
# IMPROVING EFFECTIVENESS OF MATERIAL PLANNING OF SUPPLY CHAIN MANAGEMENT USING BUSINESS PROCESS MODELLING

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MASTER OF BUSINESS INFORMATION MANAGEMENT

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## Institute of Technology Management and Entrepreneurship

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**TAN YING YAN**

**A master project submitted**
**in partial fulfillment of the requirements for the degree of**
**Master of Business Information Management**



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**DECLARATION**

I declare that this master project “Improving Effectiveness of Material Planning of Supply Chain Management Using Business Process Modelling” is the result of my research except as cited in the references. The master project has not been accepted for any degree and is not concurrently submitted as a candidature for any other degree.

Signature :.....

Name : Tan Ying Yan

Date : 29th Aug 2024

**APPROVAL**

I hereby declare that I have read this master project and in my opinion, this master project is sufficient in terms of scope and quality as a partial fulfillment of Master of Business Information Management.

Signature :..... .....

Supervisor Name : Proffesor Dr. Ahmad Zaki bin A Bakar

Date :20th Sep 2024

**DEDICATION**

To my beloved mother and father.

## ABSTRACT

This research proposes to improve the effectiveness of material planning within the realm of supply chain management frameworks using the Business Process Model and Notation (BPMN). Material planning plays a critical role in supply chain operations, impacting production schedules, inventory levels, and operational costs significantly. However, traditional material planning processes often need more standardisation and communication barriers due to the use of conventional diagramming methods such as flowcharts. BPMN offers a better alternative by providing a standardised graphical representation of business processes and a structured and visual approach to modelling and analysing workflows. The expected outcomes include increased process visibility, standardised operations, enhanced communication, efficient workflows, improved decision-making, cost reduction, and improved adaptability.

The objectives of this research are to analyse current material planning practices, develop BPMN models illustrating these processes, and evaluate the impact of BPMN adoption on key performance indicators like lead times, inventory turnover, and resource utilisation. The research questions are: what are the strategies that can enhance the effectiveness of material planning in manufacturing? How can the Business Process Model and Notation (BPMN) capture the effective process flow of the material planning? And how do we evaluate the effectiveness of the material planning process flow based on BPNM? Through a mixed-methods approach, data about the industry's material planning practices were collected from industry practitioners through a survey and a semi-structured interview. The research findings from the analysis found that BPMN significantly enhances material planning efficiency by improving communication, efficiency, and decision-making while also addressing key challenges like communication breakdowns and lack of standardised processes.

The study revealed that the implementation of the Business Process Model and Notation (BPMN) significantly improved material planning efficiency within the manufacturing sector. Key challenges identified in traditional material planning processes included communication breakdowns, lack of standardised workflows, and inefficient decision-making. The adoption of BPMN addressed these issues by providing a standardised visual representation of processes, which improved communication across departments, enhanced workflow transparency, and facilitated better decision-making. Specifically, 40% of participants reported improved communication, while 33% saw enhanced decision-making, and 20% noted increased workflow efficiency.

The findings also highlighted barriers to BPMN implementation, such as resistance to change (60%) and the complexity of integrating new processes (33%). Despite these challenges, the post-implementation assessment showed positive results, with significant reductions in lead times, better inventory turnover, and more efficient resource utilisation. Employee feedback further confirmed that BPMN facilitated clearer process flows, greater accountability, and improved collaboration. Overall, BPMN was shown to be a valuable tool

in optimising material planning, reducing costs, and promoting continuous improvement within supply chain operations.

The research showed that BPMN is a valuable tool for optimising material planning. This research recommends that organisations use BPNM to enhance their supply chain performance, ultimately promoting operational excellence and competitiveness in the market.

***MENINGKATKAN KEBERKESANAN PERANCANGAN BAHAN DALAM PENGURUSAN RANTAIAN BEKALAN MENGGUNAKAN PEMODELAN PROSES PERNIAGAAN***

## *ABSTRAK*

*Kajian ini mencadangkan peningkatan keberkesanan perancangan bahan dalam rangka kerja pengurusan rantaian bekalan dengan menggunakan Pemodelan Proses Perniagaan (BPMN). Perancangan bahan memainkan peranan kritikal dalam operasi rantaian bekalan, memberi kesan yang ketara terhadap jadual pengeluaran, tahap inventori, dan kos operasi. Namun, proses perancangan bahan tradisional sering menghadapi cabaran seperti ketidakcekapan, kekurangan standardisasi, dan halangan komunikasi akibat penggunaan kaedah penggambaran tradisional seperti carta alir. BPMN menawarkan alternatif yang lebih baik dengan menyediakan representasi grafik yang standard bagi proses perniagaan, memberikan pendekatan yang berstruktur dan visual untuk memodelkan serta menganalisis aliran kerja. Hasil yang dijangkakan termasuk peningkatan keterlihatan proses, operasi yang diselaraskan, komunikasi yang dipertingkatkan, aliran kerja yang cekap, pembuatan keputusan yang lebih baik, pengurangan kos, dan penyesuaian yang lebih baik.*

*Objektif kajian ini adalah untuk menganalisis amalan perancangan bahan semasa, membangunkan model BPMN yang menggambarkan proses-proses ini, dan menilai kesan penggunaan BPMN terhadap penunjuk prestasi utama seperti masa pemenuhan, pusingan inventori, dan penggunaan sumber. Soalan kajian adalah: apakah strategi yang dapat meningkatkan keberkesanan perancangan bahan dalam sektor pembuatan? bagaimana Model dan Tatatanda Proses Perniagaan (BPMN) dapat menangkap aliran proses perancangan bahan yang berkesan? dan bagaimana menilai keberkesanan aliran proses perancangan bahan berdasarkan BPMN? Melalui pendekatan kaedah campuran, data mengenai amalan perancangan bahan industri telah dikumpulkan daripada pengamal industri melalui tinjauan dan temu bual separa berstruktur. Dapatan kajian dari analisis menunjukkan bahawa BPMN secara signifikan meningkatkan kecekapan perancangan bahan dengan memperbaiki komunikasi, meningkatkan kecekapan, dan pembuatan keputusan, di samping menangani cabaran utama seperti kerosakan komunikasi dan kekurangan proses yang standard.*

*Kajian ini mendedahkan bahawa pelaksanaan BPMN secara signifikan meningkatkan kecekapan perancangan bahan dalam sektor pembuatan. Cabaran utama yang dikenal pasti dalam proses perancangan bahan tradisional termasuklah gangguan komunikasi, kekurangan aliran kerja yang standard, dan ketidakcekapan dalam membuat keputusan. Penggunaan BPMN menangani isu-isu ini dengan menyediakan representasi visual yang standard bagi proses, yang meningkatkan komunikasi antara jabatan, meningkatkan ketelusan aliran kerja, dan memudahkan pembuatan keputusan yang lebih baik. Khususnya, 40% peserta melaporkan peningkatan komunikasi, manakala 33% melihat peningkatan dalam pembuatan keputusan, dan 20% mencatat peningkatan dalam kecekapan aliran kerja.*

*Penemuan ini juga menyoroti halangan kepada pelaksanaan BPMN, seperti rintangan terhadap perubahan (60%) dan kerumitan dalam mengintegrasikan proses baru (33%). Walaupun terdapat cabaran-cabaran ini, penilaian selepas pelaksanaan menunjukkan hasil yang positif, dengan pengurangan masa pusingan yang ketara, perolehan inventori yang lebih baik, dan penggunaan sumber yang lebih cekap. Maklum balas daripada pekerja juga mengesahkan bahawa BPMN memudahkan aliran proses yang lebih jelas, akauntabiliti yang lebih besar, dan kerjasama yang lebih baik. Secara keseluruhan, BPMN telah terbukti menjadi alat yang berharga dalam mengoptimumkan perancangan bahan, mengurangkan kos, dan mempromosikan penambahbaikan berterusan dalam operasi rantaian bekalan.*

*Kajian ini menunjukkan bahawa BPMN adalah alat yang bernilai untuk mengoptimumkan perancangan bahan. Kajian ini mengesyorkan agar organisasi menggunakan BPMN untuk meningkatkan prestasi rantaian bekalan mereka, seterusnya mempromosikan kecemerlangan operasi dan daya saing dalam pasaran.*

## ACKNOWLEDGEMENT

I wish to convey my profound appreciation to all those who have aided me during the process of finalising this dissertation. Foremost among them, I am deeply grateful to my supervisor, Professor Dr. Ahmad Zaki bin A Bakar, for his invaluable guidance, unwavering support, and continuous encouragement. The profound insights and suggestions he offered have significantly enhanced this scholarly work.

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In conclusion, I am indebted to my family for their unwavering love, patience, and sacrifices. The completion of this dissertation would have been unattainable without the backing of these exceptional individuals. I express my gratitude to each one of you.

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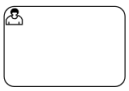
## LIST OF ABBREVIATIONS

BPMN - Business Process Model and Notation

# LIST OF SYMBOLS

 - Start Event

 - End Event

 - User Task

 - Send Task

 - Service Task

 - Data Store

 - Sequence Flow

 - Data Object

 - Directional

 - Parallel

## LIST OF APPENDICES

# CHAPTER 1

# INTRODUCTION

## 1.1 Background

This research explores the application of the Business Process Model and Notation (BPMN) to improve material planning efficiency in supply chain management. Material planning is vital in coordinating the smooth movement of materials across the supply chain, influencing production timetables, stock levels, and operational expenses. Nevertheless, conventional material planning procedures frequently face inefficiencies due to the absence of standardization, leading to unclear communication issues, suboptimal decision-making, and higher operational expenses (Zor et al., 2010).

The incorporation of BPMN presents a hopeful approach to remedying these deficiencies. It furnishes a standardized visual representation for delineating business procedures, thereby facilitating workflow visualization, analysis, and optimization.



The principal aim of this investigation involves examining alternative approaches, specifically in the utilization of Business Process Modelling and the adoption of BPMN, to boost material planning efficacy. Moreover, the study intends to devise an efficient process flow for material planning, utilizing the BPMN notation. Additionally, the research strives to assess the efficacy of the material planning process flow established using BPMN, employing suitable methodologies and measures to evaluate performance and guide continuous enhancement endeavours within the supply chain operations.

Critical elements of this study comprise a comprehensive literature review to construct a theoretical framework that recognizes current practices, obstacles, and potential remedies in material planning and BPMN applications. The study will incorporate qualitative techniques, such as interviews, observations, and surveys, to comprehensively assess the influence of BPMN integration on material planning efficiency. The construction of BPMN models will visually represent material planning procedures, pinpointing areas for enhancement and streamlining.

Anticipated outcomes of this study encompass heightened process transparency, operational standardization, enhanced communication, more efficient workflows, improved decision-making, cost reductions, and heightened adaptability within supply chain operations as proposed by Polancic and Orban (2022) and Msonsalve et al. (2010). By validating BPMN's effectiveness as a tool for optimizing material planning, this study offers practical insights and suggestions for organizations to enhance their supply chain performance, cultivating operational distinction and reinforcing competitiveness in the market.



The pragmatic implications for industrial professionals involve the utilization of BPMN to augment the efficiency of material planning. This strategy holds the potential to establish uniformity in procedures, resulting in improved clarity in communication, enhanced decision-making based on better information, and decreased operational expenses. Professionals in the industry may anticipate enhanced workflows, improved synchronization of material transport, and more efficient supervision of inventory levels. By integrating BPMN, businesses can realize increased clarity, standardization in operations, and flexibility

in their supply chain activities, ultimately reducing expenses and bolstering competitiveness in the marketplace.

In general, this research aims to address a significant void in the literature by examining the impact of BPMN on improving material planning efficiency in supply chain management contexts. By elucidating the advantages, hurdles, and repercussions of BPMN implementation, this research strives to deliver valuable contributions to theory and practice in supply chain management and material planning optimization.

## 1.2 Problem Statement

Due to their complexity, material planning processes in supply chain management suffer inefficiency. Conventional approaches to material planning lack standardization, leading to issues like unclear communication, suboptimal decision-making, and higher operational expenses. The resulting inefficiencies hinder organizations from managing their materials effectively, causing problems such as stockouts, excess inventory, and production delays.



For example, an electronics manufacturer encountered difficulties in overseeing its supply chain due to the dynamic nature of the sector and the necessity for precise availability of components for assembly lines. The conventional material planning system was operated manually and lacked coordination among various departments. Consequently, planners struggled to accurately forecast material requirements, resulting in stockouts and overstock situations. Communication deficiencies further complicated the collaboration between the procurement and production teams. The impact on stockouts is that production frequently comes to a halt due to the unavailability of components, leading to delays in product launches

and impacting market competitiveness. Excess inventory accumulates non-essential components tied up with capital and raises warehousing costs. Production delays are inconsistent management of the supply chain and disrupted production schedules, leading to missed deadlines. The solution is embracing BPMN, which enabled the organization to visualize and enhance its material planning workflows. Standardized procedures enhanced communication and decision-making, resulting in more precise demand forecasting and inventory management. This decrease in occurrences of stockouts and excess inventory contributed to the streamlining of production.

## 1.3 Research Objective

This research aims to propose a systematic and effective process flow to implement the Business Process Model and Notation (BPMN) that will enhance the effectiveness of material planning in the manufacturing sector.



The research objectives are as follows:

**Research Objective 1:**

To identify alternative strategies to enhance the effectiveness of material planning in the manufacturing sector.

**Research Objective 2:**

To develop an effective process flow for material planning by adopting the use of the Business Process Model and Notation (BPMN).

**Research Objective 3:**

To evaluate the effectiveness of the material planning process flow based on BPNM.

## 1.4 Research Questions

**Research Questions 1:**

What strategies can enhance the effectiveness of material planning in the manufacturing sector ?

**Research Questions 2:**

How can the Business Process Model and Notation (BPMN) capture the effective process flow of the material planning process?

**Research Questions 3:**

How do we evaluate the effectiveness of the material planning process flow based on BPNM?

## 1.5 Scope of Research

This scholarly investigation centres on deploying the Business Process Model and Notation (BPMN) to optimize material planning efficacy within the manufacturing industry. This analysis is conducted among multinational technology enterprises in Melaka, Malaysia, where the intricacies of supply chain dynamics demand resilient and effective material planning frameworks. The selection of these corporations is predicated on their dependence on complex production schedules, inventory oversight, and procurement methodologies, which significantly impact overall operational efficacy and financial performance.

The inquiry is aimed at material planning practices within these manufacturing entities, encompassing domains such as the procurement of raw materials, inventory

administration, production scheduling, and order fulfilment. The research seeks to address inefficiencies that emerge from the absence of standardization, communication failures among departments, and insufficient process transparency. By concentrating on multinational corporations, this study investigates the potential of BPMN to enhance procedural efficiency in contexts where coordination across diverse departments and global suppliers is imperative for sustaining production timelines and minimizing operational expenditures.

The temporal scope for this research with the initial plan is to extend over 12 months, during which the BPMN framework will be introduced, implemented, and assessed. This duration encompasses several critical stages: data collection, process mapping, BPMN training, process re-engineering, and post-implementation assessment. The initial phase of data collection, executed through surveys and semi-structured interviews, is anticipated to be completed within the first quarter. At the same time, BPMN training and process mapping will ensue in the following months. The actual implementation of BPMN within the chosen enterprises is scheduled over a three-month interval, thereby affording adequate time for stakeholders to adapt to and incorporate the newly established processes. The concluding three months will be dedicated to evaluating the influence of BPMN on essential performance metrics such as lead time, inventory turnover, and resource utilization, alongside gathering feedback from the participants.



The principal resources employed for this research comprise software instruments such as BPMN modelling applications, survey platforms (Google Forms), and data analysis software (Microsoft Excel). Furthermore, human resources, including industry professionals from the participating firms—namely, inventory managers, procurement specialists,

production planners, and supply chain analysts—contribute vital insights and feedback throughout the research. The engagement of these practitioners ensures that the study is firmly anchored in practical, real-world implementations of material planning.

In summary, this research's parameters are delineated by its concentration on multinational manufacturing entities in Melaka, its application of BPMN as the principal instrument for process enhancement, and the 12 month timeline designated for implementation and evaluation.

The scope of this research is as follows:

1. Assessment of the current supply chain frameworks, existing systems, stakeholders, and organization for material planning processes.

2. Due to the time constraints of a master's thesis, the study will only focus on the material planning processes in multinational technology companies in Melaka.

3. Identify areas where and how the integration of BPMN improves the effectiveness, standardization, and optimization of different material planning processes in procurement, inventory management, production scheduling, and order fulfilment.



## 1.6 Master Project Outline

This master project is made up of five (5) chapters, which contents are summarized as follows: