



BENEFITS OF SUPPLY CHAIN PROCESS IMPROVEMENT INITIATIVES: A STRUCTURED LITERATURE REVIEW

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ABSTRACT

There is growing interest across industries to apply Business Process Improvement (BPI) initiatives in supply chains. Academic literature and standard industry practices indicate that these initiatives are undertaken subject to technological advancements. This paper aims to set the context for BPI initiatives by presenting the first structured literature review explaining how different organisations perceive the benefits, confront challenges, and realise critical success factors in the context of supply chain management. A tool-supported four-phase literature review approach was adopted as the methodology for this research and 81 papers were considered for analysis based on their relevance to the scope of this research. The analysis comprises benefits of different process improvement initiatives, classified under procurement process improvements, manufacturing process improvements, warehousing and distribution process improvements, and miscellaneous improvements. Furthermore, this study elaborates the general success factors and challenges that could be considered for any process improvement initiative. The paper concludes by summarising findings and suggesting future research directions to expand the role of BPI initiatives in decision-making.

Keywords: *Process Improvement Initiatives, Critical Success Factors, Supply Chains, Benefits, Challenges*

1. INTRODUCTION

In the current dynamic business environment, organisations must eliminate drawbacks embedded inside a system and bring performance close to perfection. To do this, businesses set the context with problem-solving initiatives. According to Smith [1], every instance of quality problem-solving entails five kinds of quality problems related to: (1) conformance, (2) unstructured performance, (3) efficiency, (4) product design and (5) process design. This predominantly includes either devising new processes or substantially revising existing processes. Accordingly, the importance of managing awareness of organisational processes, establishing process design, and constant improvement are ongoing requirements for organisational success [2].

These represent a new orientation to problem-solving, making it an integral part of the management function, practiced throughout the firm. Overall, an effective process for problem-solving ensures that the context aligns with improving the quality of products, reducing costs, eliminating wastages, reducing defects, improving skill levels, motivating workers, and enhancing morale [3].

It was observed that there is an ongoing scepticism on defining process orientation. Consequently, different authors define “process” based on the following dimensions. Hammer and Champy [4] describe a process as “set of activities which, when taken together, produce a result of value to a customer.” According to Davenport [5], a process is denoted as “a set of structured and measured activities designed to produce a specific output.” Palmberg [6] considers the process to be “a horizontal sequence of activities that transforms an input (need) to an output (result) to meet the needs of customers or stakeholders.” The global standard that discusses quality management systems defines process as “a set of interrelated or interacting activities that transforms inputs into outputs”. Business Process Management (BPM) paradigm is a novel way of looking at organisations based on the processes they perform rather than on the functional units, departments, or divisions. The incentive for change in process-based management is recognised as a prominent success factor in the literature. Trkman et al. [7] describes the importance of accepting process-based management principles to cope with the business challenges.

Business Process Improvement (BPI), as a term, is widely used in literature. According to Realyvásquez-Vargas et al. [8], when process improvement starts with careful planning, corrective and preventive actions are supported by appropriate quality assurance tools that lead to real process improvement. More importantly, BPI is an umbrella term for well-known techniques such as Lean, Six Sigma, Total Quality Management (TQM), process redesigning, and process reengineering.

Ujvagi [9] reports the interdependency prevailing between BPI and BPM. The latter term combines BPI, performance management, and organisational change management with technology. This representation has assured the success and sustainability of process improvements initiatives while enabling a process excellence culture.

The supply chain is a combination of business processes. It starts with procuring of raw materials and ends with delivering value-added finished products or services to end-users [7], [10]. Therefore, to become competitive in today's world while reaching the strategic objectives, an organisation must take necessary actions to eliminate the inefficiencies embedded to supply chain processes. BPI initiatives make this possible by removing wastage, utilising resources, and optimising processes [11]. However, it is necessary to identify the suitable BPI initiatives that can be adapted to supply chain processes with reference to the benefits that can be gained. Moreover, identifying the success factors and challenges that have to face when taking such BPI initiatives are critical.

Understanding how BPI initiatives yield benefits across the supply chain is important given that modern supply chains are increasingly tiered, with stakeholders interacting in complex ways. Several authors have discussed the benefits of supply chain process improvement initiatives using theoretical and exploratory studies [12], [13], [14], [15]. However, there is a lack of literature which combine the findings of all these studies and provide opportunities to identify comparative benefits. Thus, this paper targets to emphasise the importance of adopting BPI initiatives for supply chain processes by presenting the first structured literature review and bibliometric analysis on benefits of supply chain process improvements. It focuses on exploring how different organisations perceive the benefits, confront challenges, and realise critical success factors through process improvement initiatives in the context of supply chain management.

The remainder of the paper provides with key definitions, research background, and theoretical foundations in Section Two, the method adopted to compile the literature database in Section Three, and a bibliometric analysis of the collected papers in Section Four. Section Four provides an end-to-end perspective on BPI initiatives; it is followed by Section Five, which identifies potential gaps and suggests evidence-based implications for practitioners and future researchers regarding the state-of-art in supply chain process improvement initiatives.

2. BACKGROUND AND THEORETICAL FOUNDATION

This section highlights the key research domains in the field and a basic overview of the theoretical foundations related to the reviewed literature.

2.1. Business Process Management

There is a rich literature on Business Process Management (BPM). The first study of BPM was conducted in the 1990s, where Elzinga et al. [16] defined it as “a systematic, structured approach to analyse, improve, control, and manage processes to improve the quality of products and services”. Two years later, Zairi [9] characterizes BPM as “a structured approach to analyse and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company’s operation”. In the early 2010s, researchers considered BPM as a discipline with no academic foundation or an academic conceptual framework [17], [18]. Later, its interpretation was aligned with a list of organisational requirements that set a context for emerging discussions viz: product and service quality improvements; effective fulfilment of globalisation and highly competitive environments; and response to client needs [19]. Basically, BPM can be interpreted as a combination of Business Process Improvement (BPI), performance management, organisational change management and technology that strives organisations towards success and sustainability through process enhancements [9], [20].

2.2. Business Process Improvement

Business Process Improvement (BPI) is a one aspect of BPM [9], [20]. It is beneficial to possess BPI initiatives integrated with BPM disciplines and responsibilities, to achieve better results in the organisational BPM [19].

Evidence suggests that BPI paradigms include both continuous process improvement initiatives (Kaizen) and radical process improvement initiatives (Kaikaku) [17]. The continuous count on small improvements is advocated in the Kaizen concept, providing ambiance through gradualism. The basic tools prevailing under this discipline are mostly Lean and Six Sigma. According to Davenport [21], Kaizen represents everyone in the workforce, from managers to clerks, and is applied every day and in every position. In contrast, Kaikaku is a progressive method when large changes are needed to remain competitive or solve larger problems. Kaikaku allows organisations to transform their culture, processes, or even business models by addressing large structural reforms. The basic tools under this discipline are mostly Enterprise Resource Planning (ERP) implementation, process reengineering, and process redesign [22].

2.3. Business Process Improvements and Supply Chains

The supply chain is a combination of business processes that starts with procuring of raw materials and ends with delivering value-added finished products or services to end-users [7], [10]. BPI initiatives should be incorporated into supply chains by

obtaining an activity-wise characterisation of what occurs in the end-to-end supply chain. Procurement contributes to the process of meeting particular need(s) through an identified and evaluated source [23]. In the context of the supply chain, procurement is defined as, “overall sequence of events that sum up the purchasing activity from identification of a need to payment of invoices in respect of the goods or service purchased to satisfy a given need” [23], [24]. Most BPI initiatives in the procurement function are dedicated to improving planning, decision-making, and information sharing disciplines [25], [26]. Manufacturing is an input-output system that transforms manufacturing resources (materials and energy) products or semi-products [27]. Much of the literature tries to incorporate process innovation, total productive maintenance, and real-time information sharing as means of advocating BPI initiatives in the manufacturing discipline of supply chains [28], [29], [30]. In the context of BPI, outbound logistics functions, including warehousing, distribution activities, are more concerned with integrative business implementations [31]. One area of research in this domain that has received burgeoning attention is Lean Six Sigma (LSS) integration [32], [33]. Despite this, adopting various BPI initiatives in the outbound logistics context, including warehousing, distribution activities, has further room for contributions. Hence, it is evident that BPI initiatives vastly improve end-to-end supply chain processes [34], [35], [36].

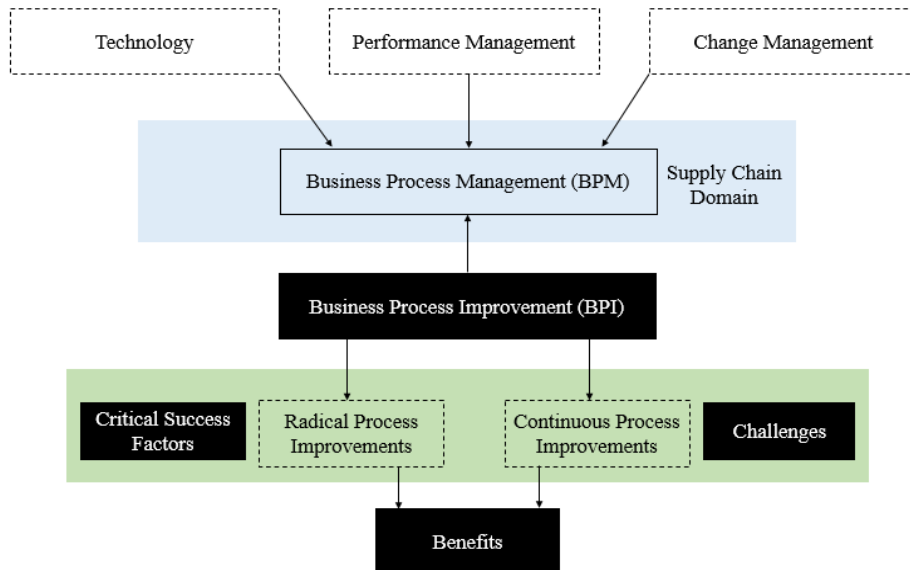


Figure 1: Structure of the theoretical background considered for the research

Moreover, the Covid-19 pandemic has caused supply chain disruptions due to lockdowns and health concerns [37], [38]. It is important to put efforts to improve supply chain resilience to cope with these challenges. As the literature demonstrates,

both continuous and radical process improvement initiatives help to maintain supply chain resilience while ensuring safety, transparency, responsiveness and collaboration [38], [39], [40].

Even amid growing academic interest in determining the relationship between BPI initiatives and the overall supply chain, there is a lack of literature that considers the state-of-the-art in BPI initiatives. Such literature should reflect benefits, challenges, and critical success factors targeting BPI initiative success. This literature review project has bridged this gap and created novel knowledge by focusing on the research question, how benefits, challenges, and critical success factors of BPI initiatives and the end-to-end process of supply chain management have been integrated into existing literature? It will be useful for future researchers to discern the already existing work and save time and resources during future research.

2.4. Research Objective

It is important to define the role of BPI initiatives, thereby increasing the organisation's overall performance and making the system resilient to dynamic environments. Thus, the main objective of the present study is to explore how different organisations in the literature perceive benefits, confront challenges, and realise critical success factors in the context of supply chain management. Hence, three Research Questions (RQs) are denoted as: (RQ1) What is the role of BPI initiatives suggested by recent research in advocating end-to-end supply chain? (RQ2) How can recent research on BPI initiatives be classified in terms of the perceived benefits, challenges, and critical success factors? (RQ3) What are the implications to practice and future research directions?

3. METHODOLOGY

A structured literature review was conducted to find answers to the above-mentioned research questions. Structured literature review is a review method which has a pre-defined plan along with criteria to search, review and analyse literature [41], [42].

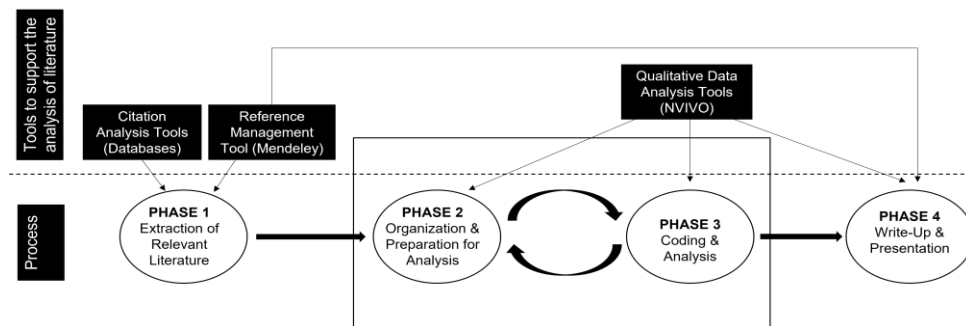


Figure 2 : Overview of the methodology followed

The tool-supported four-phase literature review approach, suggested by Bandara et al [41], was adopted (depicted in the Figure 2), as the review methodology for this research, based on a thorough review of existing literature reviewing methodologies.

As the initial step keywords were identified under the two main aspects of the research which are supply chain related keywords and business process improvement related keywords. Four search strings were developed using the identified keywords. ABI/INFORM, Scopus, Taylor and Francis and ProQuest databases were used to extract research papers, and 81 papers were considered for the final analysis based on the relevance to the review scope. Literature papers that have discussed benefits, success factors and challenges of different supply chain process improvement initiatives were selected for the final analysis which was done using NVivo software.

Main NVivo codes were made under three categories: benefits, critical success factors and challenges. Under the benefits category, additional sub-categories were made: namely, procurement process improvement, manufacturing process improvement, warehousing and distribution process improvement and miscellaneous improvements. Each sub-category was further categorised according to different initiatives such as Lean, Six-Sigma, Lean Six Sigma, ERP, Redesign and RFID, etc. This coded literature was reviewed and analysed while identifying similar benefit patterns. Critical success factors and challenges categories were further sub categorised and analysed based on similar patterns in literature.

The summary of the methodology adopted is depicted in the Figure 3.

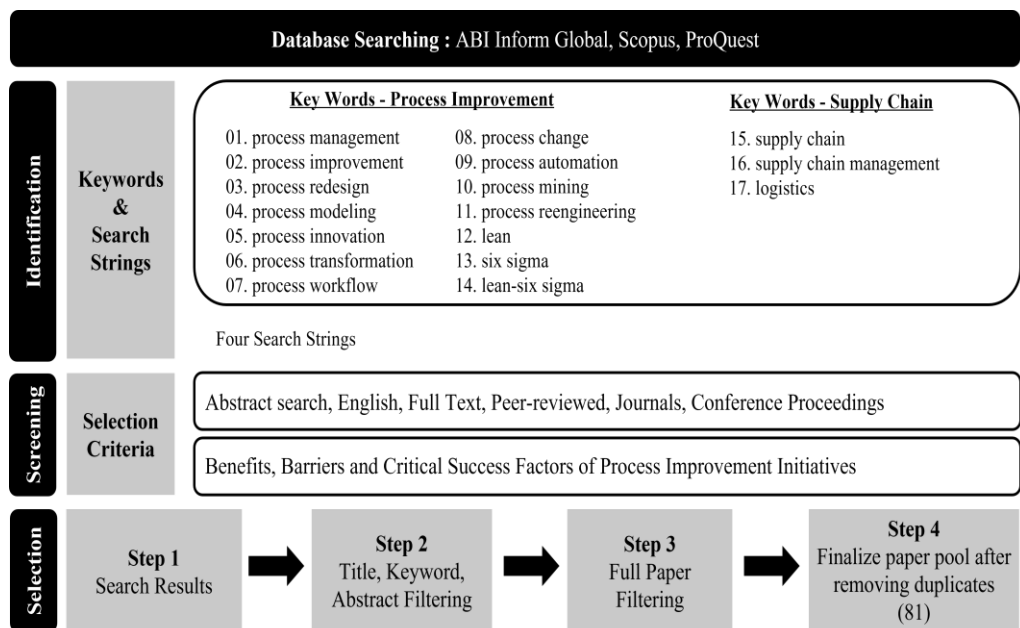


Figure 3 : Methodology summary

3.1. Profiling the Literature

This section contains a descriptive overview of existing literature. According to Figure 4, publications related to this topic can be found since 1997, and random fluctuations can be observed until 2021. The highest number of papers emerged during the year 2020, with nine papers.

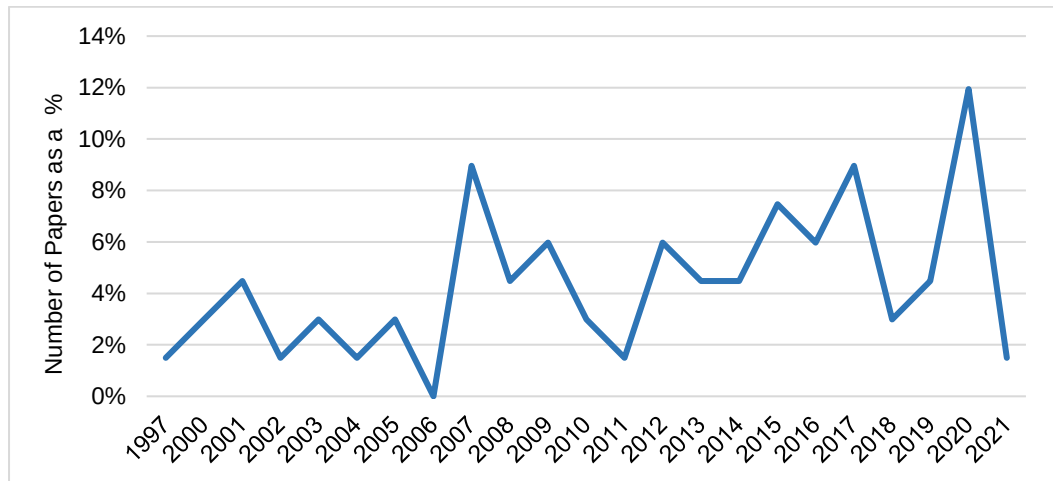


Figure 4 : Distribution of papers over the years

Figure 5 represents the industry distribution of BPI initiatives as stated by authors. Most of the research describing BPI initiatives were adopted in the manufacturing (25%) industry, followed by the logistics and distribution (16%) industry. All these industries were categorised based on authors' statements found in reviewed literature.

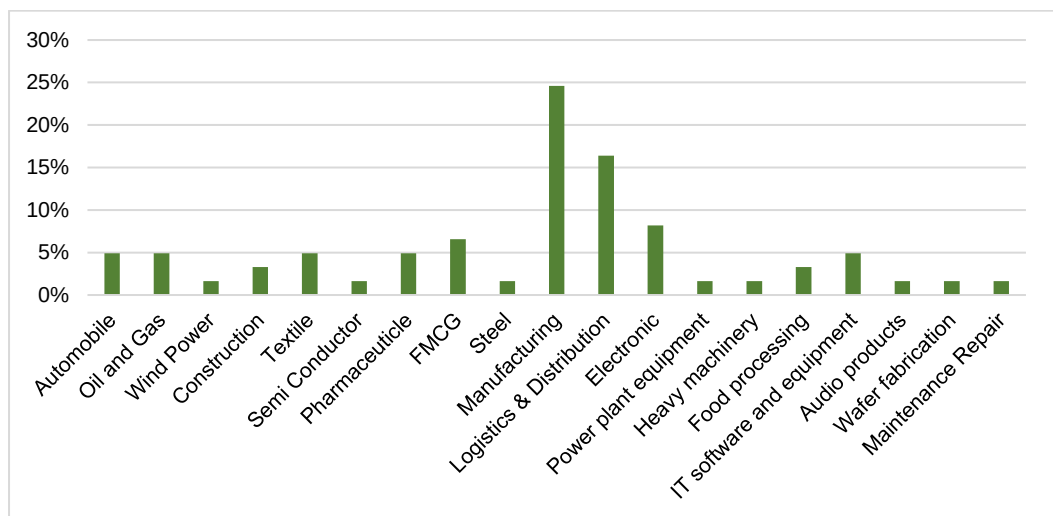


Figure 5 : Analysis of literature based on the type of industry denoted by the respective authors

Literature analysis according to the BPI paradigms used by different organisations can be found in Figure 6. It is observed that most organisations have used business process reengineering when making improvements (more than 42%) to their processes. BPI related to process redesign and Lean are accounted for around 24%.

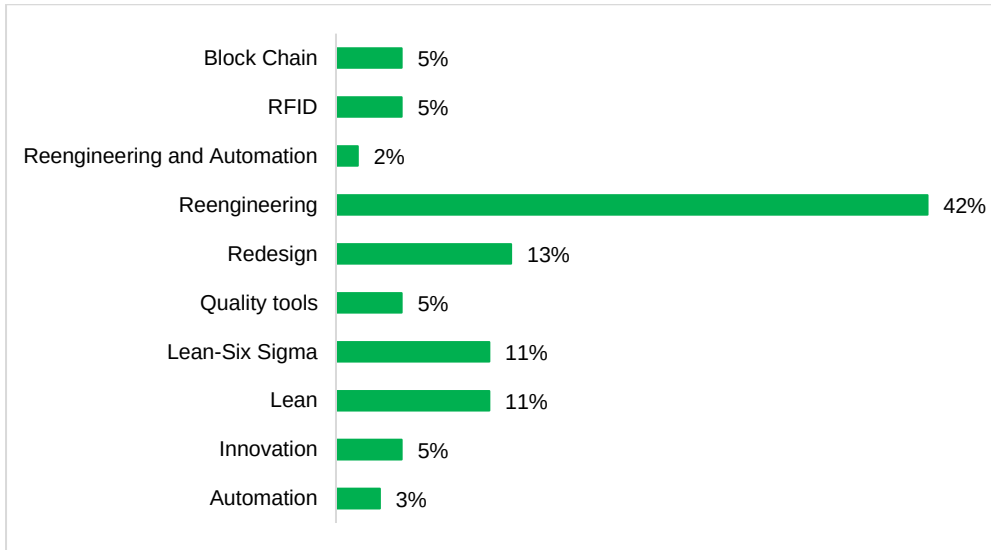


Figure 6 : Analysis of papers reviewed on the BPI paradigms

4. RESULTS AND FINDINGS

This section contains the results and findings under three main categories: benefits of supply chain process improvement initiatives, critical success factors of supply chain process improvement initiatives and barriers for supply chain process improvement initiatives.

4.1. Benefits of Supply Chain Process Improvement Initiatives

This section includes an analysis of review findings for the benefits of process improvement initiatives. Analysis was done by categorising benefits of different process improvement initiatives implemented under procurement process, manufacturing process and warehousing and distribution process. All other initiatives that are not coming under the above three categories are interpreted under a separate category named miscellaneous improvements.

4.1.1. Procurement Process Improvement Initiatives

It was observed that BPI initiatives emerged under the procurement function more focused on inter-organisational collaboration with real-time information sharing with suppliers. Based on procurement activity, Yen & Ng [25] discuss the benefits of a

government-funded E-Procurement facility called HKTAIGA (Hong Kong Textile and Apparel Industry Global Applications) for small and medium-sized enterprises in the Hong Kong textile industry. This facility provides inter-organisation communication and a portal to interact with financial institutions and logistics service providers. It reported cost reduction benefits for suppliers and buyers regarding fewer storage spaces requirements, reduced physical visits to clients, and on-time order deliveries and material supplies. In a similar study, a one-third reduction in administrative costs due to reductions in costs associated with searching for order, placing the order, and paying for an order has been identified by Croom [43] through a comparison of E-procurement and manual procurement. Accordingly, increased information for customers, reductions in stationary cost, and excluded supply chain links such as travel agents' benefits were denoted as benefits of the proposed E-Procurement system.

On the flip side, Groznik & Maslaric [26] examine the relationship between process modelling and process reengineering. In this paper, two alternatives of process reengineering were simulated for the procurement process of petrol stations through a Serbian petrol company: Information Technology (IT) facility introduction with organisational structure change (to-be A) and IT facility introduction without organisational structure change (to-be B). Both methods reported benefits through reductions in transactional cost and average lead time. However, the reduction gained through (to-be A) is larger than the (to-be B). Thus, it indicates the importance of change in organisational structure to yield more process reengineering benefits. Trkman et al. [7] also confirm that benefits such as average lead time reduction, labour cost reduction, inventory cost reduction, and process cost reduction can be achieved for the procurement process by facilitating external integration through IT implementation and process renovation. It recorded a 70% process cost reduction and 62% average lead time reduction while showing how supply chains can be improved by integrating supply chain activities.

Sammon & Hanley [44] have researched two electronic-based improvement initiatives to procurement management and payments handling, and it included a web-based option and a Business to Business (B2B) E-solution. These two options automate order sending and receiving tasks. Furthermore, B2B E-Solution provides additional benefits such as touchless transactions and fewer data entry errors on automated transactions processed by the suppliers' system. Similarly, Viale & Zouari [14] researched the impact of digitalisation of the procurement process using two companies. The technique Robotic Process Automation (RPA) has been applied as the digitalisation technique. As Viale and Zouari identified, benefits can be obtained under six categories: transaction time, productivity, compliance, accuracy, labour

hours, and costs. Thus, it resulted in reduced request completion time, increased employee satisfaction, reduced safety stocks of materials, reduced human errors, increased data accuracy, cost savings due to reduced poor production and reduced overtime workload, and increased customer satisfaction.

Ongoing negotiations with suppliers are also an important supply chain task that businesses should consider. One category of that is handling of auctions. Online auctions are a B2B E-solution that can be performed in a shorter time than traditional auctions. As Emiliani [45] confirmed, this method gives benefits not only for buyers but also for suppliers. Benefits for buyers include a much disciplined auction process, the ability to evaluate many capable suppliers, and the ability to develop negotiated prices within a few hours. Benefits for suppliers include the equal chance for all interested suppliers, reduces marketing costs, the ability to validate competitiveness among competitors, and long-term agreements. Moreover, quality associated with materials supplied is an important aspect that must be considered during supplier selection process, mainly because low-quality materials result in increasing production cost [46], [47]. In order to consider the quality aspects for supplier selection, a special model has been developed by Chen et al. [47] with reference to the process capability index. Using this model, a user can visualise each supplier's capabilities for a considered process quality characteristic, and it helps to select the best supplier and to provide quality-related recommendations for others.

4.1.2. Manufacturing and Manufacturing Supportive Processes Improvement Initiatives

A study conducted by Westhuizen & West [48] reveals that cross-function integration through ERP systems provides multiple benefits. It focuses on integrating warehousing and work order planning and warehousing activities. As it proved, the integration mentioned above provides benefits such as on-time delivery of materials, utilisation of available information via ERP system, picking time reduction, and facilitating external integration.

This has been further proven by the research conducted by Arlbjørn et al. [49] which emphasise the importance of enhancing the internal integration through ERP implementation to improve competitiveness. They focus on integrating sales and delivery, production, production planning and procurement processes through ERP implementation through integrating the company's several IT systems into one system. It resulted in reduced employee requirement, reduced capacity requirement resulting from reduced inventory, improved delivery quality resulting from reduced delivery delays and reduced wastages. In contrast, cross-functional integration through ERP implementation results in financial, operational, internal relational and external relational benefits.

Moreover, the study conducted by Yan et al. [50] identify the benefits of process redesign through developing a process resequencing model. This model re-sequences and merges the activities in the production process. It reduces safety stock, the step-up time required for different products, and improved product quality.

Lean implementation focuses on reducing wastes associated with processes by reducing non-value added activities [51], [52], [53]. Each business needs an information management method to run operations without errors and disruptions. Therefore, it is important to use available information by communicating effectively. Soares & Teixeira [54] describe the benefits of adopting a Lean information management system in logistics. The study focused on redesigning the existing information management procedures related to production orders and sales forecasts by joining them to automate data crossing and calculations. This study further reported reductions in human resources and time required to perform the task. Parry and Turner [53] describe how the manufacturing industry can benefit from adopting a Lean information management system through a case study research conducted with three aerospace leaders. This Andon-based information system has been integrated with ERP so that production details such as units, pending tasks and anticipated finishing time can be communicated to workers in the plant. This results in improved transparency in production and eliminates bottlenecks; the eventual results include cost reductions, increase in productivity and waste reductions. A similar study conducted by Senkuvienė et al. [50] discussed the manufacturing process improvement initiative of combining IT and Lean concepts. This initiative is about real-time monitoring of the production process progress and equipment workload. As a result, this method improves timely production and staff effectiveness.

An empirical study conducted by Ward and Zhou [12] suggested that implementing Lean/Just in Time (JIT) reduces the customer lead time (order receipt to order delivery to the customer). Moreover, they emphasise the mediating role of Lean/JIT on IT integration. According to the findings, both internal IT integration and external IT integration do not have a direct effect on reducing customer lead time. However, this effect will be mediated if implemented with Lean/JIT practices. Further, it elaborates that the above results are in the same manner for manufacturing lead time. The study conducted by Kovács [52] tries to emphasise the importance of combining facility redesign initiatives with Lean initiatives while proving the integrated initiative gives more benefits than implementing two initiatives separately. Facility redesign aims to optimise arrangements of facilities and material flows in the plant. Kovács applied 13 methods under Lean with facility redesign which gave 15 benefits including improved productivity, reduced travel distances, improved process transparency, ergonomics and employee satisfaction.

Several authors tried to show benefits that can be gained by combining Lean with Six Sigma (LSS). This amalgamated initiative helps to improve quality while eliminating wastages associated with processes [42], [55]. Thus, it gives more benefits than implementing separately [56]. Further, Zhang et al. [32], reveal that benefits such as cost savings, reduced cycle time, improved delivery performance, improved employee utilisation, eliminated or reduced process wastages, and improved inventory turnover can be achieved through implementing LSS tools as process improvement initiatives. This study was conducted for the logistics sector in Singapore as a survey. Similarly, the study conducted by Hill et al. [33] discusses the use of the LSS framework to identify and reduce the issues related to an Aerospace engine repair and maintenance facility. The developed framework identified causes for late calls for materials and non-value-added activities of the facility operations. This model benefits the facility by reducing late calls and reducing order-to-receipt time. Thus, it helps to improve the overall efficiency of the facility.

The case study research conducted by Vinodh et al. [55] also proves that lead time can be reduced by implementing LSS. LSS has been adopted to reduce the work-in-progress inventory and defective products which eventually gives a cleaner working environment while reducing customer complaints.

The study conducted by Thomas et al. [57] propose a new framework for LSS implementation by combining DMAIC (Define, Measure, Analyse, Improve and Control) cycle to the standard lean thinking cycle. This is somewhat at odds with the LSS implementation cases as all of them directly follow DMAIC and adopt Lean tools whenever necessary (examples: value stream maps (VSM), Kanban, total productive maintenance (TPM), etc.). As Thomas et al. state, Six Sigma centric LSS adoption contains two issues: Lean thinking is not strategically applied as Lean tools are adopted under DMAIC whenever necessary, dual impact of Lean and Six Sigma is eliminated with the use of DMAIC as the structure. Thus, it results in more quality improvement-based projects. The applicability of this framework has been proven by applying it to the aircraft manufacturing industry with the reduction of cost per aircraft manufacturing [57].

Machinery performance significantly impacts process performances such as cost, quality, productivity, and time consumption [58], [59], [60]. Therefore, it is necessary to pay attention to the timely maintenance of machinery. Total Productive Maintenance (TPM) emerged during the 1970s in Japan, considering the maximisation of equipment effectiveness. It covers productivity, inventory, cost, safety, production output, and quality depending on equipment performance [58]. Accordingly, TPM prevails to eliminate machinery breakdowns or defects caused by the production process. TPM is not the same as any other maintenance approach but

is also a critical supplement to Lean production [46]. Case study research conducted by Singh & Ahuja [29] identified the benefits of TPM such as improved productivity, improved quality, reduced labour cost.

4.1.3. Distribution and Warehousing Process Improvement Initiatives

The distribution function plays a vital role in reducing lead times embedded in an organisation. Based on that assumption, much research has discussed the role of BPI initiatives in escalating overall performance. Research shows that reducing lead time on perishable supply chains is critical. For example, in healthcare supply chain, platelet distribution is a very time-sensitive task due to the short shelf-life [61]. After the shelf life, the platelet becomes outdated and cannot be used on patients for treatments. A case study research carried out in US by Fontaine et al. [62] addresses this issue of distribution network by redesigning supply chain through better collaborations between blood centres and transfusion services. A newly designed network results in reducing expenses due to minimised safety stock and outdated stocks.

The importance of electronic information sharing is discussed by Clark & Lee [63], where they reveal that both manufacturers and retailers can benefit from improving the replenishment process to make it continuous by adopting the EDI (Electronic Data Interchange) system. This improvement initiative which combines process change with technology (EDI), results in higher inventory turnovers and reduced data entry errors. Another study conducted by Shen & Chou [61] reveal that logistics companies that apply Business Process Re-engineering (BPR) to their processes perform better than those that do not. Performance can be identified in activities or functions such as: order receiving, order picking, order processing, shipping, information processing, coordination, human resource management, organisational culture, and structure.

The application of Lean based value stream mapping method to improve the reverse logistics process has been studied by Rabnawaz Ahmed & Zhang [62], considering steps associated with inert construction waste management. As the study reveals, different future waste management strategies can be developed by comparing the value stream maps (VSM) for current state and future state of the value chain. It helps to eliminate wastages and non-value-added tasks to get an optimal solution. This method calculates and reveals benefits such as total process time reduction, fuel consumption reduction, facility and non-facility-based cost reductions, travel distance reduction, vehicle capacity utilisation, and pollution reductions [62].

A study conducted by Gutierrez-Gutierrez et al. [56] identified the benefits of process standardisation for two logistics processes: payment process and order request to

shipment process through implementing LSS. With this improvement cycle time for the process has been reduced. Specially, they tried to elaborate on how a logistics company can benefit by applying DMAIC and VSM to improve logistics processes. Besides, case study research conducted by Dzubakova & Koptak [64] about the logistics process standardisation also provides evidence regarding the benefits of standardisation. Dzubakova & Koptak mentioned benefits such as cycle time reduction, variability reduction, waste reduction, and efficiency improvement through process standardisation.

Agreements for quotations between logistics service providers and customers, including negotiations, are time-consuming activities. Therefore, logistics service providers need to take action to improve mutual understanding and mutual benefits. Liu & Li [63] suggest a Quality Function Deployment (QFD), a tool-based argumentation model, to address this issue. This solution provides benefits such as quick response time and more transparent negotiations while improving overall business efficiency for both parties.

Managing relationships with customers is a very important aspect of a make-to-order business. Therefore, it is important to take initiatives to improve the customer relationship management process. Brashear Alejandro et al. [65] suggest a novel approach by considering customers' lifetime value, which gives an improved delivery performance as a benefit. The presented model in [65] considers past, future, and customer loyalty to decide the lifetime value. The model has been validated using a case study approach, and results show an increase in customer satisfaction.

RFID (Radio Frequency Identification) technology and Electronic Product Code (EPC) systems are two other IT technology dimensions adopted by most businesses. RFID enabled Walmart stores, which recorded significant cost savings through stock shortage reduction, is one of the best examples [66], [67]. A study conducted by Wamba & Boeck [68] regarding the RFID and EPC adoption in the retail industry also validated the cost savings. The study reveals benefits such as time savings in the receiving process due to automated information flow, reduced labour cost, reduced human errors, and reduced information tracking due to an automated tracking system. Moreover, as Wamba and Chatfield [69] have demonstrated, this would help to identify the variations in customer orders and receiving or dispatch quantities automatically as it can be connected with the warehouse management system (WMS)/ERP system of the organisation. Further, it can be used to give indications for drivers regarding whether the order has been completely loaded or not [70]. Generally, this tracking system gives significant cost savings by automating information flows, reducing human errors, reducing labour requirements and reducing process costs [68], [66], [70], [71].

4.1.4. Miscellaneous Supply Chain Process Improvement Initiatives

Supply Chain Management (SCM) is a cross-functional activity that considers integrating materials, information/data, and money between different functions such as sales, marketing, finance, procurement, manufacturing, and IT [72], [73]. Thus, much research developed across SCM elaborates the role of BPI initiatives in curtailing discrepancies through managing technology holistically. Auramo et al. [34] confirm that improved service level, operational efficiency, information quality, and agility can be obtained through IT implementation for supply chain activities. This study used 18 IT implementation cases in different industries to identify the benefits mentioned above through propositions validation. However, the study has been focused on ERP, electronic data interchange (EDI), internet, system web portals (B2B web portals), and third-party B2B web portals. Besides, benefits of cost-saving resulting from reduced human errors, better information flow resulting from better inter and intra-organisational communication, shorter response time, and improved profit have been identified as Electronic Supply Chain Management's (E-SCM) benefits by [74]. These benefits have been obtained through a study conducted on the Electronic Manufacturing Services (EMS) industry of North America.

Furthermore, efficiency benefits of labour cost reduction, inventory management cost reduction, and material order process cost reduction have been identified by Barsauskas et al. [36] through a study conducted to explore the impact of E-SCM on business efficiency. However, this study has been considered only the B2B E-SCM activities. This case study conducted for Lithuanian computer equipment wholesale company mentioned that there is a 57% increment in business efficiency with using B2B E-SCM. Moreover, Hwang & Lu [30] discuss the benefits of an E-SCM implementation project in Taiwan's Semi-Conductor industry to integrate all supply chain partners. According to Hwang & Lu, this project provided several benefits, including reduced data transfer time, on-time delivery of information, improved data transparency, and improved data accuracy. Akyuz & Rehan [75] also identified several other benefits of E-SCM such as the integration of internal and external supply chain functions, real-time collaboration, automated business activities.

A Green Lean Six Sigma (GLSS) model for public sector supply chains has been introduced by Sreedharan V et al. [76], considering the procurement, production, and distribution supply chain functions. This module evaluates suppliers using eco-friendly standards while ensuring the procurement process in linear and green conditions. The production process of the module has been prepared to ensure the application voice of the customer, eco-friendly production, and total productive maintenance. The distribution process identifies and evaluates the non-value adding tasks and finally eliminates non-value adding tasks' impact. Overall, this model

reduces wastes while reducing the burden on the environment and humans. In addition, De Giovanni & Cariola [77] confirms that three categories of benefits: improved environmental performances, operational performance, and economic performances can be obtained through adopting Green Supply Chain Management (GSCM) practices. This paper concludes the fact that the adoption of lean also contributes to the benefits mentioned above. These results have been validated using data from several industries from multiple countries.

In addition, improved operational performance on process and product innovation has been proved by Tarigan [78] through a study conducted using 42 small and medium-sized shoe firms in Indonesia. As a result, innovation firms can reduce labour costs and burden costs while lowering the product price. Additionally, firms can improve competitiveness with the industry through customer attractiveness and affordable products through product innovation. Nguyen & Harrison [79] prove that benefits related to financial performance and cost reductions can be reached through process innovation. Besides, process innovation benefits such as flexible production processes, improved product quality, expanded production capacity, and reduced labour costs and production costs have been reported by Macurova et al. [28] using a cross-industry analysis for firms in the Czech Republic.

A study conducted by Jayaram et al. [80] confirm the impact of information systems infrastructure on on-time performance. Information systems infrastructure plays a significant role in supply chain process improvement as it facilitates the integration of different supply chain activities. The study tested the impact of the three sectors of information systems infrastructure: IT, Design Manufacturing Integration (DMI), and manufacturing technology on-time performance. As the study reveals, DMI reduces product development time and delivery time. The other two sectors also reduce the product development time while improving the responsiveness to customers. Thus, it clearly shows the impact of information systems infrastructure on cycle time reduction of processes. A study conducted by Dehning et al. [35] confirm that IT-based SCM practices benefit both inbound and outbound supply chain practices while enabling better relationships with customers and suppliers. Thus, it reduces the required inventory levels for a firm and results in cost savings. This study further reveals that benefits related to the firm's internal process can only be gained through redesign and IT implementation. Saygin & Sarangapani [81] mentioned the supply chain level benefits of RFID system implementation through a study conducted for time-sensitive inventory tracking in the manufacturing industry. Mainly, it facilitates the vendor-managed inventory concept as it helps to eliminate the requirement of middle parties such as distributors through direct information sharing between supplier and buyer. It gives additional benefits including reduced labour intensiveness

due to automated data tracking and monitoring, utilisation of workers due to automated repetitive tasks, improved productivity and quality due to high data visibility, and mobile database facility. Gorla et al. [82] introduced an IT-based Business Process Re-engineering (BPR) model for process improvement. This model includes eight steps and shows the importance of organisational structure change and continuous improvement in BPR projects. Besides, the study records a 43.3% net profit increment in a year after the case study project completion.

In a study conducted by Mohanty & Deshmukh [10], lead time reduction, labour requirement reduction, inventory reduction, and risk reduction were identified as BPR benefits resulting from eliminating non-value-added processes. Mcadam & McCormack [16] argue that benefits such as long-term and stronger relationships with customers and inter-connected logistics and production processes can be gained through business process redesign. This redesign was about restructuring the organisation from production plants to supply chain activity centres. Banerjee [83] identified the benefits of process reengineering by introducing new three IT software related to procurement management, order planning, and order fulfilment. IT adoption to order fulfilment facilitates real-time order processing and transmission while eliminating orders via time-consuming media such as fax, telephones, and emails, requiring manual order entries. Its adoption to the procurement process gives benefits, including reduced lead time causing better connections with suppliers, increased data accuracy, and reduced inventory requirement due to reduced re-order points. More accurate forecasts and timely information for replenishment requirements benefit from the software adopted order planning process. Radosevic et al. [84] explore benefits gained using the lean-based value stream analysis tool as a process improvement initiative. Existing supply chain management practices have been improved after analysing it, and the following are the benefits received from it: reduced stock holding cost, reduced time for production line changes due to well-maintained planning activities, reduced write-offs of finished goods and raw materials due to better alignment of procurement and production planning activities, reduced warehousing cost, reduced transport cost and increased customer satisfaction due to quality service.

Jahre et al. [85] conducted a study to find reasons for stock shortage in the drug supply chain in a city of Uganda. Jahre suggests a supply chain redesign model which eliminates and reduces the identified reasons such as lack of storage facilities, transport facilities, proper ordering method, and staff competency levels. Jahre et al. [48] identified benefits by addressing these issues via the developed model, including lead time reduction, uncertainty reductions, and reduced stocks due to improved order frequency. Improvement initiatives to address these issues include introducing a

postponement strategy, implementing proper information flow, and strengthening the supply chain through internal and external integration and simplified structure. A new dimension to BPI initiatives was discussed in a case study research conducted by Arlbjorn et al. [49], where it discussed the benefits of integrating finance, logistics, production, procurement, sales and logistics through the ERP system integration. As mentioned, benefits including productivity improvement, delivery quality improvement, inventory cost reduction, labour requirement reduction, annual capacity cost reduction and energy cost reduction were achieved through this implementation.

Block chain is an emerging technology in the supply chain domain due to its track and trace ability and security [86], [87]. Block chain technology facilitates the ability to come up with smart contracts while building trust among strangers. This will reduce paper-based processing costs and traveling costs [87]. As Perboli et al. [88] state, block chain being a decentralised system prevents issues on trust, fraud and corruption that arise in relation to current centralised logistics management systems. Using a food supply chain as an example, Perboli shows how blockchains facilitate supply chain visibility while providing accurate and secure information and reducing human errors. Thus, it provides accurate information for forecasts which eventually help producers to reduce the bullwhip effect and stock-out situations through optimised and efficient production and capacity plans. Moreover, it enables prompt actions against food contamination and delivery delays that cause additional costs [88], [86]. Further, it provides accurate data regarding expiration dates and quality for food safety auditors. [88].

4.2. Critical Success Factors of Process Improvement Initiatives

This section describes the success factors identified through the literature reviewing process.

Top management is the utmost level of organisational hierarchy and has great influential power over the decisions. Even though top management typically does not participate in the improvement implementation stage, their guidance, motivation, appreciation, commitment, timely decisions, and resource providence positively impact project success [56] [30]. Moreover, there can be several processes with inefficiencies in an organisation. Therefore, a thorough analysis must be done to identify the supply chain process which has the most negative impact on organisational performance.

After a thorough review of selected papers, the factors summarised in the Table 1 (below) were identified as general success factors that could be considered for any process improvement initiative.

Table 1: General critical success factors obtained from the analysis

• Top management involvement	[89], [14], [54], [90], [91], [78], [30], [56], [55], [52]
• Proper identification of the process to be improved	[14], [55]
• Analysing the existing state of the process in the pre-implementation stage	[81], [92]
• Conducting a pilot project before the actual implementation	[81], [68], [26], [7], [93], [94]
• Conducting a feasibility study in the pre-implementation stage	[81], [15], [71]
• Prior implementation of quality standards.	[95], [96]
• Employee training and awareness regarding the improvement initiative	[74], [26], [97], [57], [13]
• Commitment, motivation and involvement of all stakeholders who are involving and affecting the implementation	[16], [81], [15], [79], [10], [26], [82], [97], [54]
• Establishment of a cross-functional team as the initiative team	[10], [82], [56], [55], [13], [88]
• Information sharing among stakeholders	[11], [13]
• Organisational structure changes	[26], [7]
• Continuous monitoring of results and progress	[82]
• Clearly identifying the importance of process improvement initiative for organisation's vision and strategy	[56], [14]

Proper identification of the improvement project will benefit the organisation in both financial and operational aspects. In addition, analysing the existing state of the process will help consider all the non-value-added activities. Flow charts, value stream maps and SWOT analysis can be used to analyse the existing state.

Moreover, some process improvement initiatives like IT implementation and machinery replacement require huge financial investments. Improper implementation of such initiatives will not provide actual benefits as estimated. Therefore, it is necessary to conduct a pilot project before implementing the improvement initiative (Example - Simulation). Besides, performing a feasibility study before the

implementation helps to understand the relationship between costs and benefits of the initiative. Thus, it acts as a guide to decide whether to invest and implement or not. Process improvement initiatives change some tasks performed by employees. As an example, the implementation of ERP systems eliminates reduces manual tasks performed by employees. Therefore, it is necessary to train employees regarding the new operational procedures and software interfaces, etc. Role plays, process-oriented learning, user manuals, and workshops can be used to train employees [74], [26].

Implementing quality standards help to maintain well-disciplined organisational processes. Therefore, such implementations influence the process improvement capabilities making it easy to improve [95]. Commitment, motivation and involvement of all stakeholders who are involving and affecting through the implementation is much required to direct the initiative towards the right path and to ensure success through continuity. Appointing a cross-functional team comprised of employees with multiple skills and knowledge areas is also acts as a success factor as it ensures the multidisciplinary aspects required for the initiative's success [82]. Information sharing among stakeholders provides opportunities to identify and take actions whenever necessary against possible risks. Further, sharing of information such as benefits and process changes among process users is important as it facilitates project continuation and continuous improvement.

4.3. Challenges for Process Improvement Initiatives

This section describes the challenges identified through the literature review process. After a thorough review of selected papers, those presented in the Table 2 were identified as general challenges for any process improvement initiative.

Table 2: General challenges for BPI initiatives obtained from the analysis

• Resistant to change and adopt for new process	[25], [14], [98], [32], [82], [42]
• Resource allocation issues	[36], [98], [42], [99], [25], [15], [69]
• Lack of top management commitment	[100], [42], [85], [10], [57]
• Lack of availability of customer data	[100], [65]
• Lack of employee training	[56], [42], [74]
• Issues related to information sharing	[7], [42], [101], [90], [15]
• Organisational culture barriers	[42], [102], [15]
• Implementing the process improvement initiative without organisational structure change	[26]

Resistance to change may arise from employees who perform the newly improved tasks [25]. Therefore, it is necessary to make them aware of the benefits they can gain and motivate them to adopt new changes. Resource allocation issues such as lack of financial resources, lack of machinery, lack of human resources and lack of technical knowledge is another barrier that must be taken into consideration when taking supply chain process improvement initiatives. Lack of top management involvement was found to be another important barrier [103]. Without top management's active commitment, guidance, and enthusiasm improvement initiatives are impossible to become a success.

Issues related to information sharing include lack of information, the accuracy of the information, and confidentiality of information. Some improvement initiatives expand the degree of information sharing requirement with other internal and external parties (Example – suppliers, consultants, etc.). Thus, it creates problems with the confidentiality of information. On the other hand, employees must be aware of initiatives' benefits and objectives through proper communication methods. Lack of training causes for unawareness of employees regarding the tasks [56]. Thus, it may affect productivity through wastages and time consumption.

5. DISCUSSION AND CONCLUDING REMARKS

The most recent literature review on BPI initiatives dates back to over two decades ago [63]. This paper presented the first systematic review of its kind. The study started keywords formulation without being restricted to any time limit. When compiling the documents based on their relevance to our scope, this study only reviewed papers from 1997. This rigorous iterative process provided a pool of 81 research papers spanning end-to-end supply chain disciplines.

This study aimed to set the context in determining the nature of BPI initiatives in terms of benefits, challenges, and critical success factors. Benefits of process improvement initiatives can be identified under four basic categories. These include operational benefits such as waste reductions, financial benefits such as cost reductions, internal relational benefits such as integration with internal divisions or parties and external relational benefits such as integrations with external parties (suppliers and customers).

Moreover, two types of trends can be observed among critical success factors and challenges. It was observed that success factors in the first type eventually become challenges if an organisation is unable to facilitate it. As an example, better top management involvement and adequate employee training regarding the new initiative are success factors for a supply chain process improvement initiative. On

the other hand, lack of top management involvement and lack of employee training become challenges for a supply chain process improvement initiative. This implies they are interchangeable. The second type of success factors act as leveraging factors and therefore they do not become challenges for a process improvement initiative. For example, prior implementation of quality standards influences supply chain process improvement initiatives by providing more disciplined organisational processes. However, it is not a mandatory requirement as it can be facilitated even through the process improvement initiative. Hence, they are not interchangeable.

The analysis arrived at several key findings and potential research directions as noted below. The present state of the literature reviewed in this paper has mostly considered process reengineering initiatives. Software developments including ERP, B2B web portals, EDI, special procurement software, and planning and scheduling software were considered part of process reengineering initiatives in this study. RFID technology became indispensable to researchers as an IT-related technology. This has become widely accepted in storage & distribution facility improvement projects assessing inventory tracking. Process redesign initiatives are common in the industry, yet academic research has not extensively explored this phenomenon. The prevalence of resequencing, restructuring, merging and route network redesigning was attached to this particular research discipline. More evidence-based studies that explain the applicability of RPA and Blockchain technology as process improvement initiatives for supply chain processes can be identified as a future research direction. Given the global trends in Lean, including value stream mapping, TPM, and lean information management initiatives, various aspects of culture and risk attitudes in implementation could be an important emerging research area in this domain. This notion has inevitably inspired academic studies to discern how LSS initiatives contribute to end-to-end supply chain practices. Even though process improvement initiatives are considered, they may fail if anti-systematic approaches are followed [104]. Exploring systematic approaches or systematic models for supply chain process improvement initiatives embedded in systems thinking can be identified as a future research direction.

Moreover, benefits realisation management provides opportunities for an organisation to evaluate and measure how improvement projects or initiatives add actual values to organisations [105]. However, there is a lack of literature which discusses benefits realisation frameworks and practices which leverage the process improvement success. Therefore, exploring benefits realisation frameworks and practices associated with achieving target benefits of the supply chain process improvement initiatives can be identified as a future research direction. Literature proves that combined Lean-Six Sigma and Lean-process redesign improvement

initiatives which simultaneously apply two process improvement initiatives can give more benefits than applying them individually [52], [26], [13]. However, there is a lack of research that shows the dependencies between different types of technology-based process improvement initiatives from the organisation's strategic objectives achievement perspective. Therefore, identify the dependencies between benefits and overall contributions towards organisation's strategic objectives can be identified as a potential future research direction.

While BPI initiatives have a rich history in academic research, most preceding work looks at overall benefits/performance improvement without connecting to the general challenges and critical success factors. BPI initiatives can open the path for this success through removing wastages, utilising resources and optimising processes [11]. However, it is necessary to identify the suitable process improvement initiatives with reference to the benefits that can be gained and success factors and challenges that have to be faced.

Therefore, this research was able to synthesise industry perceived benefits, challenges, and critical success factors; as summarised in the Table 1, Table 2, Table 3, Table 4, Table 5 and Table 6. The findings of this research therefore enable future researchers and industry practitioners to better comprehend the state of the literature and identify opportunities for future works.

Table 3: Summary of supply chain process improvement initiatives under procurement category

Improvement Initiative	Main Focus	Additional Benefits
E-procurement facilities	Enhancing inter-organisational collaboration with real-time information sharing with suppliers.	• A portal to interact with financial institutions and logistics service providers • Process cost and time reduction
Robotic Process Automation (RPA)	Automating repetitive tasks like order sending and receiving.	• Reduced data entry errors • Reduced overtime workload
Online auctions	Reducing the time associated with selecting suppliers.	• Ability to evaluate more suppliers and equal chance for all of them • Gives a more disciplined auction process
Quality based supplier selection model	Selecting suppliers based on their process capability	• Ability to provide quality-related recommendations for suppliers

Table 4: Summary of supply chain process improvement initiatives under manufacturing and manufacturing supportive category

Improvement Initiative	Main Focus	Additional Benefits
Cross-functional integration through ERP systems	Enhancing internal integration among supply chain processes.	• Facilitate external integration • Utilisation of available information • Reduced lead time associated with decision making • Reduced employee requirement • Reduced capacity requirement resulting from reduced inventory • Improved delivery quality resulting from reduced delivery delays • Reduced wastages
Process Redesign	Re-sequencing and merging of production activities	• Reducing the set-up time required for different products. • Improved product quality resulting from reduced defects • Reduced safety stock
Lean		
1) Value stream maps	Identifying wastages associated with 7 waste types.	
2) Total Productive Maintenance (TPM)	Leveraging production process through reduced machinery breakdowns.	• Improved product quality • Improved productivity • Reduced human resources requirement
3) Lean information management	a) Reduced time waste by redesigning and automating data crossing and calculations.	• Reduced human resources requirement • Reduced task time
	b) Use of Andon method to monitor real-time progress.	• Enhanced response to customers and suppliers • Improved process discipline • Improved production process transparency • Easy identification bottlenecks • Waste reduction
4) Lean-Six Sigma	Improving quality while reducing wastes	• Cost savings resulting from reduced wastages and improved quality

Table 5: Summary of supply chain process improvement initiatives under distribution and warehousing category

Improvement Initiative	Main Focus	Additional Benefits
Distribution process redesign	Reducing the lead time associated with time-sensitive product distribution.	• Minimised outdated stock • Minimised safety stock
Electronic Data Interchange (EDI)	Real-time information sharing that will result in higher inventory turns.	• Reduced data entry error • Higher inventory turns
RFID implementation	Saving the time resulting from automated information tracking/ product verification.	• Reduced human error • Reduced labour requirement • Eliminated paperwork related to the process (eg: product counts) • Increased visibility throughout product movement.
IT-based transparent quotation for logistics services	Reducing the time associated to come-up with customer agreements.	• Improved mutual understanding resulting from increased transparency • Quick response time
Lean	Reducing cycle time associated with processes.	• Variability reduction • Efficiency improvement

Table 6: Summary of supply chain process improvement initiatives under miscellaneous category

Improvement Initiative	Main Focus	Additional Benefits
Process innovation	Reducing costs associated with existing processes.	• Flexible production processes • Expanded production capacity • Improved product innovation capability • Improved product quality and competitiveness
E-Supply Chain Management (E-SCM)	Integrating all supply chain partners.	• Enhanced information flow • Shorter response time • Improved data transparency
Blockchain Technology	Enhancing trust, accuracy and traceability	• Reduced paper-based processing cost and time resulting from smart contracts • Reduced human errors • Reduced bullwhip effect due to accurate information • Optimised and efficient production and capacity plan resulting from accurate information • Ability to take prompt actions and decisions due to traceability

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