



Managing growth of Product Lifecycle at maturity level: a Systematic Literature Review

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ABSTRACT

In the face of stable sales and market saturation, managing the expansion of the product lifecycle at a mature stage is essential for maintaining market relevance and profitability. Through the synthesis and analysis of 64 papers, from JSTOR, Science Direct, and Google Scholar data bases, this systematic literature review identified major themes and provided insights into growth management strategies, marketing tactics, challenges, and opportunities that managers confront in their quest to sustain competitiveness and profitability in mature markets. Product diversification, market segmentation, innovation management, cost-effective lifecycle planning, price strategies, market expansion, client retention, alliances, and collaboration are a few examples of important tactics. The difficulties include growing rivalry, market saturation, shrinking profit margins, and shifting consumer tastes. To maintain competition, there are nevertheless still chances to take advantage of economies of scale, brand equity, and customer loyalty. The review's insights deepen our understanding of how businesses may best manage opportunities and overcome obstacles to maximize product lifecycle management at maturity level. This review provides practical guidance for practitioners and identifies gaps for future research.

KEY WORDS

Product lifecycle maturity, product lifecycle Management, growth strategies

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1. Introduction

As far as lifecycle management is concerned, it could be either product or service lifecycle management (Wiesner et al., 2015); however, for the purpose of this systematic literature review, this paper focuses on part of product lifecycle management (PLM), specifically maturity level PLM. Evidence shows that a diversity of stakeholders need good management of the product lifecycle (Gecevska et al., 2010). The strategies of price, distribution, product, competition, and promotion are distinct for different stages of the product lifecycle (Sharma, 2013). Managing the growth of a product lifecycle at the maturity level is crucial for the profitability, long-term success, and sustainability of a business (Tao et al., 2022), not only in large enterprises but also in small and medium enterprises (Paavel et al., 2017b). This is because the maturity stage is a very critical juncture in the product lifecycle, where careful management is essential to sustain market relevance, maximize profits, and prepare for the subsequent decline, and this importance needs proper management (Kambanou, 2020) beyond the known business legacy system (Krishnan, 2016) to respond accordingly.

Special attention to innovation (Ewa et al., 2017), cost optimization (Krishnamoorthi, 2013), customer loyalty (Wuest & Wellsandt, 2016), and market segmentation (Herdero & Gómez, 2014) distinguishes maturity level management from other stages in PLM. During this stage, the product has already reached its peak point in terms of market penetration and sales. In order to continue to flourish and stay competitive, it is crucial for businesses to effectively manage growth at the maturity stage of their product's lifecycle (Youssar & Berrado, 2017). Businesses often encounter difficulties during the maturity stage of a product's lifecycle, including market saturation, diminishing sales, and heightened competition. To surmount these obstacles and maintain expansion, companies must adopt tactics that focus on proficiently managing mature products (Rossi et al., 2013). In essence, this entails expanding the product line's offerings (Gecevska et al., 2010), figuring out new market niches (Herdero & Gómez, 2014), and investigating chances for product innovation and enhancement (Management, 2015). This will prolong the product's lifecycle, produce steady income, and hold onto market share (Sen & Ongsakul, 2017; Angelo et al., 2018; Williams, 2022). This is accomplished by utilizing a variety of related resources, including people, data, and processes, as

well as integrating this information with those of other organizations (Hicking et al., 2018; Moroza & Jurgelane-Kaldava, 2019).

Aligning innovation with the product lifecycle has great importance (Gecevska et al., 2010; Foufou & Eds, 2016; Angelo et al., 2018; Tchoffa et al., 2021; Chen et al., 2022; Matenga & Mpofu, 2023) and determines pricing adjustment (Wang et al., 2021). In connection with this, the development of industry 4.0 plays a key role in enabling managers to produce higher-quality products and goods with the minimum possible cost (Li et al., 2015; Hicking et al., 2018; Letters, 2018; Tao et al., 2022); further, sustainability issues are also addressed in industry 5.0 (Mesjasz-Lech & Mesjasz-Lech, 2023) and have a high impact on firms growth rate that enables firms to attain their maximum sustainable profitability climax (Murmman & Korn, 2019).

Many products have many different sales curves, forming many maturity curves, and hence the complex behavior enhanced scholars to develop almost all inclusive models (Krishnamoorthi, 2013; Letters, 2018), and therefore, this high variation in nature demands good management of mature products. Generally, the implementation of effective and efficient strategies such as streamlining operations, optimizing resources, pricing strategies, and the maturity stage of a product's lifecycle should be carefully managed in the growth of a product lifecycle so that businesses can maximize profitability and minimize costs (Kambanou, 2020; Tao et al., 2022).

The previous review did not concentrate on the systematic literature review on "managing growth of product lifecycle at maturity level"; instead, on PLM on "innovative and competitive business environment." (Gecevska et al., 2010). Olanipekun (2023) carried out a methodical, non-empirical study of PLM in the aspect of "entrepreneurship and knowledge economy." This systematic literature review primarily aims to synthesize and summarize themes on strategies that can be used in managing growth in product lifecycle management at the maturity level. It also draws attention to opportunities and challenges that face product managers at the maturity level. Management and marketing techniques for mature products are important to maintaining competitive advantage with mature products. This is because different maturity models

are associated with different attributes, and reusability in the application of maturity models has become a challenge (Vezzetti et al., 2014).

2. Theoretical Literature Review

According to Gecevska et al. (2010), Product Lifecycle Management (PLM) is the process of managing a product from its inception to its market introduction, improvement, and upkeep. As a useful tool for management and decision-making, it lowers costs by boosting productivity and is essential for preserving product-related data throughout its lifecycle (Vezzetti et al., 2014). (Kambanou, 2020). A crucial component of PLM, maturity refers to an organization's capacity to manage information and resources in order to satisfy client demands (Kärkkäinen et al., 2012). PLM maturity is supported by a number of ideas, such as customer relationship management, product line extension, and PLM theory, which tries to optimize value through its four stages (Olanipekun, 2023). In order to ensure alignment with corporate goals as PLM processes expand with business growth, strategic management is crucial. A number of maturity models aid in assessing and improving PLM capabilities, including Schuh's scenario analysis, Zhang's business/IT alignment, and Batenburg's five-source model (Bey, 2017). These models help businesses define objectives, evaluate where they are now, and create a plan for growth. By overcoming organizational resistance, data security concerns, interoperability challenges, and technical developments, PLM management can become more effective as it reaches maturity (Bey, 2017; Tchoffa et al., 2021). Businesses leverage technology like blockchain and AI, invest in training, encourage innovation, match PLM with business objectives, and create mature products. Efficiency is maximized by a strategic strategy that integrates PLM with supply chain management, customer relationship management, and corporate resource planning (Christopher et al., 2012; Paavel et al., 2017b). Metrics including cost-effectiveness, time-to-market, innovation, and customer satisfaction are crucial for making decisions and adjusting PLM strategies (Olanipekun, 2023). To maintain competitiveness and long-term success, PLM expansion must be managed with a smart and adaptable approach that makes use

of industry lessons, theoretical frameworks, and best practices.

3. Methodology

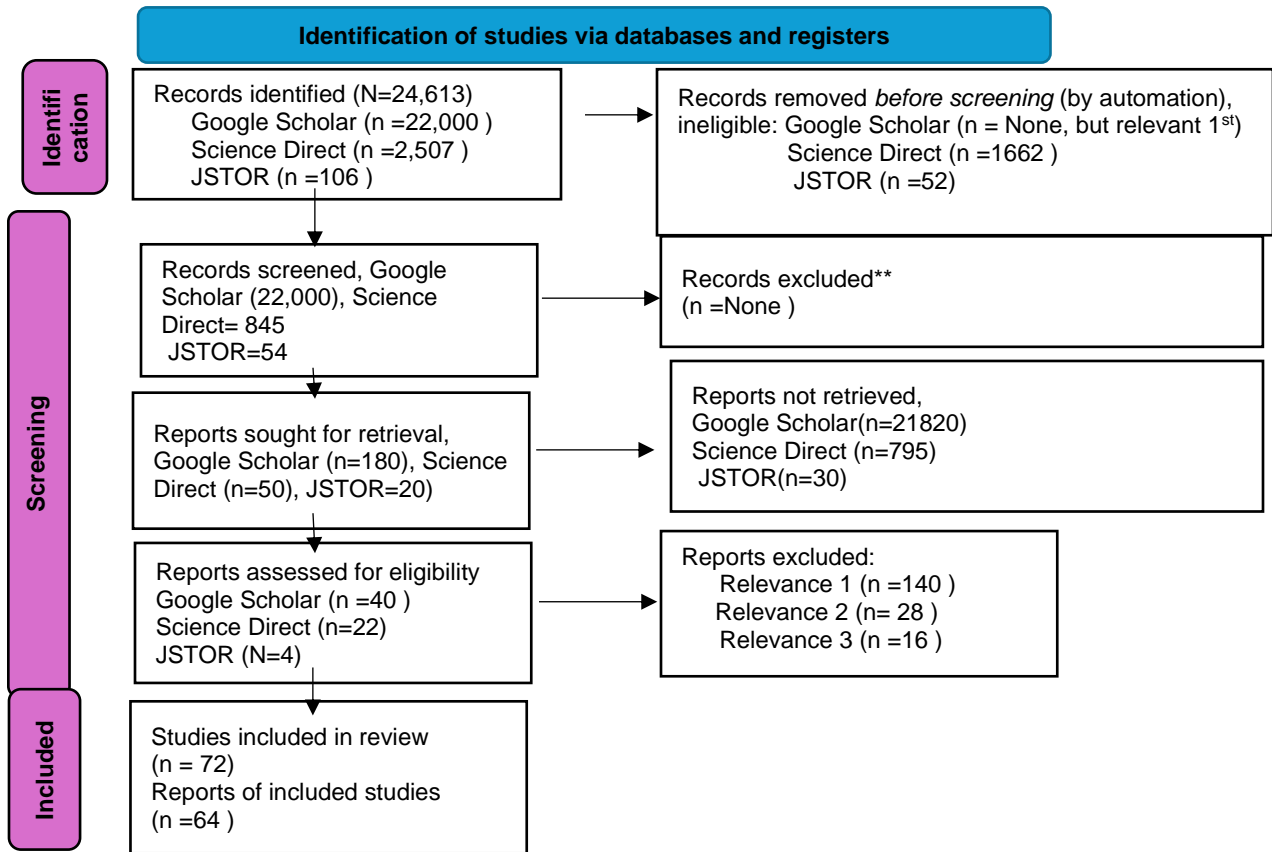
Based on Tranfield (2003), this systematic literature evaluation is carried out in three steps. The purpose of this systematic review is to identify bodies of evidence and update them with new research (Snyder, 2019; Wohlin et al., 2020). The primary goals of this systematic literature review are to comprehend how growth is managed during the maturity phase of a product's lifecycle, as well as the opportunities and challenges that face practitioners and product managers in managing product lifecycle growth at the maturity level. Additionally, the review aims to identify marketing strategies used in mature products to maintain a competitive advantage in the management of mature products. To find pertinent literature reviews, the researchers used the search method (MacFarlane et al., 2022).

Because it was advised to use multiple databases (Turnbull et al., 2023), the researchers used JSTOR, ScienceDirect, and Google Scholar. The search terms that were employed were "product lifecycle maturity" OR "product lifecycle management" OR "product growth strategies." Peer-reviewed journal articles, conference proceedings, and academic books published in English were the inclusion and exclusion criteria used. We included 64 papers with the intention of being sufficiently thorough to prevent missing any eligible studies (Mathew, 2024). Additionally, articles published within the last 15 years, from 2010 to 2024, were included because it is recommended that publications published within the previous 10 to 50 years (Rialp, Rialp, & Knight, 2005, cited in Paul & Criado, 2020). The screening process was also undertaken. Data extraction is based on relevance to the topic, reading the abstract, conclusion, and full text (Turnbull et al., 2023). Quality assessment is conducted based on trustworthy reliability and validity (Seo & Kim, 2012) that reliability equal and above 0.7 was accepted as inclusion criteria for quantitative studies. Data synthesis and analysis are used to identify common themes, patterns, and insights related to the topic, and we use qualitative methods, which is thematic analysis. Interpretation and discussion were performed, discussing the implications of these findings for theory, practice, and future research

direction. Use of PRISMA, increased transparency (Page et al., 2021), search strategy, inclusion/exclusion criteria, screening procedure, data extraction, quality evaluation, data synthesis, analysis, findings, recommendations, implications, and

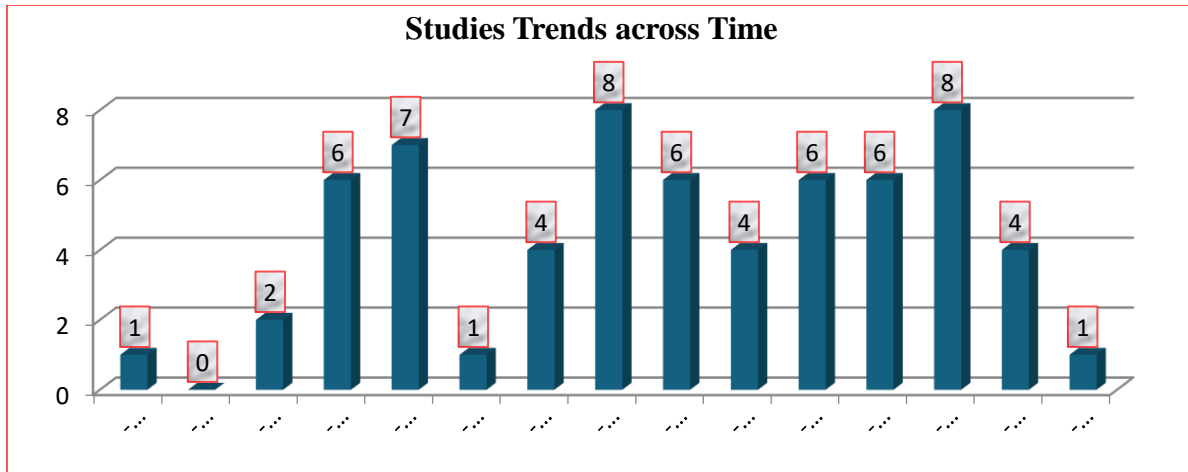
conclusions were all included in the documentation and reporting that was completed. Lastly, we perform a thorough, systematic literature review on controlling growth in the product lifecycle at the maturity level by adhering to these methodological stages.

I. PRISMA



4. Results

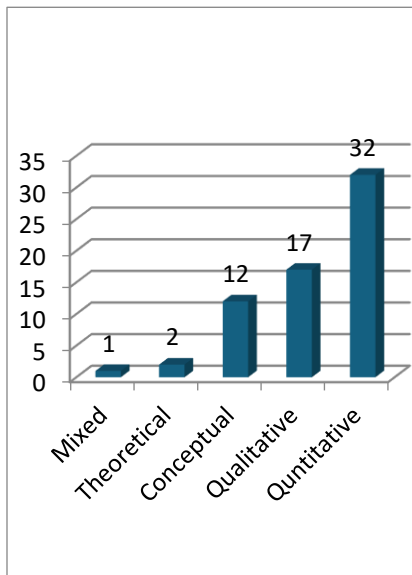
II. Trends of the study across time



While we observe the analyzed studies across time trends, it is slightly increasing on average in the recent direction, or the graph is skewed to the right in the recent direction. However, more studies are

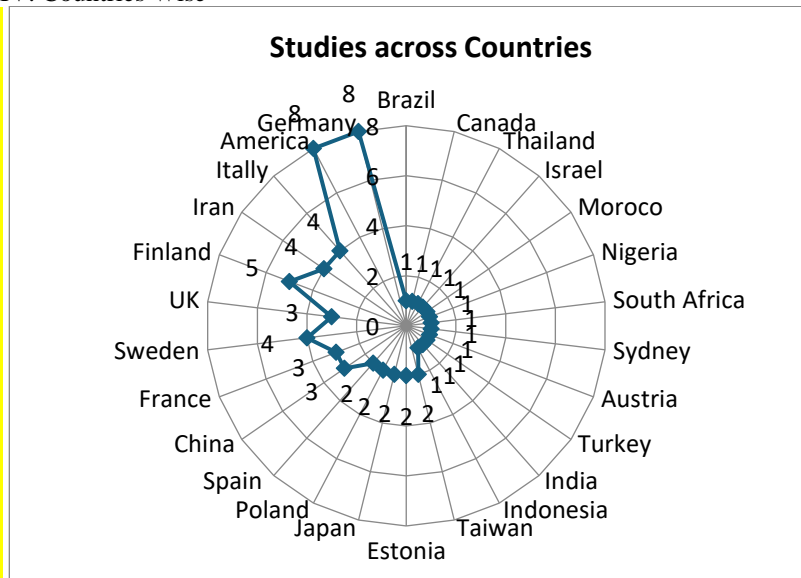
needed to explore further new insights, including the recommended ones, so that product managers and practitioners can utilize the insights.

III. Methodological



The methodology employed in the analyzed articles lacks a mixed approach, so future studies are recommended to conduct a mixed approach in their research. On the other hand, we observed that studies conducted related to the topic 'managing growth of PLM at maturity level' have been widely conducted in developed countries, especially Western countries, in Africa, only in countries with giant economies like South Africa and Nigeria, but other sub-Saharan countries have conducted research on the 'managing

IV. Countries Wise



growth of PLM at maturity level'. Generally, when we summarize, there is a slight time gap, a place gap, and a methodological gap.

A consideration of the capability maturity model is important to manage the growth of the product lifecycle for mature markets, as it enables better coordination, a more methodical approach, and careful planning of the process. Marketing knowledge plays a critical role in managing the growth of the product lifecycle at maturity, as it determines the

success, profitability, competitiveness, market share, and survival of businesses (Kärkkäinen et al., 2012; Krishnamoorthi, 2013). In light of this, a thorough and systematic literature review has identified themes that serve as growth strategies. These themes include market segmentation, product enhancement, cost optimization, price adjustment, market expansion, customer retention, diversification, partnerships and collaboration, lifecycle planning and monitoring, and feedback. These themes will be covered in more detail below.

4.1. Strategies for Sustaining Products in the Maturity Phase

4.1.1. Lifecycle Planning

A critical component of managing PLM as firms advance through maturity levels is lifecycle planning, which involves meticulous coordination, strategic thinking, and forward-thinking to ensure the seamless flow of products from conception to retirement (Müller et al., 2018). According to Schönmann et al. (2016) and Riascos et al. (2020), lifecycle planning is crucial for organizations to effectively manage the complexity of product lifecycle management at maturity level, align it with business objectives, implement risk management methods, and foster cross-functional collaboration. By adopting new technologies and taking regulatory and environmental aspects into consideration, organizations can ensure an adaptable and comprehensive strategy to manage the full product lifecycle and eventually contribute to sustained success, profitability, and competitiveness (Yousefnezhad et al., 2020).

4.1.2. Market Segmentation

Niche marketing is a useful tactic to address pricing rivalry in a mature market and efficiently manage growth for mature products. Understanding niche markets' demands, wants, and preferences, and acting accordingly is the main goal of market segmentation in managing the expansion of the product lifecycle at maturity (Sharma, 2013). Segmenting the market is essential to keeping items viable at the mature stage. It makes it easier to target marketing, differentiate products, allocate resources effectively, retain customers longer, spot new opportunities, and develop effective communication strategies. These advantages ensure that companies survive a competitive market by helping them to hold onto their profitability and market position (Gecevska et al., 2010; Heredero & Gómez, 2014).

4.1.3. Product Enhancement

It is important to manage PLM growth when it reaches maturity because, at this point in the product lifecycle, competition is more intense and demands that features be added to the product in order to maintain market share. Businesses that reach maturity see that continual development and product enhancement are essential to sustaining profitability and competitiveness in the marketplace (Gecevska et al., 2010). Product enhancement methods, which prioritize user experience optimization, the integration of cutting-edge technology, and adaptation to the ever-evolving market, are crucial for managing the mature product lifecycle. Therefore, organizations can gain the upper hand to thrive in a constantly changing business landscape while effectively managing the maturity of their PLM processes by utilizing advanced technologies, implementing agile development practices, making data-driven decisions, ensuring scalability, optimizing user experiences, and fostering continuous feedback loops (Tipu et al., 2022).

4.1.4. Cost Optimization

One of the essential elements of PLM's maturity level growth management is cost optimization (Krishnamoorthi, 2013). By doing an overall cost-benefit analysis, adopting cloud-based solutions and automating processes, leveraging technology rationalization, and generally implementing a holistic approach, organizations can optimize costs and gain an efficient supply chain in PLM processes at maturity level without compromising on efficiency and effectiveness (Gecevska et al., 2010). Through lean and agile PLM frameworks that support success, profitability, and competitiveness in PLM at the maturity level, these techniques help firms grow. Scholarly literature needs to be thoroughly researched because, at the maturity level, product lifecycle costing plays a significant role in a company's ability to succeed by increasing its profitability (Kambanou, 2020). Consequently, it is necessary to pay attention to cost optimization or lowering product lifetime costs at the maturity level without compromising the best possible business operations. Selecting suppliers with the lowest possible costs is essential to business management since lower net costs boost a company's profitability. At this stage, production costs must be decreased and marketing expenses must decline. Innovation must be pursued, news must be designed to maximize market presence, customer feedback must be sought, and demographic research must be conducted. Therefore, optimizing product lifecycle costs at the maturity level is essential (Tao et al., 2022). Reducing production costs without sacrificing

quality is essential for controlling the expansion of a product's life cycle at a mature stage since it boosts profitability. This lowers the cost of the products that are offered, and businesses can reduce their overall operating expenses by digitally reusing and manufacturing plans, producing plant information, and automating processes (Gecevska et al., 2010; Walter et al., 2017). Some academics have advised people to study non-linear cost modeling in addition to linear cost modeling (Letters, 2018), since it is diversified and complex.

4.1.5. Price adjustment

One of the most important parts of managing the growth of PLM at maturity level is price adjustment. Demand rates can fluctuate over time as products and markets change (Krishnamoorthi, 2013). Therefore, it's crucial to strategically adjust pricing strategies and match them with value propositions, competitive landscapes, and market demands. Consequently, sound techniques are required for efficient price adjustment in managing PLM at the maturity level, and efficient pricing adjustment is crucial for controlling. Organizations can optimize price structures throughout the product lifecycle by adopting a dynamic strategy that takes into account market dynamics, customer expectations, and competition strategies (Kapur et al., 2019). Organizations can attain growth goals and remain competitive by adjusting their price in a way that complements the evolution of their value proposition. In pricing policies, the price and price adjustment are determined by comparing the positions of competitors, sales, making informed decisions when raising or lowering the price. This is considered taking into account the introduction of coupons for consumer goods, and accounting for the efforts made in advertising and promotion to attract new customers as well as the efforts made in product differentiation to maintain quality to extend the maturity stage and dependability in the PLM. At times, the fight against disruption persists when a product matures more successfully than anybody could have predicted (Ewa et al., 2017; Dos Santos et al., 2018). Additionally, when innovation spreads, consumer psychology and the invention's goodwill influence price adjustments. The combination of these three concurrent processes may influence pricing changes, which would enhance business profitability (Gecevska & Stojanova, n.d.; Kapur et al., 2019).

4.1.6. Market Expansion

Gaining power in a new market is vital to maintaining organizational success, reducing risks, and seizing emerging possibilities. It is also a fundamental strategic component of managing product lifecycle management (PLM) in the mature stage. Expanding the market while managing growth at a mature level, requires a greater understanding of the markets as well as strategic vision and flexibility, as it's a complex undertaking. Organizations seeking to expand their market share can achieve greater success by conducting market research, forming strategic alliances, introducing creative pricing strategies, accommodating cultural differences, and maintaining an agile supply chain management system. These actions can also help businesses gain a competitive edge and increase profitability (Angelo et al., 2018; Williams, 2022). The battle for market expansion is crucial to managing growth at the maturity stage because organizations with expanded markets enjoy higher profit margins, higher sales volume growth, and the highest returns from products that achieve the greatest market share. This increases profitability by addressing declining profit margins in PLM at the maturity level (Sharma, 2013; Dos Santos et al., 2018). Producing smart devices that create a favorable environment for online marketing to extend the lifecycle of products and IoT (internet of things) supported by security issues are two ways to expand the market while managing the growth of the product lifecycle at maturity level. Today's business is becoming an online market that facilitates the ordering of goods because customers need smart devices that are secure from. This can be further extended to the Internet of Everything (IoE) (Krishnan, 2016), which allows for a potentially higher maturity level by making it easier for manufacturers to monitor and control with a single click. This could be widely implemented in Industry 5.0 in the future, despite the fact that the concept is currently risky (Riascos Castaneda et al., 2020), complex, and difficult to value in terms of business. As a result, it requires an appropriate strategy in conjunction with consistent change management within the organization to increase customer benefit and attract additional market share (Voell et al., 2018).

4.1.7. Customer Retention

A product service system that concentrates on customer value generation and supports companies in maintaining customer satisfaction is essential to managing the product lifecycle at a mature level in product lifecycle management (PLM). As PLM

processes develop and mature within organizations, it is critical to implement strategies that not only bring in new business but also maintain the loyalty and satisfaction of current clients (Wuest & Wellsandt, 2016). To boost customer satisfaction, data management for conceptual, digital, and physical product types must be differentiated (Liu et al., 2021). Customers want benefits in the form of cost, time, and quality (Gecevska & Stojanova, n.d.). Consequently, through carefully analyzing customers' needs and wants and then satisfying them in a way that aligns with those needs, customer retention can be achieved (Kärkkäinen et al., 2012; Paavel et al., 2017a). This is because the maturity level of the product lifecycle affects the means of transportation of commodities that directly affect cost, time, and quality (Murakami & Matsuse, 2014). When PLM reaches a mature stage, managing client retention effectively requires a comprehensive strategy that includes strong support systems, ongoing development, customized engagement, and open communication.

Organizations should use the process of prioritizing customer loyalty and maintaining long-term customer happiness as a crucial foundation for future growth, success, and profitability throughout the PLM journey during the maturity stage (Ewa et al., 2017). A short-term shift in lifespan and design is required in order to address disruptions that impact societal and organizational concerns and maintain profit (Chen et al., 2022). Furthermore, social media utilization at a mature level with sound discourse logic is crucial for co-creating value in order to boost customer engagement and retention (Pouyan et al., 2022).

4.1.8. Diversification

Adopting diversification methods is essential to sustaining growth, profitability, and success as organizations and products advance and the market changes. Diversification is critical to PLM success at the maturity level. Due to a variety of factors, including competitors, dynamic industry shifts, and the need to develop new strategies for the success of organizations in order to stay competitive and sustainably grow over time, diversification is crucial for managing growth at the product maturity level (Gecevska et al., 2010). During the management of PLM at maturity level, the diversification strategies that are applicable are entering new markets, embracing emerging technologies, expanding product portfolios, and adapting to changing customer preferences (Teknologi, 2014). Generally, by

diversifying strategically, companies can capitalize on new opportunities, mitigate risks, and sustain growth throughout the product lifecycle, creating higher significance for overall maturity, profitability, and competitiveness (Sen & Ongsakul, 2017).

4.1.9. Partnerships and Collaboration

Building partnerships and collaborations is essential in the ever-changing PLM ecosystem when it comes to managing PLM at a mature level. For enterprises looking to manage the challenges of product creation, foster innovation, and guarantee sustainable growth throughout maturity levels, collaboration and partnerships have become essential. It is vitally necessary to have a collaborative and partnership environment where all stakeholders perform their respective roles constructively to maximize resource use (Gabrow, 2021). Effective PLM requires collaboration and partnerships, especially as organizations go through different stages of development. Establishing connections with diverse stakeholders allows firms to take advantage of their combined knowledge, stimulate creativity, and approach PLM obstacles with a cooperative and flexible approach, all of which support long-term expansion and competitiveness (Tchoffa et al., 2021). Organizations can ensure a holistic and adaptive approach to managing the entire product lifecycle by adopting advanced technologies, fostering cross-functional collaboration, incorporating risk management strategies, aligning with business goals, taking environmental and regulatory factors into consideration, and adopting advanced technologies (Yousefnezhad et al., 2020). These actions will ultimately contribute to sustained success and competitiveness.

4.1.10. Innovation and adaptation at the maturity level

A thorough balance between successfully managing the current operations, determining directions for sustained profit, and strategically planning for the future is required when delving into the management of the PLM maturity stage. This is because managing growth effectively and efficiently requires enabling strategies in adaptation and innovation (Sen & Ongsakul, 2017). According to Ewa et al. (2017), innovation in PLM at a mature level requires constant product improvement in order to meet customer expectations and market dynamics. This could involve raising the bar on features, functionality, or quality in order to keep a competitive advantage. In addition, the implementation of technological advancements

supported by digital technologies enables profitability in the implementation of industry 4.0, which is further strengthened by industry 5.0 in sustainable or environmentally friendly business operations (Mesjasz-lech & Mesjasz-lech, 2023) because it has a high relationship with operational systems (Hadaya & Marchildon, 2012; Matenga & Mpofu, 2023) and discovering emerging trends has significance to the product's importance and demand, ensuring it remains a favored special among consumers. This can be accomplished by adapting to changing market demands, customer preferences, and outside variables with flexibility. This adaptability can be enhanced by a proactive response strategy that allows the product to stay flexible in a competitive, ever-changing environment. By doing this, cost effectiveness can be attained, which promotes success and profitability (Angelo et al., 2018; Williams, 2022). Generally, in managing expansion of PLM at maturity phases, successful management of growth rests on a dynamic interplay between innovation and adaptation. Therefore, by continuously enhancing the product, optimizing costs, exploring new markets, strategically adapting to market changes, and embracing digital transformation, businesses can not only weather the challenges of maturity but also position the product for extended success in the ever-changing marketplace (Gecevska et al., 2010; Sen & Ongsakul, 2017), including using IT support systems (Teknologi, 2014) that add value (Sen & Ongsakul, 2017).

4.2. Challenges and opportunities that face managers in Managing Mature Products

Generally speaking, effective growth management of PLM at maturity stages depends on the dynamic interaction of innovation and adaptation. Thus, firms can not only overcome the obstacles of maturity but also position the product for extended success in the constantly shifting marketplace by consistently improving the product, cutting costs, investigating new markets, strategically responding to changes in the market, and embracing digital transformation (Gecevska et al., 2010; Sen & Ongsakul, 2017). This includes utilizing value-adding IT support systems (Teknologi, 2014). Market saturation (Rota et al., 2016) that necessitates innovation strategies due to little market potential remaining; intense competition from both current and new market players, needing differentiation or staying in crowded competition, increasing competitive edges (Cameron et al., 2015); decline in profit margins that require critical cost

management to sustain profitability (Tao et al., 2022). These are some of the major challenges associated with managing mature products. Additional difficulties include evolving customer preferences, which are a result of customers' needs changing over time. Growth management for mature products must therefore adapt to these demands, making it extremely difficult for product managers to anticipate and address these changing preferences as technology ages. If mature products confront the possibility of technological obsolescence, issues of demanding research and development arise, and a lack of innovation results in a major challenge (Ates & Acur, 2022).

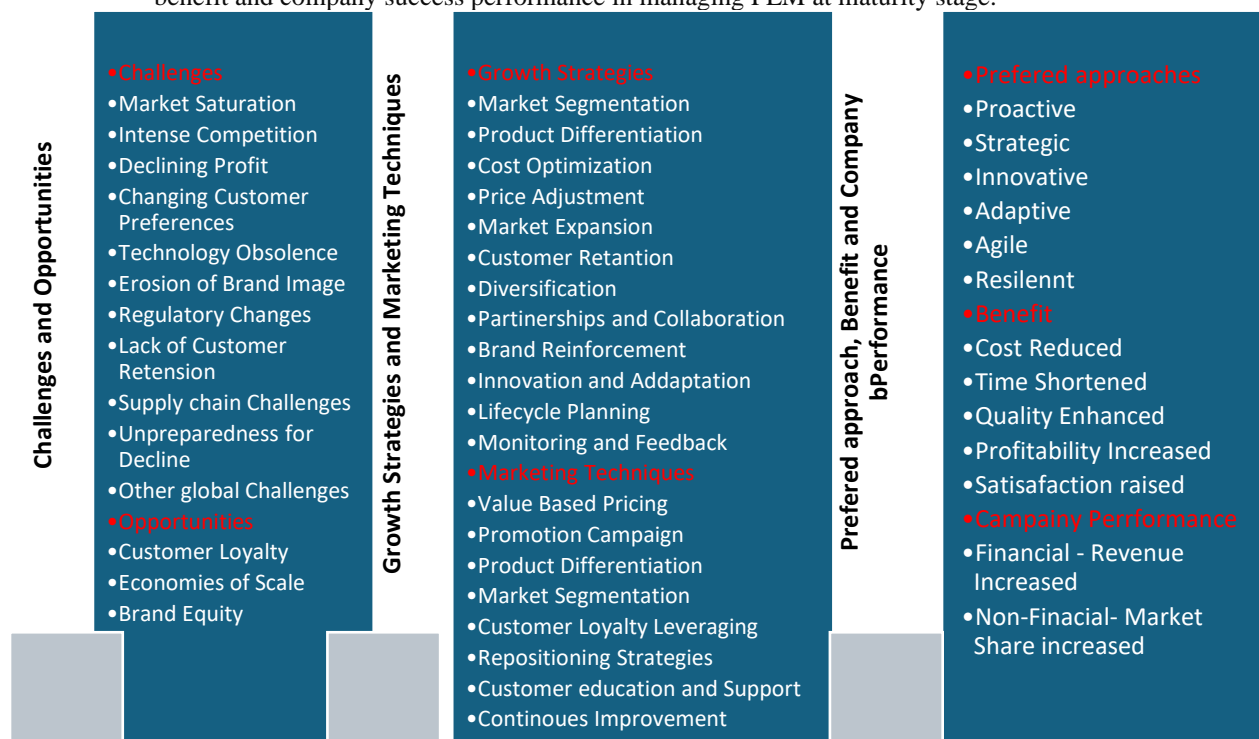
Other challenges that product managers face in the PLM process at the maturity level include brand image erosion (Ewa et al., 2017), regulatory changes, a lack of customer retention, supply chain challenges, an inability to plan for decline, and other global economic factors that may arise in managing the growth of mature products. Effective management of these challenges requires a proactive and strategic approach, and therefore, organizations must frequently reassess market dynamics, implement adaptive strategies, and invest in innovation to navigate the complexities that face organizations in managing the growth of PLM at maturity level successfully (Kapur et al., 2019; Mesjasz-Lech & Mesjasz-Lech, 2023). Despite the fact that mature products face several obstacles, opportunities remain for clever product managers to capitalize on. These mature markets offer a variety of opportunities, such as customer loyalty (Kärkkäinen et al., 2012; Paavel et al., 2017a), economies of scale (Krishnamoorthi, 2013), and utilizing brand equity to sustain growth and competitiveness. Future studies should focus on analyzing techniques for overcoming hurdles and capitalizing on opportunities in the process of controlling PLM growth at maturity.

4.3. Marketing techniques for mature products to maintaining competitive advantage with mature products

Despite the fact that mature products face several obstacles, opportunities remain for clever product managers to capitalize on. These mature markets offer a variety of opportunities, such as customer loyalty (Kärkkäinen et al., 2012; Paavel et al., 2017a), economies of scale (Krishnamoorthi, 2013), and utilizing brand equity to sustain growth and competitiveness. Future studies should focus on analyzing techniques for overcoming hurdles and capitalizing on opportunities in the process of

controlling PLM growth at maturity. Third, value-based pricing emphasizes value-based pricing techniques (Töytäri et al., 2015). Fourth, tailored promotional activities that address consumers' pain points or important consumer issues differentiate items from competitors (Boiral et al., 2022). Fifth, leveraging customer loyalty by building on current customer loyalty to promote or make brand equity memorable in order to retain customers and encourage repeat purchases (Heredero & Gómez, 2014; Kamalaldin et al., 2020). Sixth, repositioning techniques are useful for updating marketing messages, establishing good packaging, and branding to demonstrate the product's dynamic position and

IV. Frame work of challenges, opportunities, growth strategies, marketing techniques, preferred approaches, benefit and company success performance in managing PLM at maturity stage.



5. Discussion

This systematic literature review looked into strategies for managing product lifecycle management (PLM) at the maturity stage, such as product diversification, market segmentation (Sharma, 2013), innovation management (Mesjasz-lech & Mesjasz-lech, 2023), pricing strategies (Kapur et al., 2019), and cost optimization. Effective lifecycle planning, market expansion, client retention, alliances, and collaboration are all key strategies for long-term success and competitiveness in developed markets. The review underlines the need for continual innovation and

current value propositions (Lu et al., 2022). Seventh, customer education and support provide customers with excellent after-sales services to build loyalty and trust in the organization, leading to repeat purchases (Jain et al., 2021). Finally, continuous improvement entails monitoring competitors' activities, market trends, and customer feedback in order to evaluate opportunities that need to be utilized and improved (Marshall, 2010). As a result, by actively implementing successful marketing tactics, firms can boost profitability, gain market share, sustain sales for mature products, and lay the groundwork for future success and growth.

strategic planning in managing mature products, as previously reported (Müller et al., 2018; Schönmann et al., 2016). It broadens this perspective by incorporating cutting-edge technological solutions while focusing on client retention and market expansion. Despite the emphasis on continuous innovation and differentiation, there is no scholarly consensus on the most effective techniques, highlighting the need for more empirical research. In mature markets, updated technologies, as well as dynamic pricing and diversification strategies, are crucial for upgrading current theoretical frameworks. Practitioners can use this information to

develop comprehensive strategies that prioritize cost reduction, customer retention, and market expansion. Policymakers can foster an environment that promotes strategic planning and innovation. The review acknowledges potential publishing bias and restrictions caused by the removal of non-English research.

Challenges such as research heterogeneity and potential biases in study selection were discovered. Future studies should look into the impact of future technologies such as artificial intelligence (AI) and the Internet of Things (IoT) on managing mature product lifecycles, as well as use longitudinal studies to measure long-term outcomes. While most studies used sound methodologies, more empirical research is required to confirm the proposed tactics, as insufficient data in some studies may have risked their validity. Growing competition (Cameron et al., 2015), market saturation (Rota et al., 2016), declining profit margins (Tao et al., 2022), and changing client preferences are among the challenges identified. Opportunities include consumer loyalty (Kärkkäinen et al., 2012; Paavel et al., 2017a), economies of scale, and capitalizing on brand equity (Hidayatno & Rahman, 2016). Future research should concentrate on methods for overcoming obstacles and leveraging opportunities in managing PLM at maturity. The assessment emphasizes the necessity of a variety of strategies for managing older products, including cost optimization, adapting to changing market conditions, continual product enhancement, and effective lifecycle planning. The combination of breakthrough technologies, consumer interaction, and strategic market diversification can increase competitiveness even more. Practitioners should follow these procedures to ensure long-term success and a competitive advantage. Future assessments may benefit from more advanced data synthesis techniques and a broader range of investigations.

5.1. Theoretical implications and future research directions

Managing product growth in the maturity stage of the product lifecycle presents new difficulties and opportunities. Traditional PLC models depict a linear evolution, but recent research suggests a more dynamic and iterative process affected by market trends, technical advancements, and strategic management practices. By synthesizing the existing theory and empirical evidence, this systematic literature review contributes to the development of a more comprehensive theoretical frame work for managing growth of PLM at maturity level, however, future

research is needed in testing, exploring and refining theoretical propositions, confirm the validations of the their applicability throughout different industries and contexts to contribute further for managing growth of PLM at maturity level. This systematic literature analysis investigates the theoretical implications of managing product growth at maturity, focusing on strategic flexibility, constant innovation, strong customer relationship management, and exploiting organizational resources and competencies. It also discusses the functions of organizational learning, market segmentation. By integrating these varied theoretical frameworks, this research provides a thorough knowledge of viable tactics for maintaining development and competitive advantage during the PLC's maturity period.

5.2. Practical implications for managers and practitioners

This systematic literature review has provided managerial and practitioners' implication and insight that recommends for effectively managing growth of PLM at maturity level. Various strategies such as market segmentation, continues innovation, cost optimization, customer engagement are identified, pricing adjustment, product enhancement are identified as a key drivers of success in managing growth of PLM at maturity level, so that managers can make utilize of these insight in managing growth of PLM at maturity level to provide informed decision making and develop strategies that fit with organizational goals and market conditions.

5.3. Conclusion

Finally, this systematic literature review sheds light on numerous dimensions of managing growth in PLM at maturity stages and indicated by synthesizing existing literature on managing growth of PLM at maturity level and identified recommendations for future research, contributed for the current discourses on effective PLM strategies. Therefore, the implementation of these insights derived from this systematic literature review, enable managers and practitioners' to be empower their organizations to navigate the complexities of product growth and sustain their growth, profitability and competitiveness in the dynamic markets.

References

Angelo, C., Mariangela, L., Manuela, M., & Lorenzo, Q. (2018). Innovating performing arts management through a product lifecycle management approach. In IFIP Advances in Information and Communication Technology

- (Vol. 540). Springer International Publishing. https://doi.org/10.1007/978-3-030-01614-2_39.
- Ates, A., & Acur, N. (2022). Making obsolescence obsolete : Execution of digital transformation in a high-tech manufacturing SME. *Journal of Business Research*, 152, 336–348. <https://doi.org/10.1016/j.jbusres.2022.07.052>.
- Author, B., Axelband, E., Drezner, J. A., Brian, B., Iv, J. G., Held, B. J., McMahan, K. S., Walter, L., Rizzi, C., Shah, A. R., Wilson, P. A., & Sollinger, J. M. (2012). Technology Choices and Development in FCS.
- Bey, N. (2017). Life cycle management. In *Life Cycle Assessment: Theory and Practice*. https://doi.org/10.1007/978-3-319-56475-3_22.
- Boiral, O., Brotherton, M., Yuriev, A., & Talbot, D. (2022). Through the Smokescreen of the Dieselgate Disclosure : Neutralizing the Impacts of a Major Sustainability Scandal. <https://doi.org/10.1177/10860266211043561>.
- Cameron, A. D., Gardiner, B. A., Ramsay, J., & Drewett, T. A. (2015). Effect of early release from intense competition within high density natural regeneration on the properties of juvenile and mature wood of 40-year-old Sitka spruce (*Picea sitchensis* (Bong .) Carr .). 99–107. <https://doi.org/10.1007/s13595-014-0402-4>.
- Chen, J., Wang, H., & Fu, Y. (2022). A multi-stage supply chain disruption mitigation strategy considering product life cycle during COVID-19. *Environmental Science and Pollution Research*, 0123456789. <https://doi.org/10.1007/s11356-022-18931-7>.
- Dos Santos, K. C. P., de Freitas Rocha Loures, E., Junior, O. C., & Santos, E. A. P. (2018). Product lifecycle management maturity models in industry 4.0. *IFIP Advances in Information and Communication Technology*, 540, 659–669. https://doi.org/10.1007/978-3-030-01614-2_60.
- Ewa, W.-J., Milosz, P., Martyna, K., & Michal, N. (2017). Apple Products: A Discussion of the Product Life Cycle. 31(*Msmi*), 159–164. <https://doi.org/10.2991/msmi-17.2017.36>
- Foufou, S., & Eds, K. T. (2016). Product Lifecycle Management in the Era of Internet of Things. 467, 529–540. <https://doi.org/10.1007/978-3-319-33111-9>.
- Gabrow, R. Y. (2021). Concurrent engineering, product life cycle management using cross-functional teams: A case study. *Periodicals of Engineering and Natural Sciences*, 9(2), 842–857. <https://doi.org/10.21533/pen.v9i2.1916>.
- Gecevaska, V., Chiabert, P., Anisic, Z., Lombardi, F., & Cus, F. (2010). Product lifecycle management through innovative and competitive business environment. *Journal of Industrial Engineering and Management*, 3(2), 323–336. <https://doi.org/10.3926/jiem.2010.v3n2.p323-336>.
- Gecevaska, V., & Stojanova, T. (n.d.). Product lifecycle management tools. 219–222.
- Hadaya, P., & Marchildon, P. (2012). Understanding product lifecycle management and supporting systems. 112(4), 559–583. <https://doi.org/10.1108/02635571211225486>.
- Han, T., & Mukherjee, A. (2023). Mergers of complements , endogenous product differentiation and welfare. *Mathematical Social Sciences*, 126(September), 30–41. <https://doi.org/10.1016/j.mathsocsci.2023.09.001>.
- Herederó, P., & Gómez, G. (2014). The contribution of CRMs to the ability of market segmentation : The case of the VIPS group. *Procedia Technology*, 16, 355–364. <https://doi.org/10.1016/j.protcy.2014.10.101>
- Hicking, J., Zeller, V., & Schuh, G. (2018). Goal-oriented approach to enable new business models for SME using smart products. In *IFIP Advances in Information and Communication Technology* (Vol. 540). https://doi.org/10.1007/978-3-030-01614-2_14
- Hidayatno, A., & Rahman, I. (2016). Understanding the Dynamics of 6P Branding Strategy with Brand Equity for a Mature Customer-Goods Brand using a System Dynamics Model Understanding the Dynamics of 6P Branding Strategy with Brand Equity for a Mature Customer-Goods Brand using a System Dynamics Model. June 2013.
- Jain, V., Brien, W. O., & Gloria, T. P. (2021). Improved solutions for shared value creation and maximization from used clothes : Streamlined structure of clothing consumption system and a framework of closed loop hybrid business model. *Cleaner and Responsible Consumption*, 3(September), 100039.

- <https://doi.org/10.1016/j.clrc.2021.100039>.
- Kamalaldin, A., Linde, L., Sjödin, D., & Parida, V. (2020). Transforming provider-customer relationships in digital servitization: A relational view on digitalization. *Industrial Marketing Management*, 89(February), 306–325. <https://doi.org/10.1016/j.indmarman.2020.02.004>.
- Kambanou, M. L. (2020). Life cycle costing: Understanding how it is practised and its relationship to life cycle management-A case study. *Sustainability (Switzerland)*, 12(8), 3252. <https://doi.org/10.3390/SU12083252>
- Kapur, P. K., Panwar, S., & Singh, O. (2019). Modeling two-dimensional technology diffusion process under dynamic adoption rate. *Journal of Modelling in Management*, 14(3), 717–737. <https://doi.org/10.1108/JM2-06-2018-0088>.
- Kärkkäinen, H., Pels, H. J., & Silventoinen, A. (2012). Defining the customer dimension of PLM maturity. *IFIP Advances in Information and Communication Technology*, 388 AICT, 623–634. https://doi.org/10.1007/978-3-642-35758-9_56
- Krishnamoorthi, C. (2013). An EPQ Model for Product Life Cycle (Maturity Stage) with Deteriorating Items and Shortages. *Iranian Journal of Operations Research*, 4(1), 75–87.
- Krishnan, S. (2016). Web Service Interface for Legacy Virtual Product Lifecycle Management System.
- Letters, M. (2018). Predicting product life cycle patterns Author (s): Yair Orbach and Gila E . Fruchter Published by: Springer Stable URL : <https://www.jstor.org/stable/24571087>. 25(1), 37–52.
- Li, J., Tao, F., Cheng, Y., & Zhao, L. (2015). Big Data in product lifecycle management. 667–684. <https://doi.org/10.1007/s00170-015-7151-x>
- Liu, G., Man, R., & Wang, Y. (2021). A data management approach based on product morphology in product lifecycle management. *Processes*, 9(7). <https://doi.org/10.3390/pr9071235>
- Lu, L., Qin, J., Chen, J., Yu, N., Miyano, S., Deng, Z., & Li, C. (2022). Recent computational drug repositioning strategies against SARS-CoV-2. 20, 5713–5728. <https://doi.org/10.1016/j.csbj.2022.10.017>
- MacFarlane, A., Russell-Rose, T., & Shokraneh, F. (2022). Search strategy formulation for systematic reviews: Issues, challenges and opportunities. *Intelligent Systems with Applications*, 15, 200091. <https://doi.org/10.1016/j.iswa.2022.200091>
- Management, L. (2015). Lifecycle Management in the Era of Internet.
- Marshall, S. (2010). A Quality Framework for Continuous Improvement of e-Learning: The e-Learning Maturity Model. 24(1), 143–166.
- Matenga, A. E., & Mpfu, K. (2023). Blockchain-based Product Lifecycle Management using Supply Chain Management for Railcar Remanufacturing. *Procedia CIRP*, 116, 486–491. <https://doi.org/10.1016/j.procir.2023.02.082>
- Mathew, M. J. (2024). Literature search in systematic reviews: How much is good enough? *Clinical Epidemiology and Global Health*, 25(December 2023), 101485. <https://doi.org/10.1016/j.cegh.2023.101485>
- Mesjasz-lech, A., & Mesjasz-lech, A. (2023). ScienceDirect ScienceDirect ScienceDirect Can Industry 5 . 0 be seen as a remedy for the problem of waste in industrial companies ? Can Industry 5 . 0 be seen as a remedy for the problem of waste in industrial companies ? *Procedia Computer Science*, 225, 1816–1825. <https://doi.org/10.1016/j.procs.2023.10.171>
- Momsen, K. (2021). Journal of Economic Behavior and Organization product differentiation ☆. *Journal of Economic Behavior and Organization*, 183, 19–38. <https://doi.org/10.1016/j.jebo.2020.12.018>
- Moroza, N., & Jurgelane-Kaldava, I. (2019). Development and Location of Logistics Centres: A Systematic Review of Literature. *Economics and Business*, 33(1), 264–272. <https://doi.org/10.2478/eb-2019-0019>
- Müller, J. R., Panarotto, M., Malmqvist, J., & Isaksson, O. (2018). Lifecycle design and management of additive manufacturing technologies. *Procedia Manufacturing*, 19(2017), 135–142. <https://doi.org/10.1016/j.promfg.2018.01.019>
- Murakami, H., & Matsuse, Y. (2014). Dynamic analysis of product lifecycle and sea/air modal choice: Evidence of export from Japan. *Asian Journal of Shipping and Logistics*, 30(3), 431–

446. <https://doi.org/10.1016/j.ajsl.2014.12.010>
- Murmann, J. P., & Korn, J. (2019). *Lucius & Lucius Verlagsgesellschaft mbH How Fast Can Firms Grow?* Author (s): Johann Peter Murmann, Jenny Korn and Hagen Worch Source: *Jahrbücher für Nationalökonomie und Statistik / Journal of Economics and Statistics*, Vol. 234, No. 2 / 3, Theme. 234(2), 210–233.
- Olanipekun, L. O. (2023). *Book of journals for covenant university*. February.
- Paavel, M., Karjust, K., & Majak, J. (2017a). FAHP-meetodi baasil PLM-küpsusmudeli arendus. *Proceedings of the Estonian Academy of Sciences*, 66(3), 279–286. <https://doi.org/10.3176/proc.2017.3.05>
- Paavel, M., Karjust, K., & Majak, J. (2017b). PLM Maturity Model Development and Implementation in SME. *Procedia CIRP*, 63, 651–657. <https://doi.org/10.1016/j.procir.2017.03.144>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., ... Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, 88(March). <https://doi.org/10.1016/j.ijsu.2021.105906>
- Paul, J., & Criado, A. R. (2020). The art of writing literature review: What do we know and what do we need to know? *International Business Review*, 29(4). <https://doi.org/10.1016/j.ibusrev.2020.101717>
- Pouyan, S., Ghasemaghaei, M., & Hassanein, K. (2022). Understanding consumer engagement in social media: The role of product lifecycle. *Decision Support Systems*, 162(August 2021), 113707. <https://doi.org/10.1016/j.dss.2021.113707>
- Riascos Castaneda, R., Ostrosi, E., Majić, T., Stjepandić, J., & Sagot, J. C. (2020). A METHOD to EXPLORE PRODUCT RISK in PRODUCT LIFECYCLE MANAGEMENT of CONFIGURED PRODUCTS. *Proceedings of the Design Society: DESIGN Conference*, 1, 687–696. <https://doi.org/10.1017/dsd.2020.318>
- Rossi, M., Riboldi, D., Cerri, D., Terzi, S., & Garetti, M. (2013). Product lifecycle management adoption versus lifecycle orientation: Evidences from Italian companies. *IFIP Advances in Information and Communication Technology*, 409, 346–355. https://doi.org/10.1007/978-3-642-41501-2_35
- Rota, M. F., Carcedo, J. M., & García, J. P. (2016). Dual approach for modelling demand saturation levels in the automobile market. The Gomper \hat{J} curve: Macro versus micro data. *Investigación Económica*, 75(296), 43–72. <https://doi.org/10.1016/j.inveco.2016.07.003>
- Schönmann, A., Greitemann, J., & Reinhart, G. (2016). Proactive Management of Production Technologies: A Conceptual Framework. *Procedia CIRP*, 52, 198–203. <https://doi.org/10.1016/j.procir.2016.08.011>
- Sen, S. K., & Ongsakul, V. (2017). Emerging frontiers in entrepreneurship through Retail-E-Business: “Centripetal momentum” engaged Product Life Cycle model. *Journal of Business and Retail Management Research*, 12(1), 13–25. <https://doi.org/10.24052/jbrmr/v12is01/efietrebcmplcm>
- Seo, H. J., & Kim, K. U. (2012). Quality assessment of systematic reviews or meta-analyses of nursing interventions conducted by Korean reviewers. *BMC Medical Research Methodology*, 12. <https://doi.org/10.1186/1471-2288-12-129>
- Sharma, N. (2013). Marketing strategy on different stages PLC and its marketing implications on FMCG products. *International Journal of Marketing, Financial Services & Management Research*, 2(3), 121–136. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1078.3797&rep=rep1&type=pdfhttps://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1078.3797&rep=rep1&type=pdf>
- Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104(July), 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>
- Tao, Y., Lin, Y., Lee, H., Gan, G., & Tu, C. (2022). Using a Product Life Cycle Cost Model to Solve Supplier Selection Problems in a Sustainable, Resilient Supply Chain.
- Tchoffa, D., Figay, N., Ghodous, P., Panetto, H., & El

- Mhamedi, A. (2021). Alignment of the product lifecycle management federated interoperability framework with internet of things and virtual manufacturing. *Computers in Industry*, 130. <https://doi.org/10.1016/j.compind.2021.103466>
- Teknologi, U. (2014). View metadata, citation and similar papers at core.ac.uk. January.
- Tipu, W. A., Haider, F., & Imran, M. (2022). Product Life Cycle Management: Relationship between Product Lifecycle Management Centric Information and Product Quality. *Journal of Managerial Sciences*, 16(4), 1–23.
- Töytäri, P., Rajala, R., & Brashear, T. (2015). Industrial Marketing Management Organizational and institutional barriers to value-based pricing in industrial relationships. *Industrial Marketing Management*, 47, 53–64. <https://doi.org/10.1016/j.indmarman.2015.02.005>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14(3), 207–222. <https://doi.org/10.1111/1467-8551.00375>
- Turnbull, D., Chugh, R., & Luck, J. (2023). Social Sciences & Humanities Open Systematic-narrative hybrid literature review : A strategy for integrating a concise methodology into a manuscript. *Social Sciences & Humanities Open*, 7(1), 100381. <https://doi.org/10.1016/j.ssaho.2022.100381>
- Vadoudi, K., Allais, R., Reyes, T., & Troussier, N. (2014). Sustainable product lifecycle management and territoriality: New structure for PLM. *IFIP Advances in Information and Communication Technology*, 442, 475–484. https://doi.org/10.1007/978-3-662-45937-9_47
- Vezzetti, E., Violante, M. G., & Marcolin, F. (2014). A benchmarking framework for product lifecycle management (PLM) maturity models. *International Journal of Advanced Manufacturing Technology*, 71(5–8), 899–918. <https://doi.org/10.1007/s00170-013-5529-1>
- Voell, C., Chatterjee, P., Rauch, A., & Golovatchev, J. (2018). How digital twins enable the next level of PLM – a guide for the concept and the implementation in the internet of everything era. In *IFIP Advances in Information and Communication Technology* (Vol. 540). Springer International Publishing. https://doi.org/10.1007/978-3-030-01614-2_22
- Walter, M., Leyh, C., & Strahringer, S. (2017). Knocking on Industry’s Door: Needs in Product-Cost Optimization in the Early Product Life Cycle Stages. *Complex Systems Informatics and Modeling Quarterly*, 13, 43–60. <https://doi.org/10.7250/csinq.2017-13.03>
- Wang, L., Liu, Z., Liu, A., & Tao, F. (2021). Artificial intelligence in product lifecycle management. 771–796.
- Wiesner, S., Freitag, M., Westphal, I., & Thoben, K. (2015). Interactions between Service and Product Lifecycle Management. *Procedia CIRP*, 30, 36–41. <https://doi.org/10.1016/j.procir.2015.02.018>
- Williams, P. (2022). Smart devices. In *Cossm* (Vol. 23, Issue 12, pp. 52–53). <https://doi.org/10.1016/b978-0-08-100741-9.00012-7>
- Wohlin, C., Mendes, E., Felizardo, K. R., & Kalinowski, M. (2020). Guidelines for the search strategy to update systematic literature reviews in software engineering. *Information and Software Technology*, 127(January), 106366. <https://doi.org/10.1016/j.infsof.2020.106366>
- Wuest, T., & Wellsandt, S. (2016). Design and Development of Product Service Systems (PSS) - Impact on Product Lifecycle Perspective. *Procedia Technology*, 26(304), 152–161. <https://doi.org/10.1016/j.protcy.2016.08.021>
- Yousefnezhad, N., Malhi, A., & Främbling, K. (2020). Security in product lifecycle of IoT devices: A survey. *Journal of Network and Computer Applications*, 171(January), 102779. <https://doi.org/10.1016/j.jnca.2020.102779>
- Youssar, S., & Berrado, A. (2017). Managing product life cycle for effective supply chain strategies - Case of pharmaceutical industry in Morocco. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 2007, 2326–2336.