

Review Article

Managing Growth of Product Lifecycle at Maturity Level: A Systematic Literature Review

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Abstract

Through the synthesis and analysis of 64 papers, from JSTOR, ScienceDirect, and Google Scholar data bases, include 2010-2024 of 15 years duration paper works. this systematic literature review identified major themes and provided insights into growth management strategies, marketing tactics, challenges, and opportunities, benefits, 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 various stages of maturity. By providing a comprehensive understanding of the existing body of knowledge, this review offers valuable insights for practitioners, managers, and researchers aiming to enhance product lifecycle management (PLM) strategies at the maturity level, ultimately contributing to the development of more resilient and adaptive business models and research gaps have identified that enabled to provide future research directions.

Keywords

Product Lifecycle Maturity, Product Lifecycle Management, Growth Strategies

1. Introduction

As lifecycle management is concerned, it could be either of product or service lifecycle management [68], however, for the purpose of this systematic literature review, this paper focuses on, part of product lifecycle management (PLM), specifically, maturity level PLM [12]. Evidence shows that a diversity of stakeholders needs good management of product lifecycle [13]. The strategies, price, distribution, product, competition and promotion are distinct for different stages of product lifecycle [54].

Managing the growth of a product lifecycle at the maturity level is crucial for the profitability, long-term success and sustainability of a business [56], not only in large enterprises but also in small and medium [44] because, the maturity stage is 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 need proper management [22] beyond the known business legacy system [26], to respond accordingly. Special

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attention to innovation [10], cost optimization [25], customer loyalty [71] and market segmentation [17], and 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 so crucial for businesses to effectively manage growth at maturity stage of their product's lifecycle [73].

At the maturity stage of a product's lifecycle, organizations often face challenges such as market saturation, declining sales, and increased competition and to overcome these challenges and sustain growth, it is important for businesses to implement strategies that aim at managing mature products effectively [49]. Basically, this involves diversifying the product's offerings [13], identifying new market segments [17], and exploring opportunities for product to innovation and increase enhancement [32] to extend product's lifecycle, generate sustainable revenue and maintain market share [52, 1, 69] through utilization of many related resources; data, people, processes and integration of these information to the other organizations [18, 38].

Here, aligning innovation with product lifecycle has a great importance [13, 11, 1, 57, 7, 34] determines pricing adjustment [67]. In connection with this, the development of industry 4.0 plays key role that enables managers to produce higher quality products and goods with minimum possible cost [28, 18, 18, 56] and further, sustainability issues also addressed in industry 5.0 [36] and it has high impact on firms growth rate that enables firms to attain its maximum sustainable profitability climax [41].

Many products have many different sales curve forming many maturity curve nature and hence the complex behavior enhanced scholars to develop almost all inclusive model [25, 27] and therefore, this high variation in nature demands good management of mature products. Generally, by the implementation of effective and efficient strategies such as streamlining operations, optimizing resources, pricing strategies, and maturity stage of product's lifecycle of businesses should be carefully managed in the growth of a product lifecycle that businesses can maximize profitability and minimize costs [22, 56].

Gecevska et al. [13] conducted a systematic literature review on PLM on 'innovative and competitive business environment, previous review has not been focused on systematic literature review on 'managing growth of product lifecycle at maturity level'. Olanipekun [42] conducted a systematic review of PLM on 'entrepreneurship and knowledge economy' which was not an empirical review. Because, in managing growth of product lifecycle at maturity level, managers need to have a comprehensive knowledge because different maturity models are associated with different attributes, since in the application of maturity model reusability is gone to be a challenge [64], this systematic literature review mainly aims at synthesizing and summarizing themes on strategies that can be used in man-

aging growth in product lifecycle management at maturity level, in addition also provide attention to challenges and opportunities that face product managers at maturity level management and marketing techniques for mature products to maintaining competitive advantage with mature products.

2. Theoretical Literature Review

PLM is the process of managing products throughout the entire of its lifecycle from idea generation to the fruitful entry to product improvement, the market and maintenance [13]. PLM is an essential aspect of managing product-related information from its conception to its retirement [64] and it is important tool of decision making and management [43] reducing costs in the journey of PLM by increasing efficiency [22]. One of the PLM is product lifecycle management at maturity level, even though, there are different approaches of PLM maturity concept [63] as [24] defined, PLM maturity is "The ability to manage the knowledge and capabilities of an organization to respond effectively to specific customer needs, at any point in time". Besides the definition PLM maturity, theoretical literature review reveals theories, frameworks, key concepts, and strategies related to managing the growth of PLM at maturity level. There are various theories in line with this such as PLM theory that consists four stages aiming to maximize value, innovation diffusion theory; focusing on how innovation spread, product line extension theory; introducing variations and extensions of existing products to new segments, customer relationship management theory; aiming building and maintain strong relationship with customers [42]. As companies mature, their PLM processes progress, demanding strategic management to ensure alignment with business objectives. Various maturity models, such as Batenburg; PLM maturity and Business/Information technology (IT)-alignment, Zhang; described through five different sources, showing how it has changed through time and adapted to new deployments, Schuh; as is and to be, situation, Stark; described his three different levels, company, product development and product data management, Kärkkäinen, business dimensions and customers dimensions, Saaksvuori; business dimensions (IT, processes, structure and PLM strategy, people in PLM change management) and also Mettler proposes three different viewpoints, general model attributes, maturity model design and maturity model use [4] and the Capability Maturity Model Integration provide a structured framework to assess and improve an organization's PLM capabilities. These models enable companies to evaluate their present-day state, set realistic goals, and draw a roadmap for progression. The literature explores that adaptive and a dynamic approach is critical for effectively managing growth at maturity level and also the literature identifies numerous challenges related with managing PLM growth that include interoperability issues, data

security concerns, organizational resistance to change, and the need for continuous technological advancements. Addressing these challenges necessitates a broad understanding a proactive strategy for mitigating potential barriers and organizational context [4, 57] and also sustainability as environmentally friendly concern revealed in the literature [4].

Organizations adopt various growth strategies that fit mature products, which include making investments in training and development, raising a culture of innovation, aligning PLM initiatives with business objectives, and leveraging advancing technologies such as Internet of Things and the artificial intelligence, blockchain, internet of everything to come and others. The literature emphasizes the significance of a strategic approach that considers both technological [8] and organizational aspects, because, PLM does not function in isolation that its effectiveness is in combination with seamless integration with other business processes. The Literature stresses the importance of aligning PLM with customer relationship management, supply chain management, and enterprise resource planning to maximize the whole companies efficiency [44]. For the success of integration in organizations, careful consideration of data governance, standardization, and interoperability has to be taken place.

The Performance Metrics and Key Performance Indicators (KPIs) is essential to assess the success of PLM initiatives at maturity level and companies have to define and monitor performance metrics and KPIs. The literature advocates that companies has to go beyond the common traditional and incorporate metrics connected to cost efficiency, time-to-market, innovation, and customer satisfaction and through evaluating these metrics regularly organizations make informed decisions and adjustments to their PML strategies [42]. Therefore, this theoretical literature review makes insights into the multifaceted landscape of managing the growth of PLM at maturity level and as companies navigates the complexities of organizational dynamics, market demands, technological developments, and a nuanced and adaptive approach is critical. By drawing on theoretical frameworks, best practices, and lessons well-educated from different industries, organizations can progress strong strategies to effectively manage the growth of PLM and drive sustainable success and competitiveness.

3. Methodology

This systematic literature review is performed based [61] which consists of three stages [61]. This systematic review is important to find collective evidence and used to update it with future findings [55, 70]. The reason of this systematic literature review is mainly, to understanding how growth is managed during the maturity phase of a product's lifecycle, in addition, the challenges and opportunities that face product managers and practitioners in managing growth of product lifecycle at maturity level, and also identifying marketing techniques applied in mature products in maintaining competitive advantage in managing mature products. In the search strategy, to identify relevant literature review [31] the authors used JSTOR, ScienceDirect, and Google Scholar, because recommended to include more than one database [62] and the key words used were “product lifecycle maturity” OR “Product Lifecycle Management” OR “Product growth strategies”. Inclusion and exclusion criteria applied were, peer-reviewed journal articles, conference papers, and academic books published in English and we incorporated 64 paper with the aim having sufficiency, to avoid not to include eligible studies [35] and also articles published from 2010 to 2024, 15 years, because 10-50 years can be recommended as Rialp, Rialp, & Knight 2005 cited in [46]. The screening process was also undertaken. Data extraction performed, based on relevance to the topic reading abstract, conclusion and full text [62]. Quality Assessment conducted bases trustworthy that reliability and validity [53]. Data synthesis and analysis to identify common themes, patterns, and insights related to the topic and we use qualitative methods which is thematic analysis. Interpretation and discussion was performed, discussed the implications of these findings for theory, practice, and future research direction. Documentation and reporting was done including used PRISMA, increases transparency [45], search strategy, inclusion/exclusion criteria, screening process, data extraction, quality assessment, data synthesis, analysis, findings, recommendations, implications and conclusions. Finally, by following these methodological steps, we conduct a rigorous systematic literature review on managing growth in the product lifecycle at the maturity level.

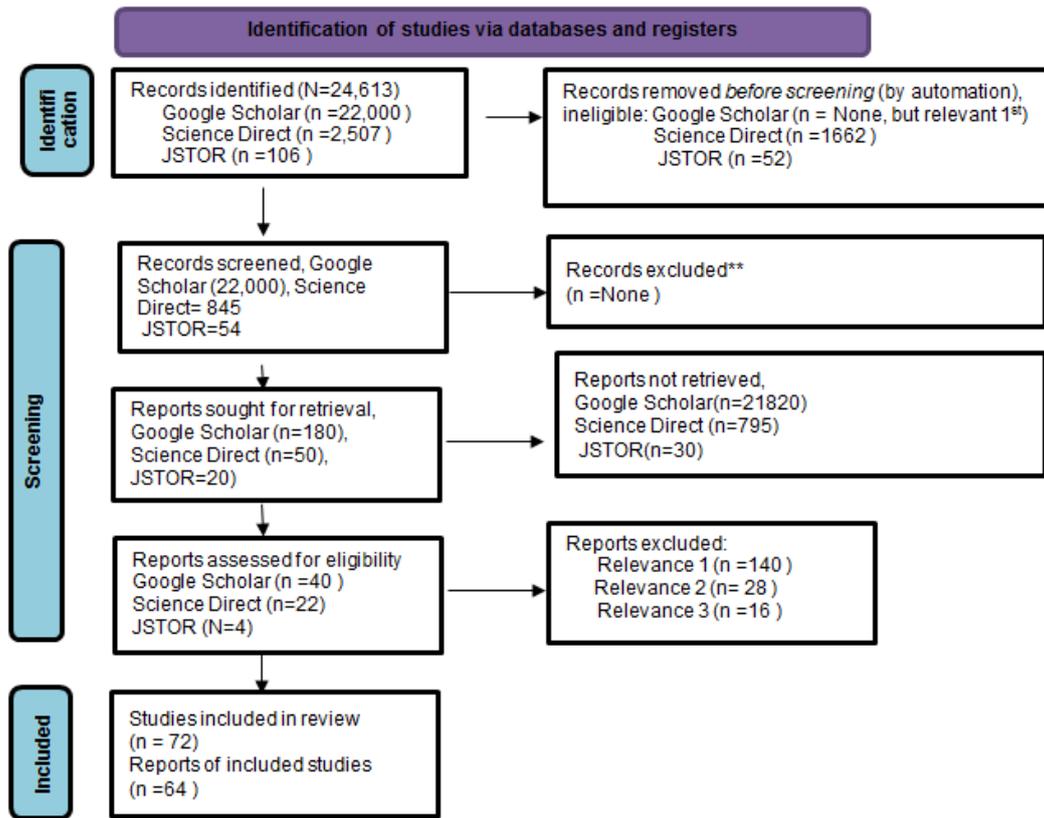


Figure 1. PRISMA.

4. Results

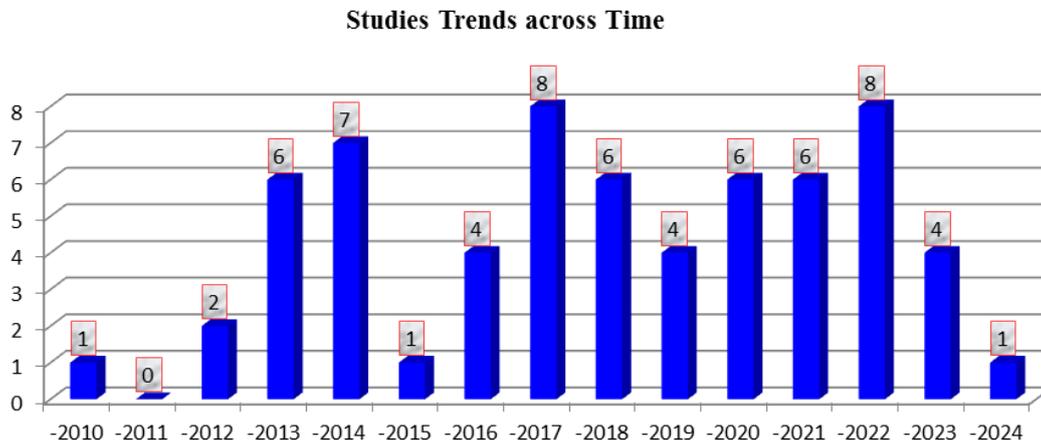


Figure 2. Studies Trend across Time.

While the authors observe the analyzed studies in figure 2, it slightly increasing on average in the recent or the graph is skewed to the right in recent direction, however, more studies

are needed to explore further new insights including the recommend ones, so that product managers and practitioners able to utilize the insights.

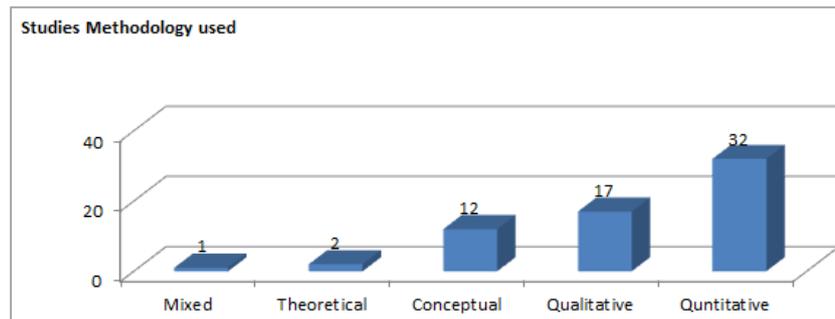


Figure 3. Incorporated Studies in terms of methods design.

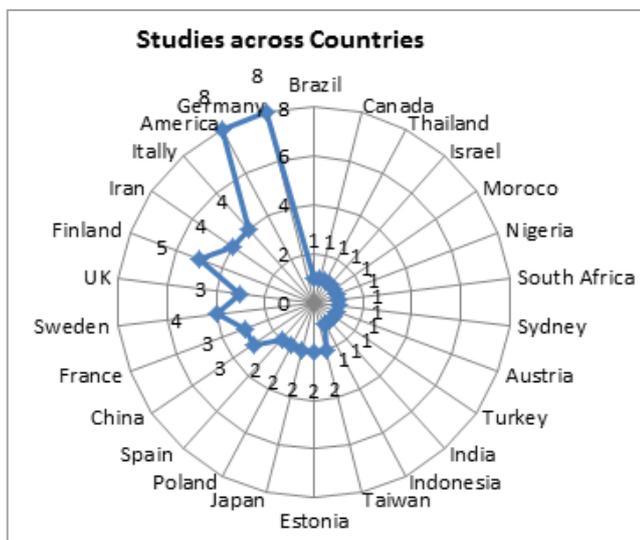


Figure 4. Studies across countries.

The methodology employed in the analyzed articles lack mixed approach, so that future studies are recommended to conduct mixed approach in their research. On the other hand, the authors observed that studies conducted related with the topic 'managing growth of PLM at maturity level' has been widely conducted in developed countries, especially Western countries, in Africa, only in countries with giant economy, South Africa and Nigeria, but other sub-Saharan has conduct research on the 'managing growth of PLM at maturity level'. Generally, when the authors summarize, there is slightly time gap, place gap and also methodological gap exists.

In managing growth of product lifecycle at maturity marketing knowledge is critically important because it determines the success, profitability, competitiveness, market share and survival of businesses and to considerations of capability maturity model is important to manage growth of product lifecycle for mature market, that enables to coordinate, better approach, and carefully plan the process [24, 25]. Having this in mind, the themes that have been identified as growth strategies upon extensive systematic literature review indicates that market segmentation, product enhancement, cost

optimization, price adjustment, market expansion, customer retention, diversification, partnerships and collaboration, lifecycle planning and monitoring and feedback are among the identified themes which are going to be discussed here under.

4.1. Strategies for Sustaining Products in the Maturity Phase

4.1.1. Lifecycle Planning

Lifecycle planning is a critically important component of managing PLM as organizations evolve through maturity level and it involves comprehensive coordination, strategizing and foresight to make ensure the seamless advancement of products from conception to retirement [39]. Effective lifecycle planning is very crucial for organizations directing the complexities of Product Lifecycle Management at maturity level and aligning it with business goals, incorporating risk management strategies, fostering cross-functional collaboration [51, 48] adopting advanced technologies, and considering regulatory and environmental factors, organizations can ensure adaptive and a holistic approach to manage the entire product lifecycle and ultimately contribute to sustained success, profitability and competitiveness [72].

4.1.2. Market Segmentation

To effectively manage growth at mature products, niche marketing is an effective strategy to provide answer for price competition in a mature industry and can use a niche market strategy. The purpose of market segmentation in managing growth of product lifecycle at maturity focuses on understanding niche markets needs wants and preferences that has to be tailored [51] that it concentrates on meeting unsatisfied customer needs, to keep customer loyalty which cannot be easily eroded by competition and upon identification of these needs and wants product differentiation is appropriate [17]. At maturity level, PLM provision of customized market fast and cost efficiently deliver of products that meets the needs and wants of specific target market and individual customers to fulfill satisfaction [13].

4.1.3. Product Enhancement

Managing growth of PLM at maturity level cannot be underestimated in the product lifecycle that, at this stage, competition intensifies demanding product functionality enhancement to retain market share. Organizations that reaches its maturity continues improvement and product enhancement become a key for business success sustain competitiveness and profitability [13]. Product enhancement strategies is essential in managing mature product lifecycle that focuses on user experience optimization, the integration of advanced technologies, and adaptability to evolving market is so demanding. Therefore, by leveraging advanced technologies, adopting agile development practices, making data-driven decisions, ensuring scalability, optimizing user experiences, and fostering continuous feedback loops, organizations can get upper hand to thrive in an ever-evolving business landscape while effectively managing the maturity of their PLM processes [59].

4.1.4. Cost Optimization

Cost optimization is one of the components of critical aspects of maturity level growth management of PLM. In the progress of organizations through different PLM, managing maturity level growth using strategies is essential that optimize costs, without compromising efficiency and effectiveness of PLM processes. Cost optimization is strategic concerns in managing mature PLM to enable organizations have higher profit, sustain with success and gain sustainable competitive advantages [25].

Organizations can optimize costs and gain efficient supply chain in PLM processes at maturity level without compromising on efficiency and effectiveness by doing the overall cost-benefit analysis, embracing cloud-based solutions and making automation, leveraging technologies rationalization, and generally implementing holistic approach [13]. These strategies enable organizations to growth with lean and agile PLM frame work supporting success, profitability and competitiveness in PLM at maturity level. Meeting the present generation need, without affecting the future generation, product lifecycle as a greater umbrella, PLM at maturity level product cycle costing has not be undervalued since it is the variable component of profitability, which to mean, as cost is higher, profit be reduced. Since, the product lifecycle costing at maturity level is a serious constituent of company success aspect by growing companies profitability, scholarly literature has to be well discovered [22]. Therefore, cost optimization or reducing product lifecycle cost at maturity level without interrupting the optimal business operation has to get attention. Supplier selection in having optimum cost is a key in business management, because minimized net cost increases firms' profitability. Managing Product lifecycle cost at maturity level is important, because, at this stage production cost has to be reduced and marketing cost decline, tries to innovate, design news to maximize market presence, tries to capture customers feedback and researching with the population de-

mographics, managing maturity level product lifecycle cost to optimize it is critical [56]. Cost reduction, in managing growth of product life cycle at maturity level is a key because reducing production cost, without compromising quality enables to increase profitability. This leads to reduction in cost of product offerings and by digitally reusing and manufacturing plan, creating plant information, and processes firms can minimize the overall costs of operation [13, 66]. In cost modeling, some scholars have recommended others to analyze not only linear cost modeling but also non-linear cost modeling [27].

4.1.5. Price Adjustment

Price adjustment is one of the critical aspects of managing the growth of PLM at maturity level and as markets change and products evolve, demand rate might be varied over time [25] that adjusting pricing strategies strategically and aligning it with competitive landscapes, market demands, and value propositions is important. Therefore good strategies are needed for effective price adjustment in managing PLM at maturity level and the effectiveness of pricing adjustment in managing growth of PLM at maturity level plays a key role. The adoption of dynamic approach which considers competitor strategies, customer expectations, market dynamics, plays an important role for organizations in optimize pricing structures in the journey of the product lifecycle [23]. The evolvement of value proposition aligned with appropriate pricing adjustment enable organizations to be competitive, achieve growth total objective in the organization. In pricing policies the price and price adjustment is based on competitors situation comparison, sales, deciding wisely in moving the price up or down, considering the introduction of coupon for consumers products and taking in to consideration the efforts made in advertising and promotion with the aim of getting new consumers and also the product differentiation efforts made with goal of having quality to prolong maturity stage and reliability in the PLM. Sometimes, the battle of disruption continues with the extended success of product maturity with even further than expect by [10, 9] and innovation diffusion, goodwill of the innovation and psychological issues of consumers affects pricing adjustment. These three simultaneous dynamics have potential impact on price change that they goes together and consequently company benefited profitability [14, 23].

4.1.6. Market Expansion

Market expansion is a crucial strategic aspect for managing PLM at maturity stage and in the process of product evolvement through their lifecycle, getting in to new market is critically important in sustaining organization success, mitigating risks and capitalizes on emerging opportunities. Market expansion in managing growth at maturity level needs to understand deeper in to markets, demands strategic foresight and adaptability because market expansion in managing PLM at maturity level is a multifaceted endeavor.

Through undertaking market research, establishing strategic partnership [12], implementing innovative pricing models and adapting to cultural distinctions and ensuring agile supply chain management organizations can enhance their success gaining profitability and competitive advantage [1, 69] in navigating market expansion efforts through exploiting new opportunities in the product lifecycle maturity journey.

In managing growth at maturity stage, struggle or battling for market expansion is a key because organization having expanded market gets the highest profit margin with higher growth of sales volume and achieves highest returns from the product achieving greatest market share objective to increase profitability, by tackling decreasing profit margins in PLM at maturity level [54, 9]. In managing growth of product lifecycle at maturity level, among others, market expansion can be possible through producing smart devices that lay conducive environment for online marketing to prolong lifecycle of products and internet of things supported with security issues because today's business is becoming online market that makes goods order easy because customers need smart devices that are secure from various cyber-attack [69]. This can be extended further to internet of everything [26] that enables to have potentially higher maturity level by facilitating the establishment of virtual representation of product that enables manufacturers to monitor and control with one click, which might be widely implemented in the future industry 5.0, even though the concept is currently risky [48] complex, difficult to value in business terms, therefore, needs appropriate strategy, coupled with consistent change management in the company to increase customer benefit that highly attract extra market [65].

4.1.7. Customer Retention

Customer retention is a critically important in managing the product lifecycle at maturity level in PLM supported by product service system that focuses on customer value creation which helps organizations continues to provide satisfaction. As organizations evolve and mature in their PLM processes, it is essential to adopt strategies that not only attract new customers but also ensure the loyalty and satisfaction of existing ones [71] and the conceptual, digital and physical product types has to be differentiated in their data management to increase satisfaction [29]. Customers need the benefit that come in the form of quality, time and cost [14], that in relation to this maturity level product lifecycle affects means of transportation modal of commodities that directly affect cost, time and quality [40] and therefore, through careful analysis of customers' needs and wants, then satisfying accordingly, results in customer retention [24, 43]. The effective management of customer retention in the process of PLM at maturity stage a holistic approach that consist robust support mechanisms, continuous improvement, tailored engagement, and transparent communication. In the process of prioritization of customer loyal and keeping

long term customer satisfaction, organizations can also leverage as critical base for further growth, success and increasing profitability in the journey of PLM during maturity stage [10]. In order to meet both customer satisfaction and sustain profit, a change in lifecycle and design needed in short term in disruption situation that affect both social and organizational concerns [7]. In addition, in co-creation of value, the usage of social media is also essential at maturity stage with good discourse logic, to increase customer engagement for customer retention [47].

4.1.8. Diversification

As organizations and products progress, diversification plays a crucial role for the success of PLM at maturity stage and market change and adopting diversification strategies are a key to sustain growth, profitability and success. Diversification in managing growth at product maturity level is a critically vital because of various driving forces of vibrant industry shifts, competitors, that forces to design new strategies for the success of the organizations and therefore, to stay competitive and persistently sustain in the long run, diversification is important [13]. During 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 [58]. Generally, by diversifying strategically, companies can capitalize on new opportunities, mitigate risks, and sustain growth throughout the product lifecycle, creating higher significance to overall maturity, profitability and competitiveness [52].

4.1.9. Partnerships and Collaboration

In the evolving landscape of PLM fostering collaboration and partnerships within the context of managing PLM at maturity level is critically vital. Collaboration and partnerships have become indispensable for organizations seeking to manage the complexities of product development, enhance innovation, and ensure sustainable growth across maturity level. Collaborative and partnership environment in which all stake holders play their role cooperatively to optimize resource use is critically important [12]. Collaboration and partnerships are essential pillars for effective PLM, especially as organizations progress through maturity levels. By fostering relationships with various stakeholders, organizations can leverage collective expertise, drive innovation, and navigate the challenges of PLM with a collaborative and adaptive mindset, ultimately contributing to sustained growth and competitiveness [57]. By aligning with business goals, fostering cross-functional collaboration, incorporating risk management strategies, adopting advanced technologies [72], and considering environmental and regulatory factors, organizations can ensure a holistic and adaptive approach to managing the entire product lifecycle, ultimately contributing to sustained success and competitiveness.

4.1.10. Innovation and Adaptation at the Maturity Level

Delving in to the management of PLM maturity stage has its own unique sets of challenges and opportunities, demanding enabling strategies in adaptation and innovation to effectively and efficiently manage growth and also need careful balance between optimizing the existing operations to manage successfully [52], identifying directions to sustained profit, and strategically planning for the future. Innovation in PLM at maturity level is demanding to continuously refine and enhance product in order to satisfy customer expectation and market dynamics [10] that could include improvements in quality, features, or functionality to maintain a competitive edge. In addition, implementation of technological advancements supported by digital technologies, that enables profitability in the implementation of industry 4.0 which further strengthened by industry 5.0 more in sustainable or environmentally friendly business operation [36] because it has high relationship with operational systems [15, 34] and discovering emerging trends has significance to the product's importance and demand, ensuring it remains a favored special among consumers. This can be achieved through adaptation that encompasses consumer preferences, the flexibility to respond to shifts in market demands, and external factors. This adaptation can be better facilitated by proactive response approach that enables product to remain agile in ever changing, competitive environment and through doing this, cost efficiency can be achieved that lead to profitability and success [1, 69].

Generally, in managing growth of PLM at maturity stages, successful management of growth hinges 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 [13, 52] including using IT support system [58] that adds value [52].

4.2. Challenges and Opportunities That Face Managers in Managing Mature Products

Managing growth of mature products in PLM process presents a distinct set of challenges that necessitate careful attention and strategic responses. Even though mature products, have established market presence and a loyal customer base, they are susceptible to various challenges that can impact their continued success. Some key challenges that associated with managing mature products are market saturation [50] that requires innovation strategies because of little market potential left; intense competition from both current and new market players, needing differentiation or remain in crowded competition increasing competitive edges [6]; decline in profit margins that demand critical cost management

to sustain with profitability [56]; are changing customer preferences that continuously changing by changing customers' needs over time and mature products growth management should align with shifting demands and therefore, anticipating and responding to these changing preferences are highly challenging product managers; technology obsolesce, if mature products face the risk of technology obsolesce, challenges of requiring research and development comes and if lack of innovation occurred it come with critical challenge [2]. Some other challenges that face product managers in the process of PML at maturity level are erosion of brand image [10], regulatory changes, lack of customer retention, supply chain challenges, and unpreparedness to strategic planning for decline and other global economic factors challenges may arise in managing growth of maturity products. The effective management of these challenges need a proactive and strategic approach and therefore, organizations must frequently reassess market dynamics, implement adaptive strategies and invest in innovation to navigate complexities that face organizations in managing growth of PLM at maturity level successfully [23, 36].

However, even though, there are numerous challenges that exist in mature products, opportunities that has to be capitalized on, are available for brilliant product manager to act accordingly. These opportunities are mature markets do have various opportunities which include customer loyalty [24, 43], economies of scale [35], leveraging brand equity to sustain growth and competitiveness [19]. Future research has to focus on examining strategies for overcoming challenges and building on opportunities in the process on managing growth of PLM at maturity level.

4.3. Marketing Techniques for Mature Products to Maintaining Competitive Advantage with Mature Products

The marketing of mature products demand different approach from that of at introduction and growth phase of PLM. These marketing techniques tailored and applicable to mature products are market segmentation; which is based on behavioral, psychological, demographic aspects of the consumers and tailored marketing messages and strategies are needed to address these specific segments of population to address their specific needs, want and preferences [47]. The second one is product differentiation; which provide focus to reliability, durability, quality or convenience to appeal to targeted markets [37, 16]. Thirdly, value based pricing which provide attention to value based pricing strategies [60]. Fourthly, promotional campaigns that focus on targeted promotional campaign addressing consumers' pain point or key consumers concerns make clear products strengths from others [5]. Fifth, leveraging customers' loyalty that builds on existing customers' loyalty that promote or make to remember brand equity in retaining customer and make customers to repeat purchase again and again [17, 21]. Sixth, the usage of repositioning

strategies is useful by updating marketing messages, developing good packaging, branding to show the products evolving position and current value propositions [30]. Seventh, customer education and support provides customers with excellent offer which is after sales services to build loyalty and trust for the organization making to repeat purchase [20] and finally, continues improvement that involves monitoring

competitors' activities, market trends and customer feedback in order to evaluate opportunities that need to be utilized and improved [33]. Therefore, in active implementation of effective marketing techniques, businesses can increase profitability, raise market share, sustain sales for mature products and also lays ground base for future success and sustained growth.

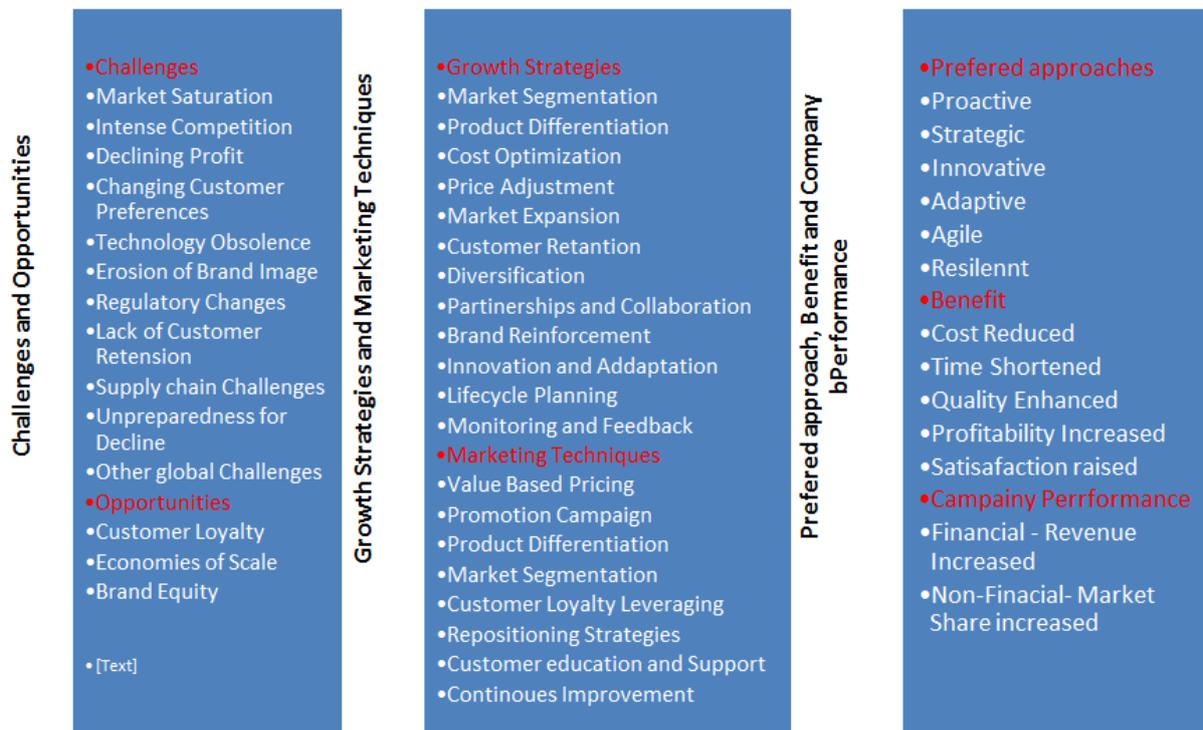


Figure 5. Frame work of challenges, opportunities, growth strategies, marketing techniques, preferred approaches, benefit and company success performance in managing PLM at maturity stage.

5. Discussion

This systematic literature review has explored several insights and trends within the existing body of knowledge. In managing growth of PLM at maturity level, strategies in managing mature products, challenges and opportunities that face product managers, marketing techniques applied for mature products has been identified. This discussion section summarizes and synthesizes the findings that has explored from the literature review, identifies common themes, indicated gaps in the research, and provided implication for theory and practice.

This systematic literature review explored various strategies used by organizations in managing the growth of PLM at maturity stage, such as product diversification, market segmentation [54], innovation management [36], pricing strategies [23], and cost optimization [13, 66]. Several studies highlighted the importance of continuous product innovation and differentiation to sustain growth in mature markets; however, consensus has not been reached by scholarly

community, indicating which strategies are more effective than others, so that it recommends further empirical research.

Despite, there is a wealth of literature focusing on customers engagement and marketing techniques strategies for mature products, highlighting the importance of targeted promotion, customer relationship management, channel optimization, and market segmentation in maintaining competitiveness and success that drive sales in mature markets, there is a limited studies that explored the impact of emerging digital marketing channels and technologies on the topic managing growth of PLM at maturity level, suggesting research recommendation in the area in the future.

There are several challenges and opportunities that are identified by literature review associated with managing growth of PLM at maturity level. The challenges involve increases competition [6], market saturation (Rota et al., 2016), declining profit margins [50], and changing customers' preferences. However, mature markets do have various opportunities which include customer loyalty [24, 43], economies of scale, leveraging brand equity to sustain

growth and competitiveness [19]. Future research has to focus on examining strategies for overcoming challenges and building on opportunities in the process of managing growth of PLM at maturity level.

5.1. Theoretical Implications and Future Research Directions

The finding of this systematic literature review indicated theoretical implications for understanding the dynamics of PLM at maturity level and market evolution. By synthesizing the existing theory and empirical evidence, this systematic literature review contributes to the development of a more comprehensive theoretical framework for managing growth of PLM at maturity level, however, future research is needed in testing, exploring and refining theoretical propositions, confirm the validations of their applicability throughout different industries and contexts to contribute further for managing growth of PLM at maturity level. Even though, there is a wealth of literature review discovered in the systematic literature review on managing growth of PLM at maturity level, further research gaps that has to be explored in the future exist and these research areas which has to be well discovered are emerging technologies such as internet of things, blockchain management, artificial intelligence, and internet of every things, implications to contribute to managing growth of PLM at maturity level. The maturity of the literature has done on the developed countries and there is a need to conduct research widely in the context of developing world, in line with managing growth of PLM at maturity level. Businesses have faced unexpected disruption in today's business environment and interests has raised to increase agility and resilience, so that future research demanded to examine strategies for navigating unforeseen challenges, and opportunities to sustain growth, competitiveness and profitability.

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.

6. Conclusion

Finally, upon conclusion, 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.

Abbreviations

PLM	Product Lifecycle Management
KPIs	Key Performance Indicators
IT	Information Technology

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] 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
- [2] 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>
- [3] Author, B., Axelband, E., Drezner, J. A., Brian, B., Iv, J. G., Held, B. J., McMahon, K. S., Walter, L., Rizzi, C., Shah, A. R., Wilson, P. A., & Sollinger, J. M. (2012). *Technology Choices and Development in FCS*.
- [4] Bey, N. (2017). Life cycle management. In *Life Cycle Assessment: Theory and Practice*. https://doi.org/10.1007/978-3-319-56475-3_22
- [5] 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>
- [6] 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>
- [7] 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>

- [8] Christopher, M. E., Miyake, A., Keenan, J. M., Pennington, B., DeFries, J. C., Wadsworth, S. J., Willcutt, E., and Olson, R. K. (2012). "Predicting word reading and comprehension with executive function and speed measures across development: a latent variable analysis," *J. Exp. Psychol. Gen.*, vol. 141, no. 3, pp. 470-488, 2012, <https://doi.org/10.1037/a0027375>
- [9] 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
- [10] 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>
- [11] 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>
- [12] 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>
- [13] Gecevska, 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>
- [14] Gecevska, V., & Stojanova, T. (n.d.). Product lifecycle management tools. 219–222.
- [15] Hadaya, P., & Marchildon, P. (2012). Understanding product lifecycle management and supporting systems. 112(4), 559–583. <https://doi.org/10.1108/02635571211225486>
- [16] 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>
- [17] Heredero, 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>
- [18] 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
- [19] 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.
- [20] 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>
- [21] 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>
- [22] 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>
- [23] 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>
- [24] K äkk änen, 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
- [25] 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.
- [26] Krishnan, S. (2016). Web Service Interface for Legacy Virtual Product Lifecycle Management System.
- [27] Letters, M. (2018). Predicting product life cycle patterns Author (s): Yair Orbach and Gila E. Fruchter Published by : Springer Stable. 25(1), 37–52. <https://www.jstor.org/stable/24571087>
- [28] 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>
- [29] 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>
- [30] 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>
- [31] 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>
- [32] Management, L. (2015). Lifecycle Management in the Era of Internet.
- [33] Marshall, S. (2010). A Quality Framework for Continuous Improvement of e-Learning : The e-Learning Maturity Model. 24(1), 143–166.

- [34] Matenga, A. E., & Mporu, 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>
- [35] 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>
- [36] Mesjasz-lech, A., & Mesjasz-lech, A. (2023). 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>
- [37] 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>
- [38] 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>
- [39] 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>
- [40] 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>
- [41] 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.
- [42] Olanipekun, L. O. (2023). Book of journals for covenant university. February.
- [43] 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>
- [44] 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>
- [45] 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>
- [46] 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>
- [47] 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>
- [48] 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>
- [49] 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
- [50] Rota, M. F., Carcedo, J. M., & García, J. P. (2016). Dual approach for modelling demand saturation levels in the automobile market. The Gompertz curve: Macro versus micro data. *Investigación Económica*, 75(296), 43–72. <https://doi.org/10.1016/j.inveco.2016.07.003>
- [51] 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>
- [52] 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/efietrebcmepbcm>
- [53] 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>
- [54] 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>
- [55] 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>
- [56] 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.

- [57] Tchhoffa, 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>
- [58] Teknologi, U. (2014). View metadata, citation and similar papers at core.ac.uk. January.
- [59] 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.
- [60] 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>
- [61] 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>
- [62] 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>
- [63] 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
- [64] 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>
- [65] 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
- [66] 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/csimq.2017-13.03>
- [67] Wang, L., Liu, Z., Liu, A., & Tao, F. (2021). Artificial intelligence in product lifecycle management. 771–796.
- [68] 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>
- [69] 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>
- [70] 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>
- [71] 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>
- [72] Yousefnezhad, N., Malhi, A., & Fränling, 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>
- [73] 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.