YRKESHÖGSKOLAN NOVIA

Business Process Model Creation and Implementation for Future Fuels

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EXAMENSARBETE

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Abstrakt

Den här avhandlingen har skapats för ett team av experter som är engagerade i leveransen av stödsystem för fartyg som använder metanol som bränslekälla genom projektarbete. På grund av strängare regler från Internationella sjöfartsorganisationen (IMO) för att minska utsläppen, blir metanol ett alltmer föredraget alternativ. Denna förändring har följaktligen ökat den globala efterfrågan på metanolanvändning.

Det primära målet med denna avhandling är att utforma och implementera en affärsprocessmodell (BPM) som förbättrar det dagliga arbetet och det övergripande arbetsflödet för detta specifika team. BPM:en är avsedd att ge en djupare insikt i hela arbetsflödet och att identifiera områden där driftseffektiviteten kan förbättras, och kvaliteten kan höjas.

Denna BPM bygger på etablerade principer för affärsprocesshantering, fördelarna med metanol som marint bränsle och kombinerade tillvägagångssätt med Lean-kontorsmetodik och processoptimeringstekniker. Utvecklingsprocessen börjar med en noggrann formulering av kundbehov och identifiering av nyckelintressenter. Efter detta genomförs en värdeflödesanalys för att bättre strukturera arbetsprocessen. Denna BPM använder tekniker för affärsprocessmodellering för att visuellt representera arbetsflödet med hjälp av olika modelleringsverktyg och diagram.

Slutligen presenterar avhandlingen en nyligen utvecklad BPM för teamet, noggrant beskriven i detta dokument. Det förväntas att denna modell kommer att driva pågående förbättringar av kvalitet, och övergripande effektivitet.

Språk: Engelska

Nyckelord: Business Process Creation, BPM, Future Fuels

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Tiivistelmä

Tämä opinnäytetyö on kehitetty tiimille, joka on omistautunut toimittamaan tukijärjestelmiä laivoille, jotka käyttävät metanolia polttoaineena projektityön kautta. Kansainvälisen merenkulkujärjestön (IMO) tiukempien säädösten vuoksi, jotka tähtäävät päästöjen vähentämiseen, metanolista on tulossa yhä suositumpi vaihtoehto. Tämä muutos on seurauksena lisännyt metanolin globaalia kysyntää.

Tämän väitöskirjan päämääränä on suunnitella ja toteuttaa liiketoimintaprosessimalli (BPM), joka parantaa tämän erityisen tiimin päivittäistä toimintaa ja koko työnkulun. BPM:n tarkoituksena on tarjota syvällisempi käsitys koko työprosessista ja tunnistaa alueita, joilla toiminnallista tehokkuutta voidaan lisätä, ja laatua voidaan parantaa.

Tämä BPM perustuu vakiintuneisiin liiketoimintaprosessien hallinnan periaatteisiin, metanolin etuihin merenkulun polttoaineena ja yhdistettyihin lähestymistapoihin Lean-toimistomenetelmiin ja prosessin optimointitekniikoihin. Kehitysprosessi alkaa asiakkaiden tarpeiden tarkan artikuloinnin ja keskeisten sidosryhmien tunnistamisen kanssa. Tämän jälkeen suoritetaan arvovirta-analyysi työprosessin paremman järjestämisen vuoksi. BPM käyttää liiketoimintaprosessien mallintamisen tekniikoita työnkulun visuaaliseen esittämiseen käyttäen erilaisia mallinnustyökaluja ja periaatteita.

Lopuksi tämä opinnäytetyö esittelee tiimille äskettäin kehitetyn BPM:n, joka on yksityiskohtaisesti kuvattu tässä asiakirjassa. Mallin odotetaan edistävän jatkuvia parannuksia laadun, ja yleisen tehokkuuden osalta.

Kieli: Englanti

Avainsanat: Business Process Creation, BPM, Future Fuels

BACHELOR'S THESIS

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Abstract

This thesis has been created for a team of experts who are dedicated to delivering support systems for ships using methanol as a fuel source through project work. Due to stricter regulations from the International Maritime Organization (IMO) aimed at reducing emissions, methanol is becoming an increasingly favoured option. This shift has consequently heightened the global demand for methanol usage.

The primary objective of this thesis is to design and implement a Business Process Model (BPM) that improves the day-to-day operations and overall workflow of this team. The BPM is intended to provide a deeper insight into the entire workflow and to pinpoint areas where operational efficiency can be enhanced, and quality can be heightened.

This BPM is grounded on established Business Process Management principles, the advantages of methanol as a marine fuel, and combined approaches of Lean office methodologies and process optimization techniques. The development process begins with a precise articulation of customer needs and the identification of key stakeholders. Following this, a value stream analysis is conducted to better structure the work process. This BPM employs business process modelling techniques to visually represent the workflow, using various modelling tools and diagrams.

Ultimately, the thesis presents a newly developed BPM for the team, carefully described within this document. It is anticipated that this model will drive ongoing improvements in quality, and overall efficiency.

Language: English

Key words: Business Process Creation, BPM, Future Fuels

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Abbreviations

This section lists all the abbreviations used in this thesis.

BOM	-	Bill of Material
BPM	-	Business Process Model
DWG	-	Drawing
EXW	-	Ex Works
FAT	-	Factory Acceptance Test
FFAD	-	Future Fuel Aux Delivery
FGSS	-	Fuel Gas Supply Systems
FVT	-	Fuel Valve Train
HS	-	Harmonized System (HS-Codes)
IPI	-	Installation Planning Instruction
LNG	-	Liquefied Natural Gas
MFPU	-	Methanol Fuel Pump Unit
NoC	-	Notice of Contract
OC	-	Order Confirmation
OPU	-	Oil Pump Unit
PDL	-	Project Document List
PM	-	Project Manager
PO	-	Purchase Order
POR	-	Purchase Order Requisition
SOR	-	Sales Order Review
VSM	-	Value Stream Mapping
TS	-	Technical Specifications

1 Introduction

This thesis addresses the refinement of business process management within a maritime-focused organization, aiming to enhance operational efficiency to its highest level. Inspired by the insights from Dumas and his book Fundamentals of Business Process Management, who emphasize the critical importance and implementation of the principle, this research undertakes an in-depth analysis and improvement of internal workflows, ensuring they align well with the organization's goals and the demands of the market (Dumas, 2018).

The research identifies that while individual processes may function efficiently on their own, their integration into a comprehensive system often reveals several hidden inefficiencies. This thesis delves into a thorough examination and integration of these discrete processes, uncovering opportunities for major enhancements. By methodically identifying and addressing these inefficiencies, the goal of this thesis is to develop a Business Process Model (BPM) framework that not only improves operational performance but also positions the organization strategically for ongoing success and leadership in the maritime sector.

From the beginning of the Industrial Revolution, there has been significant improvement in productivity due to the adoption of new technologies and methods within organizational practices. Weske illustrates in his book Business Process Management: Concepts, Languages, Architectures how the modern industrial scene has evolved, with information becoming a key product that requires detailed process management (Weske, 2019).

1.1 Background

By the year 2020, the maritime industry began significantly adopting methanol-fuelled vessels, reflecting a strong commitment to more sustainable and cleaner energy alternatives. This trend continued into 2022, with a notable rise in the number of these vessels, demonstrating a broad industry commitment to reducing carbon footprints and enhancing environmental sustainability. The trajectory suggests a continuous increase in the use of methanol-powered vessels, driven by changing fuel preferences and the imperative for ecological stewardship.

In 2023, the International Maritime Organization introduced stringent emission standards, a pivotal moment aimed at reducing the environmental impact of the maritime sector. These standards encourage the use of cleaner fuels such as methanol, recognized for their significant role in curbing emissions of harmful pollutants (IMO, 2023).

Industry dialogues confirm a consensus: IMO regulations are transforming fuel preferences across the maritime sector, with a distinct shift towards methanol. An executive highlighted these regulatory changes as crucial for updating operational frameworks, underscoring the increasing importance of methanol in meeting environmental regulations. This shift underscores the critical role of operational efficiency, particularly in activities essential to compliance and operational effectiveness.

West discusses the crucial balance between 'external' and 'internal' efficiencies. Maritime organizations may initially focus on external efficiencies to quickly meet changing demands. However, for sustained success and competitiveness, focusing on internal efficiencies is crucial in optimizing processes to ensure regulatory compliance, improve resource use, and maintain operational excellence as the industry moves towards greener alternatives (West, 2018).

1.2 Problem Statement

The maritime industry stands at a critical stage, facing mounting pressure to adapt to stringent environmental regulations while ensuring operational efficiency and competitive advantage. The International Maritime Organizations ambitious 2021 sulphur cap has imposed a paradigm shift towards cleaner fuels, positioning methanol as a frontrunner in the quest for sustainable marine propulsion. This transition is not merely a compliance mandate but a strategic imperative to mitigate the environmental footprint of maritime operations, aligning with global sustainability targets (International Maritime Organization., 2021).

Despite methanol's potential to significantly reduce greenhouse gas emissions, the adoption of methanol-powered solutions presents multifaceted challenges. The industry grapples with the need to redesign existing vessels, develop new infrastructure for methanol bunkering, and ensure the seamless integration of methanol-based energy systems. Moreover, the operational blueprint for methanol adoption extends beyond technical retrofitting, encompassing changes in organizational processes, roles, and decision-making frameworks (Smith, 2020).

Within this context, the problem statement for this thesis is to develop a Business Process Model (BPM) tailored for a marine business transitioning to methanol-powered solutions. Such a BPM must address the natural difficulties of integrating methanol as a marine fuel, including regulatory compliance, timeline diagrams, and supply chain logistics. The model should facilitate the alignment of internal and external processes, enabling organizations to optimize resource utilization, enhance operational transparency, and foster innovation.

Moreover, the BPM must be adaptive, accommodating future regulatory changes and technological advancements in methanol propulsion. It should serve as a dynamic tool for continuous improvement, ensuring that marine businesses can not only respond to immediate industry demands but also anticipate and shape future trends. Drawing upon the principles outlined by Dumas and Weske, this thesis aims to construct a BPM framework that integrates best practices in process management with the specific demands of methanol adoption, thereby contributing to the industry's sustainable transformation and long-term resilience (Dumas, 2018), (Weske, 2019).

1.3 Purpose of the Thesis

The primary purpose of this thesis is to design and implement a Business Process Model (BPM) tailored for a marine business transitioning to methanol-powered solutions, a critical response to the strict environmental regulations and the maritime industry's sustainable evolution. This effort aligns with the International Maritime Organization's (IMO) strategic directives to lower greenhouse gas emissions and reflects the industry's shift towards more sustainable energy sources (IMO, 2023).

By focusing on methanol, recognized for its lower emissions profile compared to conventional marine fuels, this thesis seeks to address the operational, strategic, and compliance challenges marine businesses face amidst this transition. The goal is to establish a BPM framework that not only streamline processes for enhanced efficiency and compliance but also fosters adaptability and resilience in a rapidly evolving regulatory landscape.

Leveraging the foundational insights provided by Dumas on business process management and Weske’s dialogue on process modelling, the thesis intends to deliver a comprehensive model that facilitates the effective integration of methanol fuel systems through BPM principles, ensuring safety, reliability, and cost-effectiveness. Ultimately, this research aims to contribute valuable knowledge and practical tools to the maritime sector, promoting a more sustainable and environmentally responsible future (Dumas, 2018), (Weske, 2019).

1.4 Research Objectives

Within the range of this thesis, a series of targeted research objectives are coupled to address the operational challenges and market opportunities associated with methanol-powered vessel projects. The primary goal is to navigate the complexities of the current maritime landscape, particularly examining the increasing prominence of methanol as an alternative marine fuel amidst evolving environmental regulations and market demands.

A critical aspect of this research involves a thorough assessment of the existing internal processes that manage the project deliveries now. By studying these processes, the aim is to unearth potential inefficiencies and develop strategies for process optimization.

Central to achieving this aim is the development of a Business Process Model (BPM) tailored specifically to the team overseeing methanol-powered vessel projects. This model will be designed to streamline workflows, enhance delivery timelines, and uphold the quality of outputs.

In evaluating the effectiveness of the BPM, the research will measure its impact in addressing the process inefficiencies previously identified. This evaluation is pivotal in determining the BPM's operational validity and its alignment with the team's requirements.

Moreover, the research aspires to lay down a solid foundation for ongoing development within the team and department. The BPM is envisioned not only as a solution to current challenges but also as a cornerstone for future enhancements and iterations.

Finally, the research will culminate in the provision of strategic recommendations for the adoption of the BPM within the company's existing operational frameworks and information channels. These recommendations will be instrumental in guiding the team towards successful implementation and sustained process improvement, ensuring that the BPM becomes an important part of the organizational fabric and not just an academic exercise.

In essence, this thesis sets out to bridge the gap between theoretical constructs and practical applications within the methanol-powered maritime operations, with the goal of advancing both the efficiency and effectiveness of the associated business processes.

1.5 Scope and Limitations

In this thesis, the scope is centered on a specific team responsible for methanol-powered vessel projects but also including surrounding teams and stakeholders within the organization.

Within the organizational structure, the adoption of the BPM is subject to specific, controlled information channels that are not universally accessible. These limitations mean that I will not be able to execute the full implementation of the BPM upon its completion. The developed BPM will be delivered to the executive team for review and potential integration via the appropriate channels. Nevertheless, the BPM will be made accessible to the team dedicated to methanol-powered vessels, ensuring that all members, regardless of their access level to information channels, can benefit from its insights.

It has been determined that the thesis will concentrate on developing a Business Process Model (BPM) tailored to the unique requirements of the team associated with one product and a divider was set between contract signing and Ex-Works. Crafting a BPM for the full breadth of the department's operations is beyond the ambit of this thesis due to the complexity of the task and the constraints of the agreed time.

1.6 Thesis Structure

The structure of this thesis is systematically arranged for clarity and academic demand. Chapter 2 delves into the theoretical underpinnings of management of business processes, methanol as a marine fuel, lean principles, and process optimization with a special focus on methanol-powered vessels, and a comprehensive analysis of BPM design and diagramming/modelling techniques. Following a comprehensive review of these foundational theories, Chapter 3 explains the empirical methodologies that will be employed in the research.

The research culminates in Chapter 4, where the findings are presented, offering concluding results, BPM introduction, implementation of the research outcomes, and recommendations for potential future inquiries into the expansion and optimization of business processes for methanol-powered vessel projects.

2 Theoretical Frame of Reference

This thesis's theoretical frame of reference centers on the core concepts of Business process management, Methanol as a marine fuel, the Lean principles and process optimization, and finally analysis all within the context of methanol-powered vessels and BPM creation. Understanding and addressing the specific requirements of customers is a primary goal for the team working on methanol-powered vessel projects, also making customer-focused strategies an integral part of this study.

The application of lean principles, traditionally used in production, will be adapted to the office environment. This adaptation aims to refine and enhance office workflows, with a focus on increasing efficiency and reducing waste in administrative and managerial processes related to methanol-powered vessel projects.

Furthermore, the thesis delves into the intricacies of business process management. This exploration will concentrate on developing and optimizing processes that align with the day-to-day operations of the team managing methanol-powered vessel projects. By examining these areas, the thesis seeks to construct a comprehensive framework that effectively supports the operational needs of methanol-powered vessel projects, ensuring that they are executed with optimal efficiency and alignment with customer specifications.

2.1 Business Process Management

Business Process Management is an integrated approach to managing and improving an organization's processes, which is crucial for enhancing efficiency and adaptability in a rapidly changing business environment (Dumas, 2018). At its core, BPM involves identifying, modeling, analyzing, optimizing, and monitoring business processes to ensure they align with the organization's strategic goals (Weske, 2019). Advanced BPM solutions pull digital tools to automate processes, enabling real-time data analysis and decision-making, thereby fostering a culture of continuous improvement (vom Brocke, 2021).

Effective BPM practices are known to enhance operational efficiency, reduce costs, and improve service delivery, positioning organizations to better respond to evolving market demands and regulatory changes (Recker, 2020). Furthermore, BPM's general view fosters greater organizational agility and innovation, ensuring sustainable competitive advantage in various sectors, including manufacturing, healthcare, and finance (Becker, 2020). Consequently, business process management emerges as a critical discipline within organizational theory and practice, underpinning the search for operational excellence and strategic differentiation.

2.1.1 Fundamentals of Business Process Management

The "Fundamentals of Business Process Management" are essential for understanding and implementing a successful BPM effectively across various industries, including the maritime sector (Dumas, 2018).

A fundamental aspect of business process management is process identification and documentation, which establishes a clear framework for understanding and analysing current processes and identifying areas for improvement. This is particularly crucial in the maritime industry, where operations are complex and multidimensional, often involving coordination across different geographic locations and jurisdictions (Becker, 2020).

Another key principle is process modelling and analysis, which leverages various tools and methodologies, such as BPMN (Business Process Model and Notation), to create detailed representations of processes. These models are instrumental in identifying bottlenecks, redundancies, and inefficiencies, thereby informing the development of optimized processes that are aligned with the maritime industry's dynamic and regulatory environment (Weske, 2019).

Moreover, the implementation and execution of business processes, supported by BPM systems, play a vital role in translating designed processes into operational practices. In the context of the maritime industry, this facilitates enhanced compliance, operational efficiency, and agility in adapting to market changes or regulatory requirements (Recker, 2020).

Continuous process monitoring and improvement, underpinned by KPIs (Key Performance Indicators) and metrics, ensure that processes remain efficient, effective, and aligned with organizational goals over time, a requirement in the ever-evolving maritime sector (vom Brocke, 2021).

In conclusion, understanding and applying the fundamentals of BPM empower maritime organizations to optimize their operations robustly and sustain competitive advantage in a challenging and fast-paced industry landscape.

2.1.2 Business Process Management in the Maritime Industry

Business Process Management in the maritime industry represents a critical attempt for enhancing operational efficiency and responding adeptly to the rapid changes and stringent regulatory demands characteristic of the sector. The integration of business process management practices allows maritime organizations to streamline their operations, enhance cross-functional collaboration, and improve service delivery, ultimately fostering a competitive edge (Papageorgiou, 2019).

Notably, the adoption of business process management within this industry is pivotal for achieving compliance with environmental regulations and standards set forth by international bodies such as the International Maritime Organization (IMO). Effective BPM practices facilitate the implementation of sustainable practices and technologies, ensuring maritime operations align with global sustainability and environmental protection goals (Kumar, 2020).

Moreover, the digital transformation wave sweeping across industries has not spared the maritime sector, with digital business process management tools offering robust solutions for automating and optimizing complex processes, from logistics and fleet management to compliance and safety procedures (Chen, 2021). These technological advancements enhance decision-making, promote transparency, and enable real-time monitoring and analysis, driving the maritime industry towards more agile and resilient operations.

In essence, the role of business process management in the maritime industry is indispensable, underpinning strategic agility, operational excellence, and sustainable development within this vital global sector.

2.2 Methanol as a Marine Fuel

Methanol, a biodegradable and clean-burning fuel, has garnered significant attention as a viable alternative to traditional marine fuels. Its relatively straightforward production process, which can utilize both fossil-based and renewable sources, positions methanol as a flexible and environmentally considerate option within the marine sector (Balcombe, 2019). Notably, methanol's lower emission profile, particularly in terms of sulphur oxides (SOx) and particulate matter, aligns with the harsh environmental regulations enforced by the International Maritime Organization (IMO) (IMO, 2023).

Moreover, the adoption of methanol as a marine fuel offers the maritime industry a pathway to reduce its greenhouse gas (GHG) emissions. When produced from renewable sources, methanol can significantly curtail life cycle GHG emissions, supporting the maritime sector's transition towards decarbonization (Österman, 2020). However, the scalability of green methanol production and the necessary infrastructural modifications in ports and vessels represent critical challenges that need to be addressed (Smith, 2020).

In conclusion, methanol's potential to act as a sustainable marine fuel is dependent upon advancements in production technologies and the maritime industry's capacity to embrace infrastructural and operational changes. Continued research and pilot projects are crucial to validate methanol's effectiveness and safety as a marine fuel, ensuring its role in the future of green shipping (Saxena, 2020).

2.2.1 Environmental Considerations

Environmental considerations are central to the evaluation of methanol as a marine fuel, given the maritime industry's imperative to alleviate its ecological footprint. Methanol stands out due to its cleaner combustion properties, which result in significantly lower emissions of sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matter compared to conventional marine fuels. This characteristic aligns with the International Maritime Organization's (IMO) stringent regulations aimed at reducing marine pollution and promoting air quality (Andersson, 2019), (IMO, 2023), (Institute., 2021).

Moreover, methanol's potential for reduced greenhouse gas (GHG) emissions is noteworthy, particularly when produced from renewable sources such as biomass or captured carbon dioxide. This "green" methanol not only offers a pathway towards decarbonization but also aligns with broader environmental goals and commitments under international agreements like the Paris Agreement. The lifecycle analysis of green methanol underscores its role in facilitating a transition to low-carbon maritime operations, although the scalability of sustainable production methods remains a key challenge (Smith, 2020).

Another critical environmental consideration is the risk associated with methanol spills. Although methanol is biodegradable and less toxic than oil-based fuels, its water solubility raises concerns about potential aquatic toxicity, necessitating precise safety and handling protocols to mitigate environmental risks (Zhang, 2021).

In conclusion, while methanol presents a promising alternative marine fuel with considerable environmental benefits, comprehensive assessments and continuous monitoring are essential to address production sustainability, lifecycle emissions, and spillage risks. Embracing methanol as part of a broader suite of alternative fuels could significantly advance the maritime industry's environmental performance and its contribution to global sustainability efforts.

2.2.2 Operational Efficiency

Operational efficiency is a key driver in the adoption of methanol as a marine fuel, offering the maritime industry the potential for streamlined fuel handling and storage, alongside optimized engine, and fuel system designs. Methanol's favourable properties, such as its liquid state at ambient conditions, ease of storage, and handling compared to other alternative fuels like LNG (Liquified Natural Gas), enhance operational simplicity and efficiency. Moreover, methanol-powered engines can achieve significant reductions in engine maintenance and downtime, attributable to methanol's clean-burning characteristics. These operational advantages not only contribute to reducing the total cost of ownership but also align with the industry's push towards more sustainable and efficient maritime operations (Institute., 2021).

2.3 Lean Principles and Process Optimization

Lean principles and process optimization embody methodologies aimed at maximizing value for customers while minimizing waste. Central to lean thinking is the identification and elimination of non-value-adding activities, thereby streamlining processes and enhancing efficiency and effectiveness. Value Stream Mapping (VSM) emerges as a pivotal tool within this paradigm, providing a visual representation of the flow of materials and information across the process landscape, enabling the identification of inefficiencies and the formulation of optimized workflows (Rother, 1999).

Incorporating lean principles into office environments, known as Lean Office, extends these methodologies beyond traditional manufacturing settings. It focuses on optimizing administrative processes, addressing inefficiencies in information flow, and reducing waste in tasks typically associated with office work, such as excessive paperwork or ineffective communication channels (Emiliani, 2015). By applying VSM in such contexts, organizations can uncover hidden inefficiencies, streamline communication, and enhance overall process efficiency.

Ultimately, lean principles and process optimization foster a culture of continuous improvement, where the relentless pursuit of waste elimination and process enhancement drives operational excellence and strategic value creation across various organizational domains.

2.3.1 Value Stream Mapping

Value Stream Mapping (VSM) is a potent lean management tool that provides a visual representation of the flow of materials and information as a product or service moves through the value stream. Originating from the Toyota Production System, VSM is utilized to identify waste and inefficiencies within processes, offering a structured visualization that helps organizations in pinpointing opportunities for improvement (Rother, 1999). By outlining every step in a process and highlighting areas where non-value-add activities occur, VSM facilitates a deep understanding of the 'current state' and aids in the design of an optimized 'future state' that enhances operational efficiency and reduces lead times (Jones, 2002).

Employing VSM allows companies to adopt a general view of their processes, ensuring that improvements are made with an end-to-end perspective, rather than in isolated segments. This comprehensive approach is critical in driving meaningful and sustainable process improvements, ultimately fostering a culture of continuous enhancement and lean thinking across organizations (Jones, 2002).

2.3.2 Lean Office

Lean Office refers to the application of lean principles and methodologies in administrative and office environments to eliminate waste, streamline processes, and improve efficiency. Unlike manufacturing settings where lean practices are more visibly applied to physical workflows, Lean Office focuses on optimizing information flows, decision-making processes, and task execution to enhance overall productivity and reduce lead times (Emiliani, 2015).

Key aspects of Lean Office include minimizing unnecessary paperwork, reducing redundant steps in information processing, optimizing communication channels, and fostering a continuous improvement culture among office staff. By employing tools such as Value Stream Mapping within an office context, organizations can visualize and analyse information flows and administrative processes, identifying bottlenecks and areas of waste that detract from value creation (Tapping, 2003).

Adopting a Lean Office approach not only enhances operational efficiency but also contributes to employee engagement and satisfaction by reducing frustration associated with inefficient practices and promoting a more organized and responsive work environment (Tapping, 2003).

2.4 Analysis

In this short chapter, I dive into the intricacies of the Business Process Model Design and also Diagramming and Modelling Techniques, pivotal for comprehending and enhancing the company's organizational workflows. Utilizing Dumas, M. L. studies and principles as a foundation, I explore how effective business process model design underpins the creation of transparent, efficient, and adaptable processes. Concurrently, I examine various diagramming and modelling techniques, as detailed by Weske, M. to illustrate their role in visualizing and refining business processes. These methodologies not only facilitate a deeper understanding of current process landscapes but also foster the identification and implementation of process improvements, critical for achieving operational excellence and strategic agility within organizations (Weske, 2019), (Rother, 1999).

2.4.1 Business Process Model Design

Business Process Model Design serves as a fundamental component in the analysis and improvement of organizational workflows. According to Dumas an effective business process model provides a structured representation of the activities, data flows, and interactions that constitute a business process, thereby enabling organizations to gain a comprehensive understanding of their operational dynamics. The design phase is critical in elucidating the core elements of each process, identifying inefficiencies, and establishing a blueprint for enhancement and optimization (Dumas, 2018).

Through the detailed design of business process models, organizations can achieve greater clarity regarding process objectives, roles, and responsibilities between various process elements. This clarity is instrumental in aligning processes with organizational goals and ensuring that they are executed consistently and efficiently. Furthermore, well-designed process models serve as a communication tool, fostering alignment and collaboration among stakeholders and facilitating the training and onboarding of personnel. Ultimately, the strategic design of business process models is paramount in laying the foundation for process analysis, optimization, and continuous improvement, driving operational excellence and competitive advantage (Dumas, 2018).

2.4.2 Diagramming and Modelling Techniques

Diagramming and modelling techniques are indispensable tools in business process management, offering visual representations that reveal the intricacies of business processes. Weske highlights the diversity of these techniques, each tailored to capture different aspects of processes, such as flow sequences, decision points, and interactions between various process entities. Among these techniques, Business Process Model and Notation (BPMN) stands out for its widespread adoption and ability to convey complex process information in an intuitive and standardized format (Weske, 2019).

The application of diagramming and modelling techniques enables a deep dive into process details, enabling analysts and stakeholders to identify bottlenecks, redundancies, and areas for improvement. Moreover, these visual tools are instrumental in communicating process information across the organization, ensuring that all members understand the processes in which they are involved and how their roles contribute to the broader organizational objectives.

In the context of continuous process improvement, diagramming and modelling serve as a basis for process simulation and what-if analyses, allowing organizations to evaluate potential changes and their implications before implementation. By leveraging these techniques, businesses can enhance process transparency, foster collaborative improvement efforts, and adapt more swiftly to changing market demands and operational challenges, thereby securing their long-term resilience and success (Weske, 2019).

2.5 My Theoretical Frame of Reference

In this chapter, I delve into the foundational theories related to the subjects addressed in this thesis. My examination has spanned from the environmental considerations and operational efficiencies of utilizing methanol as a marine fuel to the overarching principles and applications of Business Process Management within various contexts, including the maritime industry.

Understanding the environmental implications of adopting methanol as a marine fuel is crucial for maritime organizations aiming to align their operations with sustainable practices. This imposes a thorough analysis of methanol's life cycle, emission profiles, and potential environmental risks to ensure informed decision-making that prioritizes ecological stewardship.

Simultaneously, evaluating the operational efficiency offered by methanol as a marine fuel highlights the need for maritime enterprises to optimize fuel handling, storage, and engine performance. This efficiency not only impacts economic outcomes but also aligns with environmental goals by minimizing waste and emissions.

Transitioning to business process management, the discourse extends to how maritime organizations can implement BPM frameworks to enhance process efficiency, adaptability, and compliance. By embracing BPM, these entities can effectively streamline their operations, monitor performance, and foster continuous improvement, thereby achieving both operational excellence and environmental sustainability.

This investigation concludes in a synthesized understanding that no singular approach to implementing a successful BPM or adopting methanol as a marine fuel prevails. Instead, a nuanced strategy, informed by comprehensive research and tailored to the specific needs and contexts of maritime organizations, is vital. By integrating insights on customer expectations, environmental considerations, and operational efficiencies into BPM practices, maritime enterprises can develop strong frameworks that enhance their competitive edge while fostering sustainability and regulatory compliance. Through detailed process mapping and BPM modelling, organizations can visualize and refine their processes, ensuring alignment with strategic objectives and stakeholder expectations, which the goal of this thesis strongly embraces.

3 Methodology

In this segment of the thesis, the emphasis is placed on the methodologies employed in the development of a Business Process Model (BPM) specifically for the team working on methanol-powered vessel projects. The foundation for these methodologies is rooted in the theoretical research conducted for this thesis. It has been established that there is no singular, definitive approach to formulating a BPM for this particular focus group. Nonetheless, across various theoretical frameworks, a consistent theme emerges: the critical need to determine the precise requirements of the customer, to assess the current operational methods of the group, and to effectively map out these existing processes.

3.1 Research Design

Previously for LNG-based solutions the foundation has been sustained through Value Stream Mapping (VSM) workshops. These sessions have generated both current and projected workflow diagrams that serve as primary inputs in the development of the Business Process Model (BPM). The company's methodology for establishing process documentation has previously not been instituted for the team dedicated to methanol-based solutions at all due to the fuel being such a new implementation in the company.

Post-VSM activities assigned various tasks to groups, yet these assignments tended to emphasize aspects of the delivery projects, like standardizing the product portfolio, rather than enhancing the focus group's processes. Notably, the pre-existing process documentation and BPM showed several deficiencies: the information was outdated, lacked comprehensiveness, not suiting for methanol-based projects, and there was an absence of a dedicated team for continuous updates.

3.2 Data Collection Methods

The methodology for data collection in this study is twofold, covering interviews and a workshop, each chosen for their effectiveness in gathering in-depth, qualitative data. Together, these methods provided a balanced approach, combining the depth of individual experiences captured through interviews with the breadth of collaborative input gained from the workshop. This blend of data collection strategies is essential for the development of a well-informed Business Process Model that is both practical and adaptable to the dynamic needs of methanol-powered vessel projects.

3.2.1 Interviews and Workshop

Semi-structured interviews were conducted with key personnel involved in methanol-based project delivery. These interviews were designed to uncover detailed insights into the existing processes, the perceived challenges, and areas for improvement within the focus group's operational framework, then based on this newly obtained information create my own version for the methanol-based vessel projects. The open-ended nature of the questions allowed for a rich dialogue, granting interviewees the flexibility to express their views and experiences regarding methanol-based projects and the related business processes.

A collaborative workshop served as the second method of data collection. Participants included members from different levels of the project team and relevant stakeholders involved in the delivery process, ensuring a comprehensive perspective on the business process modelling for methanol-powered vessel projects. Approximately 22 members of the group working on methanol-powered vessel projects attended the workshop. The attendees included project engineers, a document engineer, purchasers, invoicing & export staff, project creation personnel, and sourcing and logistics teams. If any key persons from relevant departments were unable to attend the workshop, I followed up with them at a later stage with semi-structured interviews where their part of the process was discussed and mapped out. The workshop's objective was to map out the current state of the knowledge within the process and engage in Value Stream Mapping (VSM) exercises. This interactive setting provided a productive ground for brainstorming and consolidated diverse viewpoints into a cohesive process improvement plan. By the end of the workshop, I had gathered the bulk of the information needed to map out a working process for the newly implemented methanol-powered vessel projects.

3.2.2 Quantitative & Qualitative Research Methods

In integrating business process management within maritime operations transitioning to methanol-powered solutions, it was critical to employ both quantitative and qualitative research methods to ensure a comprehensive evaluation of the implemented processes. Even though qualitative methods were used more in this research I am sure the quantitative methods will be found more valuable post thesis. These methodologies, as detailed in the book "Metod för teknologer," provide a robust framework for analysis.

Quantitative methods are essential for obtaining measurable, statistical evidence that can quantify the effectiveness of the BPM. By gathering structured data through surveys or existing databases, you can statistically analyse variables such as operational efficiency, compliance rates, and environmental impacts. For instance, quantitative analysis can reveal the reduction in emission levels before and after BPM implementation, or measure the change in fuel consumption, providing hard data to validate the efficacy of the BPM.

Qualitative methods, on the other hand primarily used in this thesis, offer depth to the understanding of the BPM's implementation by exploring the human and organizational aspects. Through interviews, focus groups, or observational studies, qualitative research can capture insights into the experiences, perceptions, and challenges faced by the crew and stakeholders involved in the transition to methanol fuels. These insights are invaluable for understanding the nuances of behavioural changes, resistance, or acceptance within the organizational culture.

Combining both methods enhances this thesis by providing a dual perspective: the quantitative data gives a broad overview of the BPM's impacts, while qualitative insights add context and depth, illustrating how the changes are perceived and enacted on the ground.

This integrated approach not only aligns with this thesis focus on operational efficiency and environmental compliance but also enriches the analysis by addressing both the measurable outcomes and the human elements of the BPM implementation.

In conclusion, employing both quantitative and qualitative research methods allows for a thorough and nuanced assessment of BPM in maritime operations, making the findings more robust and actionable for stakeholders involved in the transition to sustainable fuel solutions (Hallin, 2014).

3.3 Conclusion

From the outset, the collective vision of the focus group, dedicated to methanol-based projects, was specific to craft work processes that resonate with the constraints of their customers. Confronted with the divergency of customer requirements, it became evident that a “one-size-fits-all” Business Process Model (BPM) would be unrealistic. Hence, the emphasis was placed on sustained dialogue, ensuring that while the BPM could not cater to every individual need, it remains a living document, adaptable and hopefully responsive to the evolving demands of methanol-based vessel projects.

The corporate standard for process modelling, supplied with exclusive symbols and definitions, was considered but ultimately set aside. The basis was to remain consistent with the broader principles of Business Process Modelling, which the company’s customized approach did not entirely embody, which led me onto a more personal style. The resolution was to conceive a foundational BPM, simplistic, to facilitate ongoing updates and serve as a frame/template for continuous improvement within the methanol-based vessel projects.

In the search to architect an effective BPM, the journey began with a thorough analysis of the existing workflows and processes. Armed with insights from this exploration, I embarked on constructing a BPM, harnessing the principles of certain experts in the field using first a pen and paper then moving on to Microsoft Excel and then finally MS Visio. The goal was to create a basic yet dynamic workflow, setting responsibilities, and tasks across the project's timeline.

4 Results

The goal of this thesis of creating and implementing a BPM for methanol-powered vessel projects was successful, which the upcoming "BPM Introduction" also show. This part of the thesis outlines the different phases of the business process developed for methanol-powered vessel projects, providing explanations for the design of each step as detailed in the findings. The results of the research conducted are presented here, showing the outcomes and their implications. When the process is eventually accessible to all team members specializing in methanol-powered vessel projects, it's important to note that any modifications to the process once fully implemented require managerial authorization to ensure that changes are controlled and deliberate.

4.1 Implementation

The newly created Business Process Model (BPM) for managing methanol-powered vessel projects has been implemented into the software systems used by the focus group. Initially, the BPM was introduced to the team through a detailed oral presentation, where the process elements were extensively explained and demonstrated.

As the completion of this thesis approaches, the responsibility for further implementing and developing the BPM will shift to the designated department. My role in this transition will focus on providing guidance and ensuring the BPM's components are fully comprehended, while also gathering feedback for future improvements. Implementing such a specialized BPM comes with significant challenges and demands careful management due to the complexity involved.

Due to certain organizational constraints mentioned earlier in the document, the complete rollout of the BPM across all the company's digital platforms cannot be achieved immediately. Therefore, the results from the initial implementation of this BPM will hopefully be shared before it is fully operationalized within the organization.

4.2 Business Process Model Introduction

When users access the Business Process Model (BPM) designed for methanol-powered vessel projects, they are initially introduced to a comprehensive view of the different segments involved in the customer delivery project, which is divided into five main parts. Each part unfolds to disclose more detailed aspects of the process. The company utilizes an internal framework known as the 'gate model,' defined by essential checkpoints and milestones that are critical for project advancement. Each component of the BPM is marked to align with these company-defined milestones and checkpoints. To reach any given checkpoint or milestone within the BPM, it is necessary to complete all related preceding tasks.

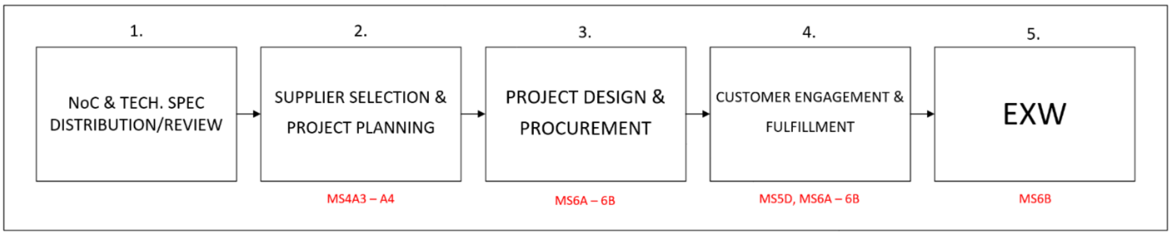

Figure 1: Overview of the different parts/segments involved in the BPM for methanol-powered vessel projects.

The figure above shows the five different parts, each with their names and relevant milestones included.

Integrating the company’s detailed gate model with the BPM for the methanol-based project team presented challenges due to the gate model's broader scope of checkpoints and milestones compared to what the BPM required. This discrepancy sometimes created the impression that the BPM was missing elements, but these were intentionally omitted as they fell outside the BPM's intended scope. In a workshop, particular checkpoints and milestones were selectively integrated into the BPM, with some forming distinct sub-processes. The specific milestones incorporated into the BPM are explained in the upcoming sub-chapter.

4.2.1 Milestones

MS4A - Product kick-off.

Objectives of milestone:

- When? To be held as soon as possible after SOR (preferably after Lead PM project kick-off, MS4)
- This is the internal FFAD kick-off with the project team.
- Meeting will be held internally.

MS4A3 - Purchasing review.

Objectives of milestone:

- When? 4 – 6 weeks after product kick-off (MS4A)
- Review the purchasing plan to ensure alignment with other project activities.
- Review and compare estimated purchasing costs against the sales budget.
- Verify that orders are placed for long-lead items in a timely manner.
- Meeting will be held internally.

MS4A4 - Shipment plan review.

Objectives of milestone:

- When? When most the equipment is purchased.
- Ensure shipment plans align with the overall project schedule and objectives.
- Confirm that customer requirements, including packing and labelling, are thoroughly captured, and addressed.
- Review inbound shipments to identify possible problems.
- Assess the status of bookings and shipments, both inbound and outbound, to ensure they meet project timelines and standards.

- Compare the transport budget against actual costs and evaluate the efficiency of bookings.

MS5D - Kick-off and Start production external.

Objectives of milestone:

- ensure that scope, schedule & actions are defined and clear for both parties.
- More information, checklists & templates associated to MS5D can be found by clicking the hyperlinked title.
- Meeting will be held internally.

MS6A - Product acceptance test.

Objectives of milestone:

- Ensure the product meets all functional, performance, and reliability specifications.
- Identify and address any potential quality or performance issues.
- Verify compliance with all applicable standards and regulations.

MS6B - Production finished.

Objectives of milestone:

- When? As soon as possible after product FAT.
- To review the product delivery completeness and close the manufacturing phase.
- The objective is to ensure that delivery is complete, and that possible carry-over work is defined.
- Meeting will be held internally.

4.2.2 Stakeholders

Each stakeholder contributes to efficient delivery of the project, and their coordinated efforts are necessary for the smooth execution and delivery of the final product. These are the stakeholders involved in the methanol-powered vessel project delivery business process and a quick explanation of each of their contribution in the process.

Class Society: In marine and technical projects, a class society provides classification, certification, and advisory services to ensure standards and regulations are met.

Customer: The customer is the recipient of the final product or service. Their needs and feedback are crucial for the project's success.

Documentation Engineer: The role of Fuel Gas Supply Systems Documentation Engineer, hereafter referred to as 'Documentation Engineer', involves creating and maintaining accurate records and documentation necessary for the project's governance and compliance.

End User: The individual or entity that will ultimately use the product or service. Their satisfaction is a primary indicator of the project's success.

Engineering: Engineering Fuel Gas Supply Systems, hereafter referred to as 'Engineering', includes various engineering disciplines that contribute to the design, development, and implementation of the project's scope of supply.

Engines Project Management. Marine, Power Supply: Customer Delivery: oversees the project's timeline, budget, and resources. They ensure that the engineering aspects of the project align with the overall project execution plan.

Fabricators: These are the manufacturers who construct parts or assemble components of the product.

Future Fuel Aux Delivery: They manage the external fuel supply system, which is critical in projects involving Methanol as a fuel.

Invoicing & Export: This department handles the billing process and ensures that all export regulations and documentation are adhered to.

Logistics: The logistics team manages the transportation of materials and products. They ensure timely delivery and efficient supply chain management.

Product Management: Fuel Gas Supply Systems Product Management, here after referred to as 'Product Management', involves defining the strategy for the product, guiding its development, and ensuring it meets customer needs and company goals as well as compliance with classification requirements.

Project Creation Team: Based on input from Sales, this team ensures that the project is correctly created in the company's ERP systems and ensures that Notice of Contract is distributed once project has been created.

Project Engineer: The Project Engineer for Engines Customer delivery department, hereafter referred to as 'Project Engineer', is involved in the project execution and development of engine systems. They apply engineering principles to create efficient and effective solutions.

Purchasing: The Fuel Gas Supply Systems Purchasing department is responsible for acquiring the materials, services, and equipment required for the project at the best possible price and quality.

Sales: The sales team is responsible for customer engagement, understanding client needs, and negotiating contracts. Their role is to ensure that the project meets the market demand and is commercially viable.

Service: After the project's completion, the service team is responsible for maintenance, support, and ongoing customer service.

Sourcing: The Fuel Gas Supply Systems Sourcing specialists identify and evaluate suppliers and negotiate contracts to procure necessary goods and services for the project.

Suppliers: External entities that provide the raw materials, components, or services necessary to carry out the project.

Trade Finance: Professionals in this area manage the financial aspects of international trade, including payment terms, exchange rates, and the securing of necessary funds.

4.2.3 Reading Instructions

The process diagram is organized with the relevant stakeholders listed on the far-left side. Each segment's tasks or workflows progress from left to right, representing a timeline where activities on the left happen earlier and those on the right occur later. Dashed or dotted lines extending outside a stakeholder's line of tasks indicate information being shared among stakeholders. The columns on the right-hand side of the main diagram serve to clarify information distribution. For example, they may detail document sharing, the initiation of sub-processes, or information relevant to multiple stakeholders. These aspects will be explained in detail in the accompanying text to enhance understanding.

4.2.4 Business Process Model (BPM)

This Methanol-powered vessel project business process primarily concentrates on the activities that occur post-contract signing. Therefore, I will begin with a brief overview of the sales process leading up to the contract signing:

Receipt of RFQ: The company receives a Request for Quotation (RFQ) from a customer, who may already have a draft technical agreement.

Review Process: The company reviews the RFQ to decide whether to proceed with a quotation.

Quotation Decision: If the decision is to quote, the Sales team drafts a Technical Specification (TS) and prepares a quote to be sent to the customer. Review meetings with the customer may be necessary to discuss the quote.

Customer Feedback: Should the customer have comments or require changes to the TS, necessary updates will be made to both the TS and the quotation.

Final Agreement: Once both parties reach an agreement on all terms, the contract and all associated documents (including the technical agreement and TS) are signed to indicate approval and review.

Contract Signing and SOR Meeting: Following the contract signing, a Sales Order Review (SOR) meeting is scheduled, marking the official commencement of the company’s Project execution phase at Milestone 3 (MS3), which continues until Gate 3 (G3), ‘Start Warranty Period’.

Project Execution Kick-off: After the SOR meeting, project execution kick-off meetings are conducted to initiate and align project activities.

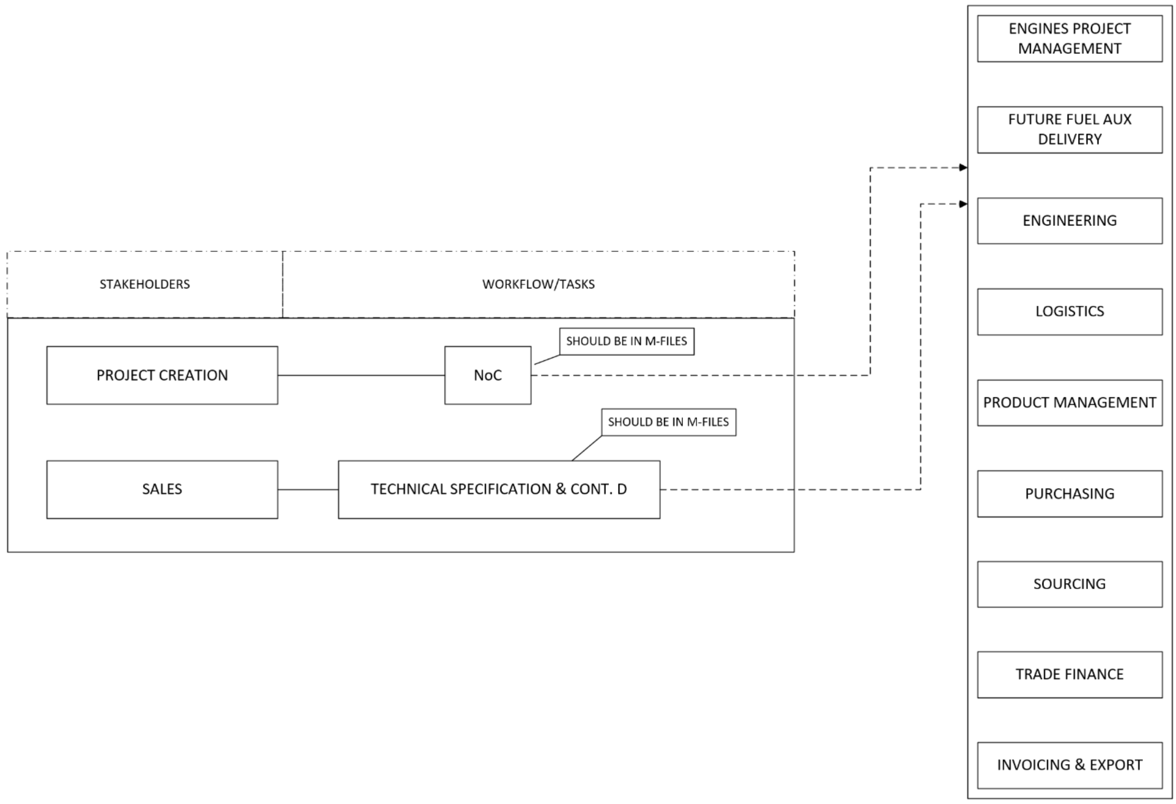

Figure 2: Overview of the first part of the BPM for methanol-powered vessel projects.

The figure above displays the details and visual components of the first segment of the BPM for the methanol-powered vessel projects, initiating the process with reviews and distribution of key documents.

To begin the “post-sales” process this business process within the organization, two primary documents are distributed and reviewed, setting the foundation for the entire project lifecycle.

Sales: The Sales team drafts the ”Technical Specification & Contractual Documentation (Cont. D)”. These comprehensive documents detail the technical requirements and specifications that the project must adhere to, informed by customer needs and market research. It also includes the contractual agreements between the company and the customer, encompassing scope, responsibilities, and legalities. The company’s quotation towards the customer is based on the technical specification. It technically specifies what has been offered, which in term makes it one of the most valuable documents that is part of the contractual documentation.

Project Creation: This team creates the project based on input from Sales. It involves the generation of the ”Notice Of Contract (NoC)” document. This pivotal document serves as a formal declaration that a project has been signed and is now opened in our ERP systems. The creation of the NOC takes place already in the sales phase, only confirmed and released once contract is signed allowing all relevant departments and stakeholders to prepare for their respective roles and its execution.

Stakeholder Distribution: Both the NoC and Technical Specification is created in the sales phase, by the Sales team. It is part of the contractual documentation and final signed version is distributed during Sales Order review. The information contained within these documents is distributed to all relevant stakeholders listed on the right side of the process diagram. This distribution ensures that all parties involved, from engineering and logistics to sourcing and finance, are informed of the new project's initiation and understand their roles in relation to the technical and contractual aspects. This flow of information is critical to synchronize cross-departmental efforts and to enable a smooth start to the project.

The distribution of the NoC indicates the start of project execution. All contractual documentation including but not limited to technical specifications shall be shared with relevant stakeholders. Each department will use the information from these documents to plan and execute their responsibilities effectively, ensuring that the project's requirements are met in a coordinated manner.

Stakeholders engaged in info distribution within this segment:

- Engines Project Management: The Engines Project Management reviews the NoC and technical specifications for relevance to the engine aspects of the project.

- Future Fuel Aux Delivery: Similarly, the Future Fuel Aux Delivery team reviews these documents.
- Engineering: The Engineering department reviews the technical specifications to ensure they are feasible and in line with engineering standards.
- Logistics: This department reviews the specifications with a focus on the logistics of project implementation.
- Product Management: The Product Management team ensures that the technical specifications align with the overall product strategy.
- Purchasing: The Purchasing department reviews the specifications to understand what needs to be acquired to fulfil the project's requirements.
- Sourcing: This team looks at the specifications to find appropriate suppliers who can meet the project's needs.
- Trade Finance: They review the financial aspects related to the technical specifications and contractual details.
- Invoicing & Export: This department is responsible for the financial transactions and the export logistics, ensuring they align with the project specifications.

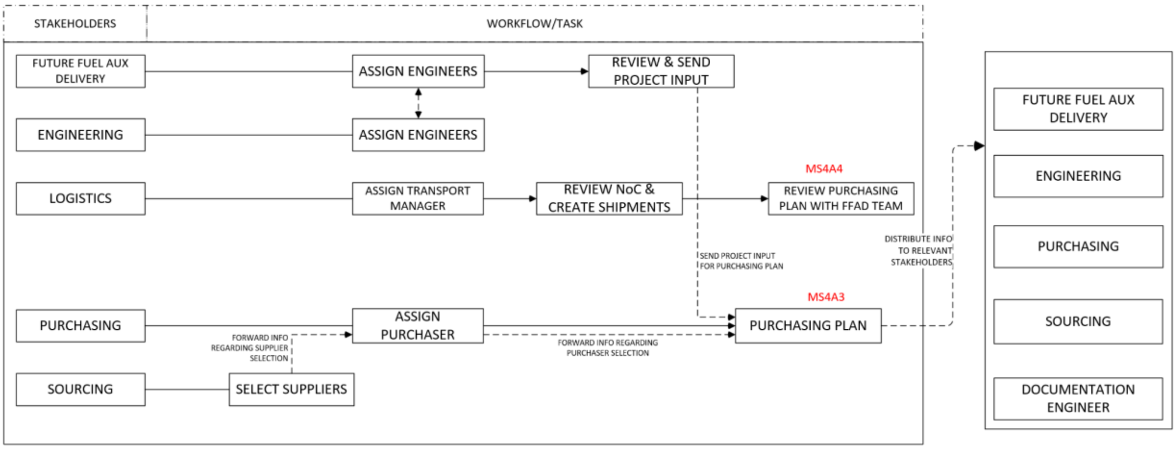

Figure 3: Overview of the second part of the BPM for methanol-powered vessel projects.

The figure above displays the details and visual components of the second segment of the BPM for the methanol-powered vessel projects, continuing the process with the selection of suppliers, engineers, and transport managers, as well as rigorous project planning.

The second part focuses on project and resource planning as well as supplier, purchaser, and engineer selection.

Sourcing: The Sourcing team initiates the process by “Selecting Appropriate Suppliers”. This is a critical step that involves evaluating potential vendors based on criteria such as price, quality, reliability, and adherence to compliance standards. Once suppliers are selected, this information is conveyed to the Purchasing department.

Purchasing: Upon receiving the supplier information from Sourcing, the Purchasing department proceeds to “Assign a Purchaser”. The assigned purchaser is responsible for managing the procurement process, which includes negotiating with suppliers, placing orders, and ensuring that the procured items meet the project's specifications and deadlines.

Future Fuel Aux Delivery and Engineering: Simultaneously, the Future Fuel Aux Delivery team and the Engineering team collaborate to “Assign Engineers” to the project. These engineers are tasked with the technical design and development work ensuring everything aligns with the project's technical specification or ensuring that engineering is done according to contract.

Logistics: Parallel to the engineering assignment, the logistics team is responsible for “Assigning a Transport Manager”. This manager's role is to plan and oversee the transportation of materials and equipment, ensuring that they are delivered on time and in good condition.

Project Input Review: The Future Fuel Aux Delivery team then conducts a thorough “Review and Sends Project Input” to the Purchasing department. This input includes specific requirements and timelines that must be considered in the purchasing decisions.

Purchasing Plan: With the project input from the Future Fuel Aux Delivery team, the Purchasing department develops a “Purchasing Plan”. This plan outlines the procurement strategy, including timelines, budgets, and milestones for the delivery of goods and services from the selected suppliers.

Class Process: Once the purchasing plan is in place, the Documentation Engineer begins the “Classification Process” which is a standard procedure in industries such as marine and energy to ensure compliance with classification society rules and regulations. This process is fundamental to ensure the project meets all industry standards and legal requirements.

This segment of the process ensures that the foundation of the project's operational phase is solidified through careful selection of suppliers, assignment of key personnel, and careful planning. Each role and activity are interconnected, and the seamless flow of information between departments underscores the importance of communication and coordination in the overall success of the project.

Stakeholders engaged in info distribution within this segment:

- Future Fuel Aux Delivery: Conducts reviews and forwards project input to the Purchasing team.
- Engineering: Coordinates reviews with the Future Fuel Aux Delivery team.
- Purchasing: Receives supplier selection details and delegates the assignment of purchasers for the development of the purchasing plan.
- Sourcing: Sends supplier selection details to Purchasing team.
- Documentation Engineer: Receives information about purchasing plan being made and preparing for classification process start.

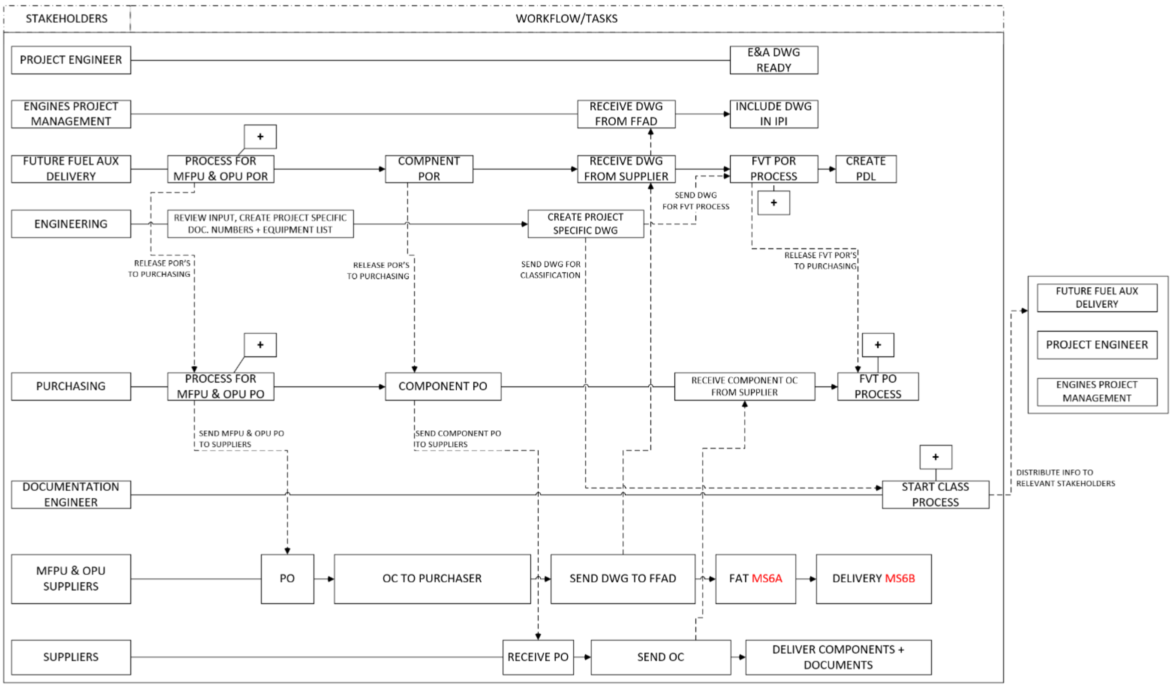

Figure 4: Overview of the Third part of the BPM for methanol-powered vessel projects.

The figure above displays the details and visual components of the third segment of the BPM for the methanol-powered vessel projects, continuing the process with the design and procurement phase, during which most components and units are designed and subsequently procured.

Procurement Coordination: The Future Fuel Aux Delivery team and engineering commence this phase with their own tasks. The Engineering team starts with the task “Review input, create project specific Doc. Numbers + Equipment list” based on the input received from the Future Fuel Aux Delivery team. The documents created in this task are essential for ensuring that every component is accounted for and matches the project specifications. The Future Fuel Aux Delivery team then start a sub-process dedicated to the procurement tasks for the MFPU and OPU; “Methanol Fuel Pump Unit (MFPU), Oil Pump Unit (OPU) Purchase Orders (PO)”. This step involves finalizing the technical details and issuing POs for the necessary units that will be part of the project's engineering solution, following this all “Component & FVT POR’s” are made within the Future Fuel Aux Delivery team under the supervision of the PM.

Drawing and Planning: Upon completion of the review, the Engineering team moves forward to create “Project-Specific Drawings (DWG)”, which serve as detailed plans for the manufacturing or construction phases.

Finalizing Technical Aspects: The Purchasing department works on the process for the “MFPU & OPU PO”, which involves coordinating with suppliers to ensure that the components ordered meet the project's technical requirements. Meanwhile, the Documentation Engineer integrates these details into the broader project documentation, ensuring that all specifications and technical information are recorded accurately.

Supplier Engagement: MFPU & OPU suppliers receive the “PO”, and corresponding “Order Confirmation (OC)” is sent to the Purchaser, marking the formal agreement and start of the supply chain activities.

Delivery and Quality Assurance (MFPU & OPU): The suppliers are responsible for sending the drawings to the Future Fuel Aux Delivery team, who will then ensure that these meet the project's specifications and quality standards. The “Factory Acceptance Test (FAT)” and we have then reached (MS6A) for these products, which is a critical step in quality assurance to verify that the units produced meet all specified requirements before they are shipped.

Delivery Process (MFPU & OPU): Once the "FAT" is approved, the MFPU and OPU are delivered (MS6B), which signifies the transfer of the units from the supplier to the consolidation point.

Final Documentation: Throughout this process, the suppliers are also tasked with delivering all necessary components and documents related to the units, which ensures that the project team has a complete set of information for installation, operation, and maintenance.

Class Process: In parallel with these steps, the Classification Process is initiated.

Stakeholders engaged in info distribution within this segment:

- Future Fuel Aux delivery: Are informed about the initiation of the Classification Process.
- Project Engineer: Same for this stakeholder
- Engines Project Management: Same for this stakeholder

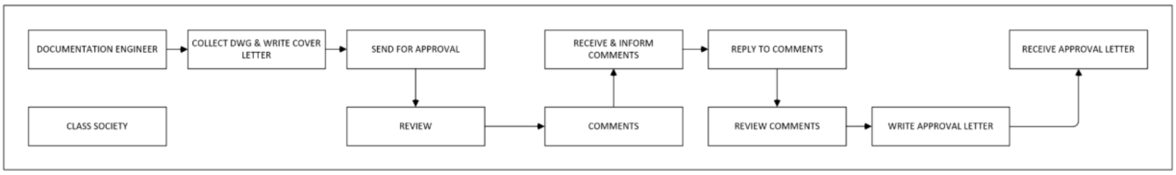

Figure 5: Overview of the Classification sub-process within the BPM for methanol-powered vessel projects.

The figure above represents the visual sub-process for the classification process, which is conducted between the documentation engineer and the classification society within the methanol-powered vessel projects.

Documentation Engineer: The Documentation Engineer begins the process by collecting the necessary drawings (DWG) and filling in the cover letter. The cover letter explains the contents of the submission and outlines the important details about the units that the Class Society needs to know for the review.

Send for Approval: After preparing the necessary documents, the Documentation Engineer sends them to the Class Society for approval. This indicates a formal request for the Class Society to review the materials and provide their consent or suggestions for changes.

Class Society: Upon receiving the documentation, the Class Society conducts a review which takes up to 4 weeks. This review is to ensure that the drawings and associated documents meet specific standards or regulations that the Class Society enforces or recommends.

Comments: After the review, the Class Society may have comments. These comments are feedback on the documentation and may include requests for clarification, changes, or additional information.

Receive & Inform Comments: The Documentation Engineer receives these comments and is informed about them. Information is then shared with the project engineer of Future Fuel Aux team, and other relevant engineer, who together with the project team reviews the comments and prepare a reply. The documentation engineer is then informed when a reply is ready to be sent and will continue the process with class society.

Reply to Comments: The Documentation Engineer then responds to the comments. This reply will include any revisions to the drawings, additional information requested, or explanations if certain suggestions cannot be implemented.

Review Comments: The Class Society reviews the responses and any changes made by the Documentation Engineer. This is to ensure that their comments were addressed adequately.

Write Approval Letter: If the Class Society is satisfied with the response and all issues have been resolved, they will write an approval letter. This letter is a formal document that signifies the Class Society's acceptance of the documentation.

Receive Approval Letter: The Documentation Engineer receives the approval letter from the Class Society, which completes the approval process. The engineer now has the official go-ahead based on the Class Society's standards.

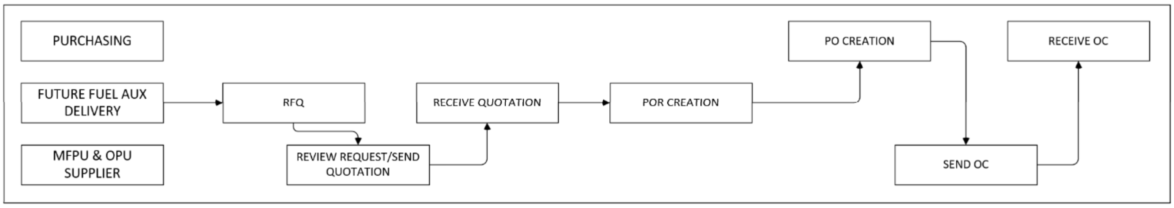

Figure 6: Overview of the MFPU & OPU sub-process within the BPM for methanol-powered vessel projects.

The figure above represents the visual sub-process for the MFPU & OPU units, two distinct components of the full product within the methanol-powered vessel projects.

RFQ (Request for Quotation): The Future Fuel Aux Delivery Team sends out a RFQ (Request for Quotation) to the MFPU & OPU suppliers.

Review Request: Upon issuing an RFQ, there is a review request step, which involve evaluating the RFQ details internally before suppliers respond, ensuring that all necessary information is included and that the RFQ is aligned with the project's needs.

Receive Quotation: Suppliers respond to the RFQ by providing quotations. These are detailed proposals that include pricing, terms, and conditions for the supply of the required goods or services.

POR Creation: Based on the quotations received, PORs are created and released in SAP. This is an internal form used to request the creation of an official Purchase Order (PO).

PO Creation: A PO is created after the POR is released successfully. The PO is a legally binding document sent to the supplier that confirms the purchase of goods or services. It includes the order details, quantities, agreed prices, and terms.

Send OC: Once the PO is sent to the supplier, the supplier sends back an Order Confirmation (OC). This document acknowledges the receipt of the PO and confirms the supplier's ability to fulfil the order as specified.

Receive OC: The Purchasing department receives the OC from the supplier, which signifies the acceptance of the order and triggers the start of the fulfilment process.

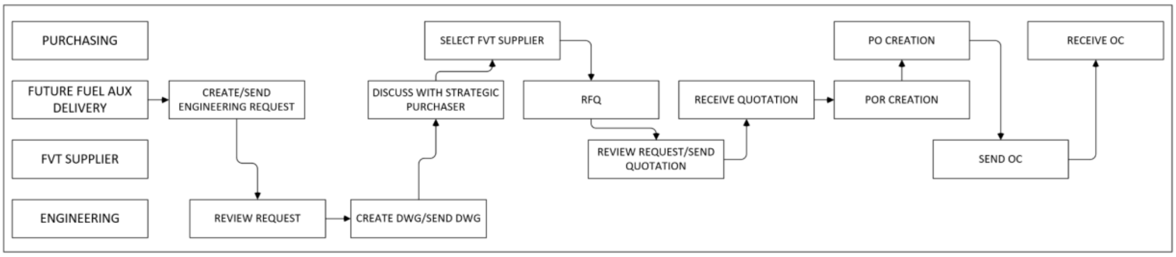

Figure 7: Overview of the FVT sub-process within the BPM for methanol-powered vessel projects.

The figure above represents the visual sub-process for the FVT unit, one of the distinct components of the full product within the methanol-powered vessel projects.

Create/Send Engineering Request: The Future Fuel Aux Delivery team creates and sends out an engineering request to the Engineering team, this request includes technical specifications or design needs for the FVT.

Review Request: After the Engineering request is created and received the Engineering team reviews and asks for any potential missing information.

Create DWG/Send DWG: After the engineering request is received and approved the Engineering team proceeds with drawing creation and when completed eventually sent out to the Future Fuel Aux Delivery team, as part of the RFQ to the FVT supplier for them to understand the project requirements fully.

Discuss with Strategic Purchaser: A strategic purchaser within the Purchasing department should be included in selecting the best suiting supplier for the project.

Select FVT Supplier: The Purchasing department selects a supplier that can provide the FVT services. This selection is based on factors such as the pricing and engineering specifications.

RFQ: The Future Fuel Aux Delivery Team sends out an RFQ (Request for Quotation) to the selected FVT suppliers.

Review Request: Upon issuing an RFQ, there is a review request step, which involve evaluating the RFQ details internally before suppliers respond, ensuring that all necessary information is included and that the RFQ is aligned with the project's needs.

Receive Quotation: Suppliers respond to the RFQ by providing quotations. These are detailed proposals that include pricing, terms, and conditions for the supply of the required goods or services.

POR Creation: Based on the quotations received, PORs are created and released in SAP. This is an internal form used to request the creation of an official Purchase Order (PO).

PO Creation: A PO is created after the POR is released successfully. The PO is a legally binding document sent to the supplier that confirms the purchase of goods or services. It includes the order details, quantities, agreed prices, and terms.

Send OC: Once the PO is sent to the supplier, the supplier sends back an Order Confirmation (OC). This document acknowledges the receipt of the PO and confirms the supplier's ability to fulfil the order as specified.

Receive OC: The Purchasing department receives the OC from the supplier, which signifies the acceptance of the order and triggers the start of the fulfilment process.

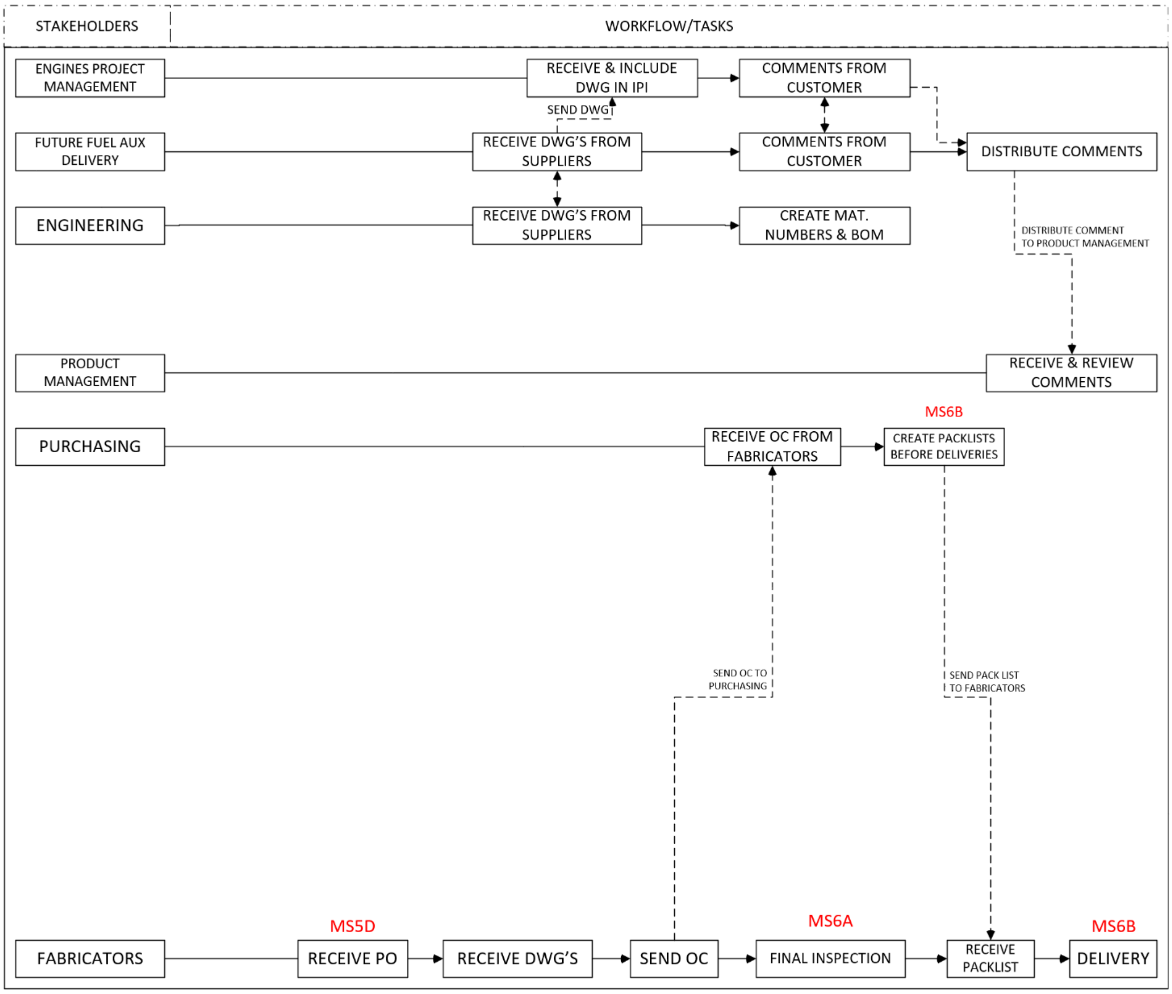

Figure 8: Overview of the Fourth part of the BPM for methanol-powered vessel projects.

The figure above displays the details and visual components of the fourth segment of the BPM for the methanol-powered vessel projects, continuing the process with customer engagement and fulfilment.

In this phase of the process, we see the progression from design finalization to the incorporation of customer feedback, and the preparation for the final delivery of the project.

Design Finalization: Stakeholders, including the Engineering and the Future Fuel Aux Delivery team, are responsible for receiving/distributing and finally Engines Project Management will integrate the technical drawings (DWGs) received from suppliers into the “IPI”.

Material and Documentation Preparation: Engineering then proceeds by “Creating Material Numbers and The Bill of Material (BOM)”, which are essential for inventory management, cost estimation, and supply chain logistics. The BOM provides a comprehensive list of raw materials, components, and assemblies required for the product.

Customer Interaction: The Future Fuel Aux Delivery team and the Engines project management “Receives and Reviews Customer Comments” following this the comments are distributed to relevant stakeholders, ensuring that the client's feedback is considered, and that the product meets their expectations. This step is vital for maintaining customer satisfaction and adherence to the project's scope.

Quality Assurance and Delivery: Following the manufacturing process, a “Final Inspection” (MS6A) is conducted to ensure that all components meet the project's quality standards such as class rules, regulations, and customer requirements. Once the inspection and other procedures such as FAT, Packing, Case Label based on Dimensions, weight, type of box are passed and “Pack list” is received from purchasing, the components are ready for “Delivery”.

Delivery Preparation: Fabricators, after "Receiving Purchase Orders (PO's)" and "Technical Drawings", send the "Order Confirmation (OC)" back to the purchasing team. This confirmation is an acknowledgment that the fabricators have all they need to proceed with final inspections, receiving the pack list from Purchasing and finally delivery.

Final Checks and Documentation: Before delivery, pack lists are created and distributed to ensure all parts and components are accounted for and properly documented. This is an essential step to ensure that the delivery is complete, and all items are traceable. (MS6B) is hereby achieved.

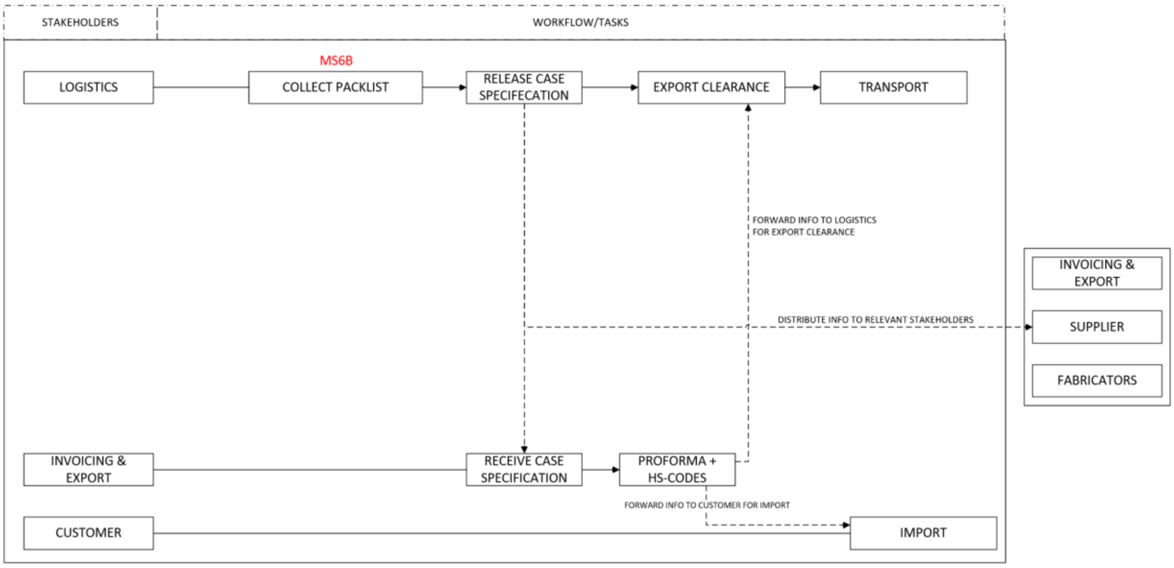

Figure 9: Overview of the fifth and final part of the BPM for methanol-powered vessel projects.

The figure above displays the details and visual components of the fifth and final segment of the BPM for the methanol-powered vessel projects, continuing the process with the ex-works phase, where the final product is handed over to the customer.

In the final part of the process, the focus shifts to logistics, final documentation, compliance with export regulations, and the actual transportation of the goods to the customer.

Logistics: The logistics team's responsibility begins with collecting the pack list, which is a detailed list of the items to be shipped. This list is crucial for verifying that all components are prepared for dispatch and that nothing is missing or erroneously included.

Case Specification: Once the pack list is confirmed, the case specifications are released. These specifications detail the packaging requirements to ensure the products are protected during transit and comply with any handling and shipping regulations.

Export Clearance: The Invoicing & Export department generates the necessary proforma invoices and Harmonized System (HS) codes. A proforma invoice is a preliminary bill of sale sent to buyers in advance of a shipment or delivery of goods, typically for customs purposes in import-export trade. HS codes are used to classify traded products and to determine tariff rates. This documentation is essential for obtaining export clearance, as it proves that the goods meet all export and import regulations, including any required certifications or inspections.

Transport: With export clearance secured, the Transport team oversees the actual shipping of the goods. They ensure that the items are delivered to the correct location, using the appropriate transportation method, and that all logistics are handled efficiently.

Customer and Import: Concurrently, the customer is kept informed of the shipping details, and preparations are made for the import process on the receiving end. The customer or their designated agents will manage the import process, which includes receiving the goods and handling any customs procedures in the destination country.

This final stage of the process is where the physical product moves from the seller to the buyer. It requires close coordination between Logistics, Invoicing & Export, and the customer to ensure a smooth transition and delivery. Each step is vital for the timely, efficient, and regulation-compliant delivery of goods, concluding the end-to-end business process.

4.3 Implementation Plan

The Business Process Model (BPM) tailored for projects involving methanol-powered vessels has been launched in digital tools used by the specific team this thesis initially revolved around and shared through an oral presentation. By the completion of this thesis, I am hoping for the team dedicated to fully launching my newly created BPM to as soon as possible share my work with the remainder of the company. To familiarize the team with the BPM, I will be working with answering any potential questions about the BPM regularly at the beginning to evaluate the BPM's effectiveness and to identify any necessary adjustments.

The accessibility of the BPM when launched will be enhanced and a final version of the BPM will also be securely stored within the company's document management system, M-files. It is important to note that the BPM’s for projects for such a newly implemented fuel will demand continuous revisions and updates in response to changes in customer demands or improvements in processes.

Modifications to the BPM are to be made initially by the management team, who are tasked with integrating it entirely into the company's wider business process framework. Due to the limitations of my access, my role will be to support by verifying that the BPM consistently reflects the conclusions of my research. Once these integrations are completed, the master file in M-files must be updated to include the latest version of the BPM.

4.4 Conclusion and Recommendations

The objective was set from the start: to shape work processes around the specific requirements of customers dealing with methanol-powered vessel projects. The team soon realized that accommodating the unique customer demand with a Business Process Model (BPM) was a good solution as it has been previously tested. Flexibility and an ongoing exchange of ideas were prioritized during the BPM development and workshop to ensure the processes remained adaptable and not overly stringent.

I departed from the company's typical guidelines for process development, which customarily utilize unique symbols and definitions specific to the company's needs. My strategy shifted towards a more unique method that did not conform to these internal conventions. By establishing a straightforward, yet modifiable BPM, I set the stage for ongoing updates and improvements. This foundation was chosen to more effectively respond to the evolving needs of methanol-powered vessel projects, aiming for a system that could adapt to future demands.

The journey to an effective BPM began with an in-depth analysis of the existing workflow for other products and solutions. This stage was crucial and involved learning and applying various BPM principles through firstly the method of old which is simply a pen and paper then Microsoft Excel and then moving on to MS Visio software. Despite no previous experience with BPM creation or MS Visio, mastering these tools was essential for designing a workflow that clearly delineated roles and responsibilities at various stages of the process.

To ensure the continued relevance and effectiveness of the Business Process Model (BPM) developed in this thesis, it is crucial to implement several strategic measures. Periodic reviews and updates are essential to align the BPM with evolving industry standards and changes in maritime regulations. This ensures the model adapts to shifts in business strategies and remains up to date.

Incorporating robust feedback mechanisms will allow for gathering direct insights from users at all levels, providing valuable information on the practical functionality of the BPM and highlighting areas for improvement. Additionally, maintaining ongoing training programs is vital. These should not only educate team members on effective BPM usage but also include refresher courses to help bridge any knowledge gaps, ensuring all team members can utilize the BPM efficiently.

Monitoring the performance of the BPM is also crucial. By establishing key performance indicators for efficiency, effectiveness, and compliance, the organization can identify successful areas and those requiring enhancements. This continuous monitoring will drive the BPM’s improvement over time.

Staying in touch of technological advancements and integrating relevant new technologies into the BPM can further enhance its functionality and user experience. This integration can make the model more effective and user-friendly, supporting seamless daily operations.

Lastly, regular assessments of the BPM’s scalability are necessary to ensure it can handle changes in the scale or scope of operations. Alongside this, implementing proactive risk management within the BPM’s processes will safeguard against potential disruptions, ensuring the model supports smooth and effective operations.

5 Bibliography

Andersson, K. &. (2019). Methanol as a Marine Fuel: Environmental and Technological Implications. *Journal of Marine Science and Engineering.*, 7(5), 147.

Balcombe, P. B. (2019). How to decarbonize international shipping: Options for fuels, technologies and policies. *Energy Conversion and Management.*, 182, 72-88. doi:https://doi.org/10.1016/j.enconman.2018.12.080

Becker, J. K. (2020). Process Management: A Guide for the Design of Business Processes. Springer.

Chen, Q. F. (2021). Navigating Digital Transformation in the Maritime Industry: The Role of Digital BPM in Enhancing Operational Efficiency. *Transportation Research Part E: Logistics and Transportation Review.*, 145, 102174.

Dumas, M. L. (2018). *Fundamentals of Business Process Management.* Springer.

Emiliani, M. (2015). *Better Thinking, Better Results: Case Study and Analysis of an Enterprise-Wide Lean Transformation.* The Center for Lean Business Management, LLC.

Hallin, P. B. (2014). *Metod för teknologer.* Stockholm: studentlitteratur.se. Retrieved from https://www.studentlitteratur.se/kurslitteratur/forskningsmetodik-och-vetenskapsteori/skrivhandbocker/metod-for-teknologer/

IMO. (2023). *2023 IMO Strategy on Reduction of GHG Emissions from Ships.* Retrieved from International Maritime Organization (IMO).: https://www.imo.org/en/OurWork/Environment/Pages/2023-IMO-Strategy-on-Reduction-of-GHG-Emissions-from-Ships.aspx

Institute., M. (2021). *Methanol as a Marine Fuel.* methanol.org. Retrieved from https://www.methanol.org/methanol-as-a-marine-fuel/

International Maritime Organization. (2021). *2023 IMO Strategy on Reduction of GHG Emissions from Ships.* Retrieved from International Maritime Organization.: https://www.imo.org/en/OurWork/Environment/Pages/2023-IMO-Strategy-on-Reduction-of-GHG-Emissions-from-Ships.aspx

Jones, D. T. (2002). *Seeing the Whole: Mapping the Extended Value Stream.* Lean Enterprise Institute.

Kumar, S. M.-L. (2020). Implementing Environmental Practices within the Business Processes of the Maritime Industry through BPM. *Journal of Cleaner Production.*, 262, 121280.

Österman, C. B. (2020). Electro-fuels in the transport sector: Assessing the potential for adoption in the marine and aviation sectors. *Renewable and Sustainable Energy Reviews.*, 119, 109492. doi:https://doi.org/10.1016/j.rser.2019.109492

Papageorgiou, S. (2019). The Impact of Business Process Management on Organizational Resilience in the Shipping Industry. *Journal of Shipping and Trade.*, 4(1), 1-15.

Recker, J. (2020). *Business Process Management: Theory and Applications.* Springer.

Rother, M. &. (1999). *Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA.* Lean Enterprise Institute.

Saxena, U. D. (2020). The role of alternative and renewable liquid fuels in environmentally sustainable transport. *Heliyon.*, 6(8), e04680. doi:https://doi.org/10.1016/j.heliyon.2020.e04680

Smith, T. W. (2020). *Third IMO GHG Study 2020.* International Maritime Organization (IMO).

Tapping, D. &. (2003). *Value Stream Management for the Lean Office.* Productivity Press.

vom Brocke, J. &. (2021). Handbook on Business Process Management 1: Introduction, Methods, and Information Systems. Springer.

Weske, M. (2019). *Business Process Management: Concepts, Languages, Architectures.* Springer.

West, R. R. (2018). *On the Difference between Internal and External Market Efficiency.* JSTOR.

Zhang, Y. W. (2021). Assessment of the Environmental Impact of Methanol as a Marine Fuel. *Science of The Total Environment.*, 751, 141734.

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