or approach. In today's dynamic business environment, organizations are constantly striving to improve themselves to remain competitive and meet ever-evolving customer demands, not least for the healthcare industry that requires IT for its operations [2]. In this effort, companies often launch IT-based improvement projects to increase operational efficiency, simplify processes, and achieve sustainable growth [3]. The company's operating activities often need help with problems that can cause financial losses due to the lack of attention to BPM implementation [4].

Change management practices are critical in achieving successful IT project implementation within organizations [5]. They highlighted the need for effective communication, stakeholder engagement, and leadership support throughout the change process. Leadership and communication are very important in implementing change management, especially regarding the conditions of work culture in each company [6], [7]. Effective change management not only minimizes resistance to change but also encourages employee engagement, aligns organizational culture, and provides adequate training and support to employees during the implementation of IT-based improvement projects [8]. There are still few companies that adopt BPM because many decision-makers need to see the value of BPM. BPM models can describe business workflows and are very useful in detecting errors and bottlenecks and in identifying possible improvements [9], [10]. BPM is also used to create planning models in companies to determine projects that need to be implemented in order to maximize company value, as well as support the formation of value in the company [11].

Although BPM has been applied to financial sector companies, it does not consider its relationship with finance itself. Many studies have been conducted on the importance of the BPM concept for companies, but only some have explored its relationship with finance, especially in Indonesia. Many studies only evaluate the positive impact of BPM on the company without looking at the economic impact that may occur if BPM is not implemented. Based on these gaps, there is still an unaddressed research gap regarding the importance of BPM implementation in enterprises and its cost impact if ignored, especially for enterprises in Indonesia.

By following the SLR approach, this paper aims to achieve two objectives: firstly, to provide a platform for researchers to recognize the various aspects of BPM that can affect the projects being developed from a cost perspective. Second, it provides a starting point for further research in this area.

2. Background of the study

2.1 BPM

Business Process Management (BPM) is a combination of art and science to monitor the implementation of work in an organization, with the aim of ensuring consistency of results and improving performance. The intended improvement objectives may vary depending on the organization's goals, such as reducing costs, execution time, and error rates, as well as achieving competitive advantage through innovation. Improvement initiatives can be one-time or ongoing, and can be carried out incrementally or radically. However, what is most important in BPM is managing the entire series of events, activities and decisions that ultimately add value to the organization and its customers, which is called a process. Keep in mind that BPM is not about improving the way individuals perform activities, but rather about managing the process as a whole [12].

2.2 BPM Life Cycle

According to [12] there are six stages in the BPM life cycle, namely:

- 1) Process identification: In this stage, a business problem is proposed and the processes related to the problem are identified, delimited, and linked to each other.
- 2) Process discovery (also called current process modeling): In this stage, the current state of the related processes is documented in the form of a current process model.
- 3) Process analysis: In this stage, problems related to the current process are identified, documented, and measured using performance measures.
- 4) Process redesign (also called process improvement): The goal of this stage is to identify changes to the process that will help address the problems identified in the previous stage and enable the organization to achieve its performance goals.
- 5) Process implementation: In this stage, the changes required to move from the current process to the future process are made, and includes organizational change management and process automation. The focus at this stage is process automation.
- 6) Process monitoring: Once the redesigned process is running, relevant data is collected and analyzed to determine how well the process is performing according to its performance measures and performance goals. New problems that arise are identified and corrective actions are taken continuously.

2.3 BPM Capability

The capability areas are arranged in accordance with the defined BPMN core elements [13], namely:

- 1) Strategic alignment: Strategic alignment refers to the ongoing alignment of organizational priorities and processes, thereby enabling the achievement of business goals. In this era, strategic alignment must focus on the value proposition of business processes and BPM.
- 2) Governance: establishes accountability and relevant and transparent decision-making processes to align rewards and guide actions. In the digital era, BPM and process governance must be highly contextual.:
- 3) Methods: methods are the approaches and techniques that support and enable consistent process actions and outcomes.
- 4) People: are individuals and groups who continually improve and apply their skills and knowledge related to processes.
- 5) Culture: comprises the collective values and beliefs that shape process-related attitudes and behaviors.

2.4 Cost Impact

Cost impact is the cost that users or organizations that develop technology may experience without the help of BPM. So this research will analyze what costs will be minimized by using BPM. Costs [14] that are easily allocated to certain cost objects are known as direct costs. Indirect costs or indirect costs are costs that cannot be assigned to certain cost objects, examples of indirect costs are indirect materials, indirect labor, indirect overhead.

3. Research Methodology

This research was conducted as a systematic literature review based on the original guidelines proposed by Kitchenham [15]. The steps in the systematic literature review method are documented in Fig. 1 below:

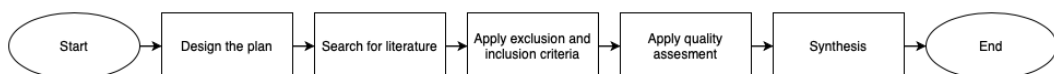


Fig. 1 Research Methodology

3.1 Define the research question.

There is a lack of in-depth research that examines recent findings regarding the impact of BPM on finance-related IT-based improvement projects. In a first step, this study aims to answer the following research questions:

RQ1: What aspects of BPM are associated with cost and accounting?

3.2 Design the plan.

The next step is to design the literature review plan, including its scope. The first thing that needs to be done in this SLR is to collect previous research literature as a source for obtaining research results. The literature search was conducted using three database sources, namely:

- 1) Emerald Insight at the link (<https://www.emeraldinsight.com/>)
- 2) Science Direct at the link (<https://www.sciencedirect.com/>)
- 3) Springer at the link (<https://link.springer.com/>)

3.3 Search for literature.

From the three databases, it is necessary to combine several keywords, including BPM, cost, activity-based costing, and accounting. The extraction method is different because each database uses another search method. The keyword combinations and the results obtained from the search are summarized in Table 1. Other results were obtained from various combinations of keywords. The literature search stage was performed by searching using specific keywords on specific pages, according to the abstract, title, or keywords in the journal. The literature search was conducted using the following keywords:

- 1) In the Science Direct database, the journal search process uses advanced search by writing keywords: **"Business Process Management" OR "BPM" AND "Activity-based costing" OR "BPM-ABC"**
- 2) In the Emerald Insight database, the journal search process uses advanced search by writing keywords: **(content-type:article) AND ("Business Process Management" AND ("BPM")) AND ("activity-based costing") AND ("accounting"))**
- 3) In the Springer database, the journal search process uses advanced search by writing keywords: **Business AND Process AND Management, AND BPM, AND Cost, AND Economic AND Value, AND Information AND Technology**

3.4 Apply exclusion and inclusion criteria.

- 1) To screen the literature, some inclusion criteria were defined as follows:
 - a. The literature reviewed included journal articles
 - b. Literature in English
 - c. Publication time between 2010 - 2023
 - d. Scopus-indexed scientific articles
- 2) The exclusion criteria used in this study are as follows:
 - a. Literature outside the discussion of the topic of the impact of IT implementation with a BPM approach from a cost point of view is rather than in accordance with the research question.
 - b. Not using conference papers, book chapters and the like
 - c. Literature outside the English language

3.5 Apply quality assessment.

The number of journals generated at each search stage and the final results of journal selection are shown in Table 1. The article selection stage is based on predetermined inclusion and exclusion criteria, as well as certain criteria, such as the research methods used, the validity of the data, and the validity of the research results, resulting in a total of 140 journals.

Table 1. Journal finding results

No.	Criteria	Science Direct	Emerald	Springer
1	Corresponding with entered keywords	513	36	3156
2	Journal/article received	98	34	535
3	Published in 2010-2023	90	27	361
4	Keywords correspond with all fields criteria include title, abstract, and contributor	75	27	38
5	Assessment by read full text journal quickly is appropriate to answer the research question in this study	7	7	7

After the journals were obtained, the researcher conducted an assessment by speed-reading the contents of the journals and analyzing them to achieve a deeper understanding of the topic or problem formulation in this study. The assessment results were obtained from a total of 21 journals.

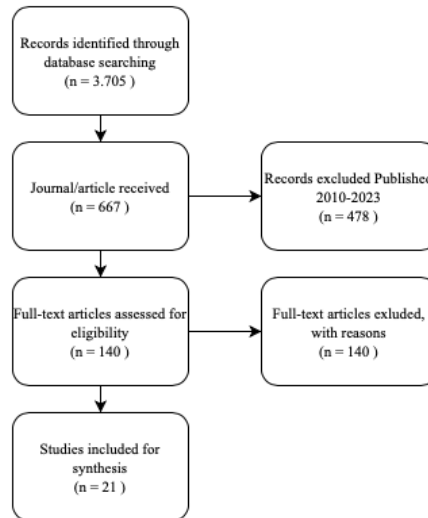


Fig. 2 Prisma Diagram Journal Selection

Based on the explanation presented in Table 1, this diagram in Fig. 2 explains the process of selecting journals as a source for conducting a systematic literature study in this research. The initial stage is identification using keywords that have been determined in several databases providing scientific articles. After searching several journal providers, we found 3,705 related articles based on the keywords we searched for. Then in the next stage, the researcher eliminated results that were not scientific articles such as book chapters or article proceedings so that the results obtained were 667. The third stage was eliminating articles

based on journals published between 2010 and 2023. This was done so that The articles used could still be relevant in the current situation, and the results of this eliminated the remaining 478 scientific articles.

Then the fourth stage is to identify full-text articles to see whether they match the research topic being conducted. At this stage, 140 remaining articles are eligible for the research topic. In the fifth stage, no articles were reduced for certain reasons, so the final result of the article reduction was in the sixth stage where 21 remaining articles were synthesized in the research. These 21 articles are articles that have been read in their entirety so that later these articles will be able to answer the research questions asked. The assessment referred to in this case is reading the entire contents of the article quickly so that it can be identified whether the synthesized journal will answer the questions from the research conducted.

3.6 Synthesis.

The last stage in this methodology is synthesis, which aims to answer the problem formulation identified in the introduction according to relevant articles. Systematic Literature Review (SLR) synthesis is carried out through several stages as follows.

- 1) Collect results from literature reviews in journals that have been assessed
- 2) List case studies on the application of BPM in companies and the economic impact of IT-based company improvement projects that use the BPM approach.
- 3) Classify journals based on case studies regarding the application of BPM in companies and the economic impact on IT-based company improvement projects using the BPM approach.
- 4) Analyze the economic impact of IT-based company improvement projects using the BPM approach.

4. Result

Based on the synthesis results, 21 journals were used as literature in this research. All journals used different case studies, contributed artefacts, and explored the BPM lifecycle stages carried out; BPM capabilities applied, types of BPM projects, and financial impacts. A summary of the results will be presented in the form of graphs and tables based on the type of study, type of artefact, BPM lifecycle stages, BPM capability stages, BPM project types, and financial impact used in the 21 journals.

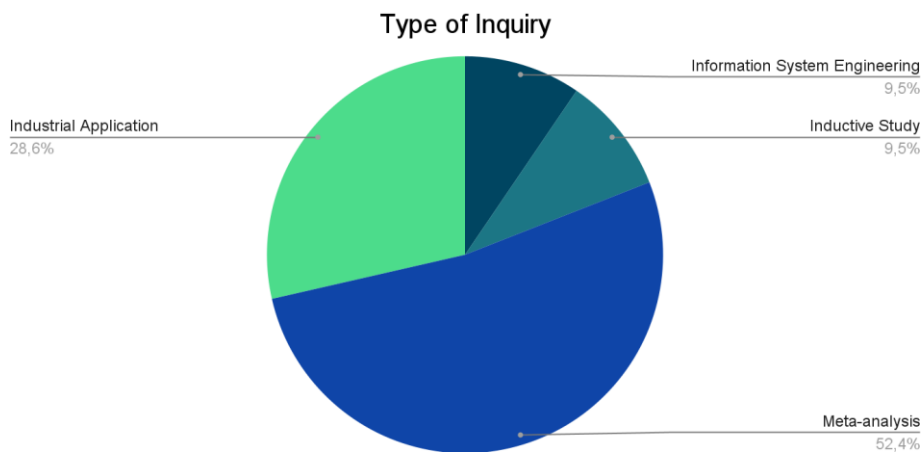


Fig. 3 Type of Inquiry Classification Results

Fig. 3 shows the type of study conducted in the research. There are four types of classifications offered. Of the 21 papers, two papers each focus on information system engineering and inductive studies. Then, there are six papers focusing on industrial research and 11 papers focusing on meta-analysis. This study in industrial application affects the acquisition of research artefacts because the coding scheme provides a condition that this industrial study does not need to be codified. Likewise, meta-analysis, which is mostly dominated by systematic literature review papers, usually only provides gap analysis and future research directions and does not provide artefacts.

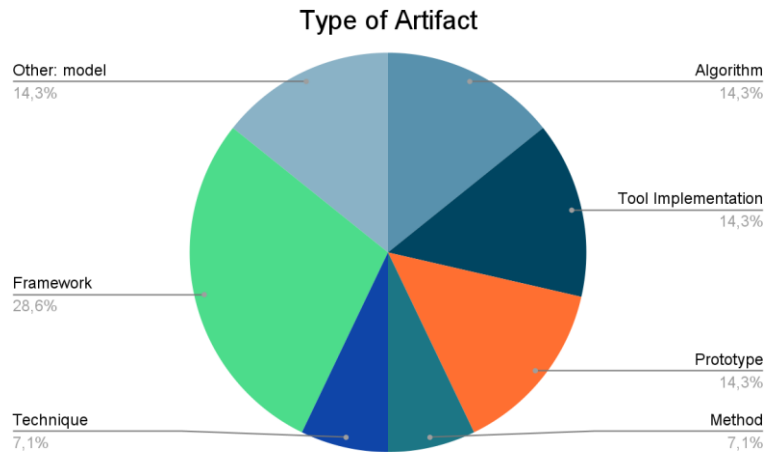


Fig. 4 Type of Artifact Classification Results

Fig. 4, shows the results of the papers that have performed the classification process based on the artefact type based on the codification guide that has been developed previously. There are seven types of classification shown. Of the 21 papers, two papers each produce algorithms, tool implementations, prototypes, and models. In addition, one paper had a method, four papers created a framework, and nine papers still needed to produce artefacts. Some documents that do not produce artefacts are based on various reasons, namely because they carry out industrial research and the rest because the paper is in the form of a literature review. Industrial research does not produce artefacts, as this corporate information may be closely guarded and not publicly disclosed, and patent protection also protects inventions, innovations and other intellectual property. Literature review papers only sometimes produce artefacts because the main focus of the paper is to collect, analyze, and synthesize previous research in a particular field. The main purpose of a literature review is to present a comprehensive understanding of the research that has been done previously. By submitting a complete summary of previous research, a literature review helps in identifying trends, important findings, or research gaps that still need to be filled. This allows other researchers to understand the development of research in the field and develop their research based on the information that has been presented.

Fig. 5 classifies the figure in order to provide insight and show what percentage of studies actually used all stages of the BPM Lifecycle and implemented some stages of the BPM Lifecycle. The results show that 22.2% (4 papers) implemented all phases of the BPM Lifecycle, and 77.8% (14 papers) implemented some stages of the BPM Lifecycle in their research. The implementation of the Business Process Management (BPM) Lifecycle in improvement projects is only sometimes fully carried out by many companies due to several factors, such as company complexity, cost, and leadership. A thorough BPM Lifecycle implementation can involve significant changes in business processes, technology, and organizational culture. Many companies may need more resources to implement BPM fully.

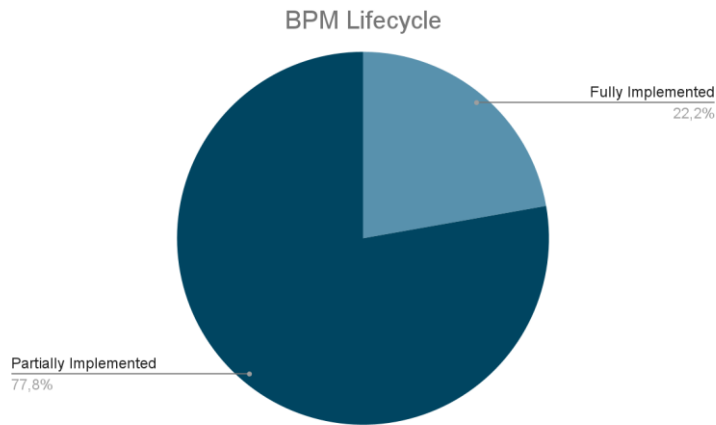


Fig. 5 BPM Lifecycle Classification Result

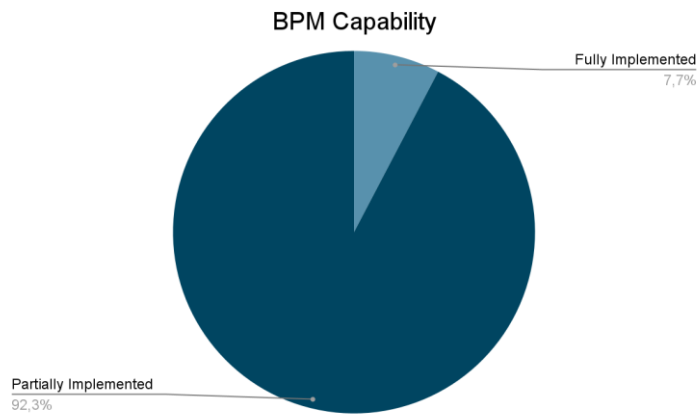


Fig. 6 BPM Capability Classification Result

Fig. 6 shows the classification results of papers that apply BPM Capability in their research. Fewer companies use BPM Capability than those that do not. This happens because of the variation or many aspects that affect the situation in the field during the research. The results show that 7.7% (1 paper) are actually in all areas of BPM Capability, and 92.3% (12 papers) are in some regions of BPM Capability. The implementation of Business Process Management (BPM) Capability in improvement projects is not always fully carried out by many companies due to several factors, such as resource constraints that make it difficult for them to allocate sufficient resources for the full implementation of BPM capability and companies must prioritize the most critical or strategic initiatives for them. The implementation of BPM capability may not be their highest priority or main focus at the time, and as a result, they may need to allocate more resources to it.

Fig. 7a shows the classification results of the BPM Project types. The classification division is taken from the journals that have been collected. The result is that 42.9% (12 papers) are categorized as strategic BPM projects, 3.6% (1 paper) as automation, 28.6% (8 papers) as improvement projects, and 25% (7 papers) as assessment projects. The complexity of process automation customization often involves developing and implementing software solutions that are tailored to a company's specific needs. These automation projects can be more complex and time-consuming, especially if the company has highly specialized or complex

business processes. Focusing on the strategic aspects helps companies define the overall direction and goals, while the automation implementation can be a separate project that follows the strategic efforts.

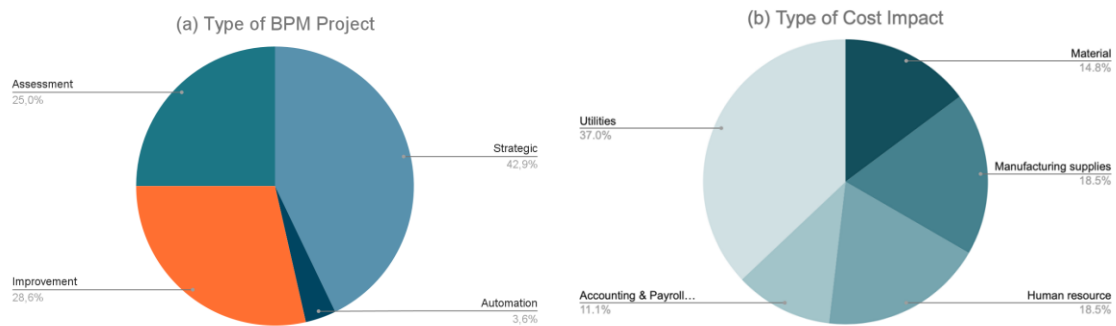


Fig. 7 (a) Type of BPM Project; (b) Cost Impact

Fig. 7b produced a diagram projection of the cost impact. For the dark colour, it is a direct cost consisting of 14.8% (4 papers) mentioning the effect of direct costs in the form of materials and 18.5% (5 papers) in the form of manufacturing supplies. The light-coloured ones are indirect costs, which consist of 18.5% (5 papers) mentioning the impact of indirect costs for human resources, 11.1% (3 papers) in the form of accounting & payroll, and 37% (10 papers) allocated to utilities. Based on the classification results, indirect costs have a greater influence due to various factors, such as spending on employee training, consulting fees, human resource development, and performance measurement.

Of the 21 papers evaluated, four papers specifically addressed the relationship between cost and the application of BPM to development projects, as well as the impact of BPM on business processes. These studies highlighted the importance of considering cost aspects in BPM deployment and explored the effect that BPM use has on business processes. The findings from these papers provide valuable insights into understanding how BPM implementation can affect costs and efficiency in development projects as well as overall business processes. However, further research is needed to dig deeper into this relationship and identify the factors that influence implemented costs in the context of BPM deployment. Some of these papers include:

- 1) An activity-based costing approach for detecting inefficiencies of healthcare processes
The purpose of this paper [2] is to set out a methodological framework to investigate how the integration of an activity-based costing (ABC) logic into the pre-existent accounting system supports healthcare organizations
- 2) The missing link between BPM and accounting Using event data for accounting in process-oriented organizations
The purpose of this paper [3] is to integrate business process management (BPM) and accounting on a conceptual level in order to account for the economic implications of process-state changes in process design-time and process run-time.
- 3) Value-oriented process modelling integrating financial perspectives into business process re-design
The purpose of this paper [4] is to propose a value-oriented approach to business process modelling based on key concepts and metrics from operations and financial management, to aid decision making in process redesign projects on the basis of process models.
- 4) Semantic process benchmarking to improve process performance
The purpose of this paper [5] is to illustrate and evaluate the semantic process benchmarking concept.

Based on the research that has been carried out, the results of the research can be seen in the following sections Table 2, where in this table a classification is made for the cost impact based on the type of BPM project carried out as well as direct and indirect costs.

Table 2. Result

Type of BPM Project	Type of artifact	Type of Cost Impact	Sub-cost Type	Source	
Strategic	Algorithm	Direct cost	Not mentioned	[16], [17]	
		Indirect cost	Employee cost, activity cost	[16], [17]	
	Tool Implementation	Direct cost	Not mentioned	[18]	
		Indirect cost	Not mentioned	[18]	
	Prototype	Direct cost	Not mentioned	[19], [20]	
		Indirect cost	Resource utilization	[19], [20]	
	Method	Direct cost	Not mentioned	[21], [22]	
		Indirect cost	Process cost	[21]	
	Technique	Direct cost	Production cost	[11]	
		Indirect cost	Not mentioned	[11]	
	Framework	Direct cost	Manufacturing supplies	[4]	
		Indirect cost	Human resource, accounting & payroll software, utilities, activity cost, process cost	[4], [16], [21], [23]	
	Automation	Tool Implementation	Direct cost	Not mentioned	[9]
			Indirect cost	Not mentioned	[9]
Improvement	Tool Implementation	Direct cost	Not mentioned	[9]	
		Indirect cost	Not mentioned	[9]	
	Framework	Direct cost	Manufacturing supplies	[4]	
		Indirect cost	Human resource, accounting & payroll software, utilities	[4], [18], [24]	
Other: Model, Industrial	Direct cost	Material, Manufacturing supplies	[2], [3], [5]		
	Indirect cost	Utilities	[6]		
Assessment	Framework	Direct cost	Manufacturing supplies	[4]	
		Indirect cost	Human resource, accounting & payroll software, utilities	[4], [25]	

Then, based on the sub-cost type of each BPM project studied, the cost impact has a lot of influence on the indirect cost impact. Some of the indirect costs mentioned include employee costs or human resources [17], [4], activity costs [16], resource utilization [19], [4], process costs [21], [22], and for direct costs, the impact is manufacturing supplies [4].

In each category coding of the content synthesized in the article such as type of study, type of artefact, BPM life cycle stages, BPM project type, and financial impact has one goal based on the research question mentioned previously, namely to find the cost impact of use. BPM in an IT project based on collected research. This research wants to know in research what kind of cost impact will be felt on the use of BPM, whether it is only limited to the algorithm or up to implementation. Likewise in the life cycle, this research aims to identify which stages have the greatest impact on cost usage. Then on the type of project, whether it is strategic or improvement which has the biggest impact on costs. A more detailed explanation is provided in the appendix on the codification method in this systematic literature study.

Based on observations made, many BPM projects have yet to discuss the impact of costs directly on the development of automation projects in organizations or companies. Even though the analysis of costs will certainly provide cost efficiency for companies, it will provide more profit and prevent losses from projects that are currently developed without a BPM approach. This systematic literature review research is expected to help companies determine what cost factors have a direct or indirect impact on the development of automation projects using the help of the BPM approach.

3.1 Expected Cost

Expected cost is the costs identified to be incurred by a particular development project. It is an estimated value of the total costs that may be incurred in a project situation. The calculation of expected costs allows companies or individuals to anticipate and plan for the expenses required in a project or business decision. It helps in effective financial management and rational decision-making. In this research, studies have been identified that discuss the relationship between BPM and the development projects they undertake. Based on several studies that examine the impact or type of costs incurred on ERP implementation development projects and the application of BPM in them, the costs incurred are still estimates by the author. This cost has yet to become real in BPM strategy [11], [16], [17], [18]. Of course, the costs incurred as an impact or influence of BPM on IT improvements are only limited to the costs that are expected to be incurred. Most of the sub-cost types identified are indirect costs, which are costs incurred uncertainly in an IT development project or IT improvement project.

3.2 Implemented Cost

Implemented cost is the actual cost that has been incurred or applied in a project or activity. It is the amount of money actually spent to implement or execute a project. In the context of project management, implemented costs include all costs associated with procuring the resources, work, or services required to complete the project. It consists of the cost of raw materials, labour wages, equipment rental costs, transportation costs, overhead costs, and other costs associated with the project. Implemented costs are often used to monitor and control spending on projects. By comparing implemented costs with expected costs, project managers can assess whether the project is going according to plan or whether there is a significant difference between the initial cost estimate and the costs actually incurred. Sonnenberg and Brocke [3] wrote one of the studies that discussed implemented costs; in their research, they discussed the economic impact on processes involving BPM. This research also adapted a model used to design a process accounting model (PAM). PAM interacts with double-entry bookkeeping, as each stock flow implies a posting to one or more accounts. When there is a receipt of goods process, the posting will be submitted to several departments until the clearing account issues the invoice. PAM is specifically capable of tracking account updates to processes and events, which can be used to support auditing and modelling. Another study [4] discusses the cost consequences of a process, calculating the value of a process, which implies that the relationship between

processes must be taken into account. This research creates a model to improve performance in a warehouse in conventional transactions still using a data warehouse, but this improvement involves CRM. For example, in DW, a manager takes 15 minutes to archive a marketing plan. However, after the automation process, the activity execution is 5 minutes faster. This research also identified an ROI of 37.85% from the automation of integration in a process.

5. Future Research Direction

Further research can be done; among others, researchers can identify the costs incurred in the development of IT improvement project implementation in detail regarding the costs involved. Some approaches that researchers can take include identifying specific expenses associated with the use of BPM in the development of IT improvement project implementation. These include BPM software costs, BPM consulting or training costs, process testing and validation costs, BPM platform usage costs, integration costs with other systems, and BPM maintenance costs. In addition, further research can be done to analyze the effect of using BPM with other alternatives that do not involve BPM. Researchers can explain the benefits gained from using BPM, such as increased process efficiency, reduced errors, accelerated implementation, and flexibility, which can help compensate for the costs involved. Comparing a project development that involves BPM and does not involve BPM in-depth, we can calculate the benefits in terms of cost by analyzing ROI (Return on Investment) on each development, both involving BPM and not.

6. Conclusion

Based on the research that has been conducted, this study concludes that only a few organizations or companies have discussed the cost impact of using BPM on their development projects. This shows that there needs to be more attention to the cost aspects of using BPM in ERP projects or other automation information systems. While BPM has significant benefits in improving the efficiency, effectiveness, and control of business processes, it is important to consider the costs associated with implementing BPM. Related costs may include initial investment in BPM software, training, system integration, and long-term maintenance. In implementing BPM on ERP projects or other IT projects, organizations need to conduct a careful cost-benefit evaluation to ensure that the investment in BPM yields a comparable return. With a better understanding of the cost impact of using BPM, organizations can make more informed decisions and optimize the use of BPM in their IT projects.

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7. Appendix

Category	Coding criteria	Relevant codes	Coding instructions
Focus and intent of paper	Goal of the paper	Free text	Identify the general research objective that is stated in the paper (e.g., copy and paste from the introduction).
	Type of paper	Full paper Short paper Keynote paper Other: please specify	Select one only
	Type of inquiry	<p>Formal science: the paper aims to define concepts by the mathematical formulae; interesting properties of these concepts are shown by the help of algorithms, lemmas and logical proofs.</p> <p>Information systems engineering: the paper aims to specify new ways of solving socio-technical problems in the context of Information systems engineering. It formulates a means-ends relationship, for which an approach or a tool is designed. Its application is demonstrated in order to support that It achieves a certain end in a better way.</p> <p>Scientific study: the paper discusses a socio-technical phenomenon and grounds It in social, psychological or cognitive theory. Hypotheses are deduced from theory and tested using forms of empirical inquiry.</p> <p>Inductive study: the paper aims to formulate a new theory for yet unexplained phenomena. The new theory can be rooted in empirical observations, interviews or analysis of documents and other material.</p> <p>Meta-analysis: the paper reviews existing literature and concepts in order to propose gaps in the research area, in order to define classification schemes, or to compare existing approaches according to certain properties.</p> <p>Industrial application: the paper describes an application of BPM concepts, method or artifacts in one or more industrial domains.</p> <p>Other: please specify.</p>	Select one only. If multiple codes could apply, select the most prominent code that best represents the type of inquiry described in the paper.
Research components of paper (*if type of inquiry is 'industrial application', do not code this section)	Artifact	Does the paper introduce a new artifact?	Yes/No plus explanation
	Type of artifact	Algorithm	An algorithm is a set of step-by-step instructions that guides the decision-making process in the IT-based BPM Project.
		Tool implementation	Tool implementation involves the development and deployment of software tools that automate and streamline tasks within the IT-based BPM Project.
		Prototype	A prototype is a preliminary model that showcases the functionalities and features of a technology or solution in IT-based BPM Project.
	Method	Method refers to a systematic approach or procedure used to accomplish specific goals or solve problems in IT-based BPM Project.	

Category	Coding criteria	Relevant codes	Coding instructions
		Technique	Technique refers to a specific approach or methodology used to achieve objectives in IT-based BPM Project.
		Framework	A framework provides guidelines and standards for organizing and managing processes in IT-based BPM Project.
		Other: Please specify	
BPM Lifecycle	Process identification	Yes/No	Is there an explicit mentioning that the paper relates to how the overall landscape of processes of an organization is identified, prioritized and managed as a whole?
	Process discovery	Yes/No	Is there an explicit mentioning that the paper relates to creating a model for a process as it is run (as-is process model)?
	Process analysis	Yes/No	Is there an explicit reference that the paper relates to assessing whether or where a process has strengths and weaknesses, and for summarizing its performance or conformance in terms of measures or indicators?
	Process re-design	Yes/No	Is there an explicit reference that the paper relates to deriving potential redesign options for a process, creating a to-be model?
	Process implementation	Yes/No	Is there an explicit reference that the paper relates to putting a to- be process model into practice, creating the organizational and technological environment in which it can be executed, and approaches and techniques of supporting the execution of processes on a technological level?
	Process monitoring & controlling	Yes/No	Is there an explicit reference that the paper relates to continuously tracing processes at runtime and signaling patterns of interest, and approaches for analyzing and presenting the execution data of a process to gain insight into performance and conformance of a process?
BPM Capability	Stategic Alignment	Yes/No	Strategic alignment refers to the continual alignment of organizational priorities and processes, enabling the achievement of business goals. In the digital age, strategic alignment must strongly focus on the value proposition of business processes and BPM.
	Governance	Yes/No	Governance establishes relevant and transparent accountability and decision-making processes to align rewards and guide actions.

Category	Coding criteria	Relevant codes	Coding instructions
	Method/Information Technology	Yes/No	Methods are the approaches and techniques that support and enable consistent process actions and outcomes. IT refers to the software, hardware, and information systems that enable and support business processes.
	People	Yes/No	People are the individuals and groups who continually enhance and apply their process-related expertise and knowledge.
	Culture	Yes/No	Culture comprises the collective values and beliefs that shape process-related attitudes and behaviors.
Cost Impact	Type of BPM Project	Strategic	BPM strategic refers to an initiative that focuses on the strategic planning, development, and implementation of BPM capabilities within an organization
		Automation	BPM automation refers to the use of technology and software solutions to streamline, optimize, and automate business processes within an organization. It involves the application of tools and systems to automate manual tasks, reduce human intervention, improve process efficiency, and ensure consistent execution of processes.
		Improvement	BPM Improvement refers to analyzing and optimizing, or can be redesigning existing business processes to increase efficiency, reduce costs, and enhance overall performance. It involves identifying bottlenecks, streamlining workflows, and implementing process changes or automation.
		Assessment	BPM assessment, refers to the evaluation and analysis of an organization's current state of its business processes, capabilities, and practices related to BPM.
	Direct cost	Material	Material costs are the costs of raw materials or parts that go directly into producing products
		Manufacturing supplies	All manufacturing expenses incurred in producing final goods or services
	Indirect cost	Overhead	Costs that are not directly related to the production process or services. Simply put, overhead costs mean additional expenses or other expenses.
		Human resource	Human resource costs are those associated with recruiting, hiring, training, and retaining employees

Category	Coding criteria	Relevant codes	Coding instructions
		Accounting & Payroll Software	Costs incurred for accounting and payroll calculation software
		Utilities	Operational costs that must be incurred, even if the business is running well or not.
Impact	Citations	Citation count	Enter count of citations using the Google Scholar engine
Coding process	Not relevant	Free text	Indicate here if you believe the paper is not relevant to be included (e.g., the reference to a research method only appears in the outlook or introduction section of the paper). State a brief reason. Once indicated here you do not need to code this paper with the other criteria.
	Requires further examination	Free text	Indicate here if you find a paper too ambiguous or difficult to code and state a brief reason (e.g., "can't make sense of it" or "very poor English"). Once indicated here you do not need to code this paper with the other criteria.
	Notes	Free text	Please enter all comments for the research team here. E.g., "I think this paper uses terms inconsistently/inappropriately" or "methodologically weak".

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