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Integrating product lifecycle thinking into financial decision-making: A Strategic Imperative for Modern Finance Leaders

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Abstract

In the contemporary fast-changing business world, it is vital to incorporate sustainability and long-term value creation into financial decision-making. Product Lifecycle Thinking (PLT) is a relatively new approach that assists an organisation in evaluating and controlling costs and consequences of what it manufactures on financial, environmental, and social levels throughout the whole lifecycle of a product. This paper examines the aspects of PLT in financial decision making and how it can be used by finance leaders to ensure costs are minimised, risks mitigated, and rates of profitability increased in the long term. Applying mixed-methods research, which involves interviews with finance authorities at the top level, case studies, surveys and financial analysis of data sets, the paper discerns the essential advantages of PLT, e.g., cost-saving, higher ROI, and augmented risk management. The findings indicate that firms implementing PLT have registered a substantial financial gain and risk reduction, though they are affected by other issues, including data availability and finance teams' resistance. The paper highlights the importance of having an effective PLT integration through cross-functional teamwork and investment in lifecycle data systems. The results are instructive to the firms that aim to ensure harmony between the strategies of finance and sustainability and promote long-term achievement.

Keywords: Product Lifecycle Thinking; Financial Decision-Making; Sustainability; Cost Optimization; Risk Mitigation; Return On Investment (Roi); Life Cycle Costing; Activity-Based Costing; Cross-Functional Collaboration; Financial Performance; Risk Management; Sustainable Business Practices

1. Introduction

In an era characterized by rapid technological advancements, increasing environmental awareness, and evolving consumer preferences, the role of financial decision-making has expanded far beyond traditional metrics of profitability and cost control. The modern business landscape demands a more holistic approach that integrates sustainability, long-term value creation, and risk management into the financial framework. One strategic approach that is increasingly being recognized for its value is the integration of Product Lifecycle Thinking (PLT) into financial decision-making. PLT encourages organizations to consider the environmental, social, and economic impacts of a product throughout its entire lifecycle, from inception and design to production, distribution, usage, and eventual disposal or recycling (Zhou et al., 2021). By doing so, it facilitates a more informed, comprehensive understanding of costs and benefits that better aligns with long-term organizational goals.

Product Lifecycle Thinking (PLT) emphasizes managing products from inception through growth, maturity, and decline, with strategic adjustments to maximize value while minimizing waste. In the Ghanaian banking sector, PLT principles are increasingly used to design innovative financial products that address evolving customer needs while ensuring operational efficiency (Agyeman, 2021). For instance, some banks in Ghana incorporate lifecycle approaches to phase out outdated payment systems while introducing mobile money and digital loan services that align with market

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maturity trends (Bank of Ghana, 2023). This lifecycle-oriented approach enables financial institutions to adapt quickly to regulatory changes, customer preferences, and sustainability imperatives.

Financial decision-making has traditionally focused on short-term profitability and cost savings, often neglecting the full scope of costs incurred throughout a product's lifecycle. Early-stage financial analyses typically emphasize initial production costs and immediate returns, leaving factors such as maintenance, repair, and end-of-life disposal out of the equation (Berg, 2020). However, as industries move towards more sustainable practices and corporate social responsibility (CSR) becomes increasingly important, businesses must look beyond the conventional boundaries of financial analysis. Product lifecycle thinking enables finance leaders to evaluate the long-term implications of product-related decisions, fostering more strategic and forward-thinking financial models (Tukker and Jansen, 2017). This approach not only leads to improved financial outcomes but also supports broader goals of sustainability, environmental stewardship, and regulatory compliance.

Sustainability in finance involves designing products and services that meet current needs without compromising future generations' ability to meet theirs. In Ghana, integrating PLT into financial product development supports sustainable banking by reducing resource inefficiencies and promoting inclusive growth (Boateng and Asiedu, 2022). For example, microfinance institutions have adapted lifecycle strategies to transition clients from small, short-term loans to larger, long-term credit facilities, fostering business resilience and community development. Such practices align with Ghana's Sustainable Banking Principles, which emphasize environmental stewardship, social responsibility, and governance (BoG, 2019).

A critical challenge in today's corporate world is aligning financial strategies with sustainable business practices. Companies are under mounting pressure from both consumers and regulatory bodies to reduce their environmental footprints and to ensure responsible product lifecycle management (Kolk and Rivera-Santos, 2020). As governments impose stricter regulations on carbon emissions, waste management, and recycling, businesses must integrate these external factors into their financial strategies. Recent studies highlight the importance of lifecycle costing in driving sustainable decision-making and reducing operational risks (Hunt et al., 2019). For instance, by integrating product lifecycle thinking, companies can optimize product design, reduce waste during production, improve energy efficiency, and ensure that materials are responsibly sourced, all of which have a direct impact on financial performance (Miller and Goff, 2022).

Moreover, modern finance leaders must contend with an increasingly complex global supply chain, where decisions made in one region can have far-reaching financial and environmental consequences (Christopher, 2021). The COVID-19 pandemic underscored the vulnerabilities in global supply chains and the critical need for more resilient, adaptable systems (Ivanov, 2020). By embracing PLT, finance leaders can gain a deeper understanding of the interconnectedness of supply chain activities and assess the hidden costs associated with each stage of the product lifecycle. For example, decisions made in the design phase regarding material selection can influence production costs, waste management expenses, and even regulatory compliance costs in the long term (van der Laan et al., 2021).

Incorporating PLT into financial decision-making is not merely about addressing regulatory pressures or market demands for sustainability. It also presents a significant opportunity for organizations to enhance their competitive edge. By proactively integrating lifecycle considerations into financial models, companies can differentiate themselves in the marketplace, attract environmentally conscious investors, and build a resilient brand that is poised for long-term success (Nguyen et al., 2020). As the financial landscape continues to evolve, the integration of product lifecycle thinking emerges as a strategic imperative that enables organizations to make decisions that are not only profitable but also environmentally responsible and socially beneficial.

This paper explores how the integration of PLT into financial decision-making can transform the way modern finance leaders approach strategic planning, risk management, and value creation. By examining the principles of PLT, its importance in today's business environment, and the key financial models that support its integration, the paper aims to provide actionable insights for finance leaders seeking to enhance their decision-making frameworks. Through a combination of theoretical analysis and practical case studies, the paper will demonstrate how PLT can be leveraged to create sustainable financial strategies that align with both organizational goals and broader societal expectations.

2. Literature review

The integration of Product Lifecycle Thinking (PLT) into financial decision-making has gained significant academic attention in recent years as businesses face increasing pressures to improve sustainability and optimize long-term value creation. This literature review explores the theoretical foundations of PLT, its application in financial decision-making, and the challenges associated with its integration into corporate finance strategies.

Product Lifecycle Thinking (PLCT) involves assessing the environmental and economic impacts of a product, service, or financial product throughout its entire life cycle—from inception to disposal. While PLCT is widely discussed in manufacturing and environmental management (Hellweg and Milà i Canals, 2014), it has more recently been applied to the financial sector to evaluate sustainable investment portfolios and banking operations. In Ghana, financial institutions have begun integrating lifecycle perspectives into sustainability frameworks, particularly through the adoption of environmental and social risk management protocols. For example, the Bank of Ghana's Sustainable Banking Principles (BoG, 2019) encourage banks to consider lifecycle environmental costs in credit decisions, particularly in high-impact sectors like mining and energy.

Sustainability in finance in Ghana has been significantly shaped by policy initiatives and regulatory frameworks aimed at aligning with the United Nations Sustainable Development Goals (SDGs). Agyeman and Baah (2022) observe that Ghanaian banks increasingly adopt green financing models and integrate environmental risk assessments into lending. These practices parallel global PLCT principles by considering long-term resource impacts and operational sustainability. For instance, Stanbic Bank Ghana and Ecobank have introduced sustainability-linked loan products that account for lifecycle emissions in financed projects (Amponsah and Darko, 2023).

While PLCT is still in its early adoption stages in Ghana's financial ecosystem, its integration aligns with the nation's strategic goals under the Ghana National Climate Change Policy. Boateng and Appiah (2021) highlight that applying lifecycle thinking to project financing allows banks to better quantify long-term risks and opportunities, thereby promoting resilience and sustainable returns. Such approaches are essential for sectors like agriculture, infrastructure, and energy, where lifecycle costs and environmental impacts are substantial.

2.1. Theoretical Foundations of Product Lifecycle Thinking (PLT)

The concept of PLT stems from the broader field of Life Cycle Assessment (LCA), which evaluates the environmental impacts associated with a product throughout its lifecycle, from raw material extraction to disposal or recycling (Kallio and Koskela, 2020). While LCA focuses primarily on environmental aspects, PLT expands this approach by incorporating economic and social considerations into the lifecycle framework. This broader perspective acknowledges that each phase of a product's lifecycle—from design and manufacturing to use and disposal—carries financial implications that must be considered in decision-making (Zhou et al., 2021).

Several scholars have explored the theoretical underpinnings of PLT, emphasizing its alignment with systems thinking and sustainability principles. Systems thinking suggests that businesses should view their operations as interconnected systems, where actions in one area can have far-reaching consequences elsewhere (Senge, 2020). PLT is grounded in these systems thinking approach, encouraging organizations to take a holistic view of product development and management. By considering the interdependencies between various lifecycle stages, companies can make more informed decisions that optimize financial and environmental performance.

Furthermore, PLT is often associated with the concept of circular economy—a model that seeks to minimize waste and maximize resource efficiency by promoting the reuse, refurbishment, and recycling of products (Geissdoerfer et al., 2017). The circular economy is increasingly recognized as a key driver of sustainable business practices, and PLT offers a framework for integrating circular principles into financial decision-making. By evaluating the financial implications of product longevity, recyclability, and waste management, finance leaders can create strategies that align with both profitability and environmental goals.

2.2. PLT in Financial Decision-Making

The integration of PLT into financial decision-making represents a shift from traditional cost-based models, which often focus on immediate or short-term financial outcomes. In contrast, PLT requires businesses to consider the total cost of ownership (TCO), which includes not only the initial purchase price but also operational, maintenance, and disposal costs (Hunt et al., 2019). This approach, commonly known as Life Cycle Costing (LCC), allows companies to assess the long-term financial implications of their product-related decisions.

Recent research has highlighted the importance of LCC in financial decision-making. For example, Frosch and Gallopoulos (2020) argue that LCC can enhance strategic decision-making by providing a more comprehensive view of the costs associated with product development and management. By integrating LCC into financial models, companies can identify opportunities for cost reduction, efficiency improvements, and sustainable resource utilization. For instance, selecting energy-efficient technologies during the design phase may incur higher upfront costs but result in significant savings over the product's lifecycle, especially in terms of operational expenses and maintenance costs (Miller and Goff, 2022).

In addition to LCC, the concept of Activity-Based Costing (ABC) has been applied to PLT in financial decision-making. ABC allocates costs to specific activities within the product lifecycle, such as design, production, and distribution, providing a detailed breakdown of cost drivers (Cokins, 2020). By using ABC, finance leaders can identify inefficiencies at each stage of the lifecycle and make more precise decisions regarding resource allocation. This method is particularly useful in complex supply chains, where costs can vary significantly between different stages of production and distribution (van der Laan et al., 2021). ABC helps to identify hidden costs, enabling companies to optimize their financial strategies and improve overall profitability.

2.3. Sustainability and Risk Mitigation

Sustainability has become an increasingly critical factor in corporate finance decision-making. Consumers, investors, and regulatory bodies are placing greater emphasis on sustainable business practices, and companies are being held accountable for the environmental and social impacts of their products (Kolk and Rivera-Santos, 2020). PLT provides a framework for integrating sustainability into financial decisions by considering the full environmental and social costs associated with a product's lifecycle.

Research by Tukker and Jansen (2017) suggests that adopting PLT can help businesses mitigate risks associated with environmental regulations, resource scarcity, and supply chain disruptions. For instance, companies that fail to account for the full environmental impact of their products may face legal penalties, reputational damage, and increased operational costs. By integrating PLT into financial strategies, organizations can proactively manage these risks and align their operations with evolving sustainability standards.

Moreover, PLT plays a crucial role in mitigating financial risks associated with the product's end-of-life phase. The disposal or recycling of products at the end of their lifecycle can result in significant costs, particularly if the product contains hazardous materials or is difficult to recycle. By incorporating PLT into financial decision-making, businesses can evaluate the potential costs of disposal and invest in design features that facilitate recycling and waste reduction (Geissdoerfer et al., 2017). This not only reduces long-term environmental impact but also helps companies comply with increasingly stringent waste management regulations.

2.4. Strategic Alignment with Corporate Goals

Integrating PLT into financial decision-making aligns with broader organizational goals, particularly in terms of profitability, innovation, and competitive advantage. As businesses face increasing pressure to demonstrate their commitment to sustainability, integrating PLT into financial strategies can serve as a key differentiator in the marketplace (Nguyen et al., 2020). For example, companies that embrace PLT and circular economy principles can attract environmentally conscious consumers and investors, while also improving operational efficiency.

Recent studies have explored how PLT can drive innovation within organizations. By considering the entire lifecycle of a product, companies can identify new opportunities for product design, material sourcing, and manufacturing processes that enhance both sustainability and financial performance (Berg, 2020). For instance, companies that invest in research and development (R\ andD) focused on sustainable materials may uncover new market opportunities and differentiate themselves from competitors (Hunt et al., 2019). As sustainability becomes a key component of corporate strategy, integrating PLT into financial decision-making allows companies to position themselves as leaders in their industries.

2.5. Challenges in Implementing PLT in Financial Decision-Making

Despite the clear benefits of integrating PLT into financial decision-making, several challenges remain. One significant barrier is the availability and accuracy of data related to each stage of the product lifecycle. For instance, obtaining reliable data on energy consumption, maintenance costs, and waste management can be difficult, especially for products with long lifecycles or those produced in multiple locations (Berg, 2020). Furthermore, integrating PLT into traditional

financial models requires a shift in mindset, as finance teams are often focused on short-term results and may be reluctant to adopt more complex, long-term frameworks (Cokins, 2020).

Another challenge is the resistance to change within organizations. Traditional financial models have been deeply embedded in business practices for decades, and integrating new models like LCC and ABC can face significant organizational pushback. Companies must invest in training and education to equip finance teams with the necessary skills and knowledge to adopt PLT-based decision-making (Kallio and Koskela, 2020). Additionally, organizations must overcome the challenge of balancing short-term financial goals with the long-term objectives of sustainability and circular economy practices.

The literature review highlights the growing importance of integrating product lifecycle thinking into financial decision-making. By considering the entire lifecycle of a product, businesses can optimize costs, mitigate risks, and enhance long-term profitability. Although challenges exist in terms of data availability and organizational resistance, the potential benefits of adopting PLT far outweigh these obstacles. As sustainability continues to gain importance in the corporate world, integrating PLT into financial strategies will become a critical tool for finance leaders seeking to create value and drive sustainable growth.

3. Methodology

This study employs a mixed-methods approach, combining both qualitative and quantitative research methods to explore how Product Lifecycle Thinking (PLT) can be integrated into financial decision-making. The research design includes in-depth interviews, case studies, surveys, and financial data analysis to provide a comprehensive understanding of PLT's impact on financial strategies.

3.1. Qualitative Research

Semi-structured interviews were conducted with senior finance leaders, sustainability managers, and product development managers in large manufacturing companies. The interviews focused on understanding the motivations, challenges, and perceived benefits of integrating PLT into financial decisions. Additionally, case studies of companies that have successfully adopted PLT were reviewed to examine real-world applications and outcomes.

3.2. Quantitative Research

A survey was distributed to 150 finance professionals to assess the current level of PLT adoption and its perceived impact on financial performance, including cost savings and profitability. Furthermore, financial data from companies that have implemented PLT was analyzed to compare financial performance before and after PLT integration, focusing on key metrics such as profit margins, cost optimization, and risk reduction.

The study was conducted across a range of companies located in the United States, Europe, and Asia, with a focus on large manufacturing and technology firms known for adopting sustainable business practices and the questionnaires were administered through Qualtrics.

3.3. Data Analysis

The qualitative data from interviews and case studies were analyzed using thematic analysis to identify key themes related to cost management, sustainability, and cross-functional collaboration. The quantitative survey data were analyzed using descriptive statistics, correlation analysis, and regression analysis to assess the relationship between PLT adoption and financial outcomes.

This mixed-methods approach allows for a comprehensive understanding of how PLT can enhance financial decision-making, providing both theoretical insights and empirical evidence on its integration into business strategies. Despite some limitations, the methodology offers valuable insights for finance leaders seeking to adopt PLT in their organizations.

4. Results

This section presents the findings from both the qualitative and quantitative components of the study. It includes insights derived from interviews, case studies, surveys, and financial data analysis. The results are discussed in the context of how Product Lifecycle Thinking (PLT) influences financial decision-making, sustainability, cost optimization, and risk management. The study was conducted across a range of companies located in the United States, Europe, and

Asia, with a focus on large manufacturing and technology firms known for adopting sustainable business practices. To facilitate clarity, the results are organized in a tabular format, followed by a discussion of the key insights.

4.1. Key Results from Interviews and Case Studies

4.1.1. Qualitative Analysis

The qualitative analysis was based on in-depth interviews and case studies of companies that had successfully integrated PLT into their financial decision-making processes. This section discusses the key themes identified through the interviews with senior finance leaders, sustainability managers, and product development managers.

4.1.2. Key Insights from Interviews

The interviews provided several key insights into the motivations for adopting PLT and the challenges faced during implementation.

- Motivations for PLT Integration: The primary motivations for adopting PLT were to align with sustainability goals, reduce long-term operational costs, and comply with increasingly strict environmental regulations. Finance leaders recognized that incorporating lifecycle considerations into financial decisions could enhance both profitability and sustainability.
- Challenges in Implementation: A significant barrier to adopting PLT was the lack of reliable data on the lifecycle impacts of products. Finance teams often faced difficulties in obtaining accurate information regarding the environmental footprint, maintenance costs, and disposal expenses of products. Furthermore, resistance from finance teams accustomed to traditional short-term financial models was a common challenge.
- Financial Benefits: Companies that successfully implemented PLT reported substantial cost savings, particularly through energy-efficient technologies, reduced waste, and improved supply chain management. In many cases, adopting PLT helped organizations identify hidden costs that were previously overlooked in traditional financial models.
- Cross-Functional Collaboration: A recurring theme in successful PLT adoption was the need for cross-functional collaboration. Finance leaders highlighted the importance of involving product development, R andD, sustainability, and operations teams in the decision-making process. This collaboration ensured that financial decisions were aligned with long-term sustainability goals.

4.2. Case Studies

Case studies of companies that integrated PLT into their financial strategies revealed that the adoption of PLT often led to tangible improvements in financial outcomes.

One case study in the automotive industry revealed that a company that adopted life cycle costing (LCC) in its financial analysis achieved a 10% reduction in manufacturing costs over five years. This reduction was achieved by making design changes to improve energy efficiency and reduce material waste during production.

Another case study in the technology sector demonstrated that risk management improved significantly after adopting PLT. By considering product disposal and recycling in their financial strategies, the company was able to avoid substantial fines for non-compliance with environmental regulations.

4.2.1. Quantitative Analysis

The quantitative analysis was focused on evaluating the impact of Product Lifecycle Thinking (PLT) on financial decision-making. The primary sources for the quantitative data were the survey responses from 150 finance professionals and financial data from companies that integrated PLT into their strategies. The quantitative analysis examines key financial metrics, including revenue growth, operating costs, return on investment (ROI), cost savings from sustainability, and risk management improvements. Below are the summarized results from the survey and financial data analysis.

4.2.2. Survey Results

The survey aimed to assess the extent to which PLT is being integrated into financial decision-making and its perceived impact on key financial metrics. The key findings are summarized in the table below:

Table 1 Survey responses on PLT integration and financial impact

Survey Question	Response
Percentage of companies integrating PLT into financial decisions	58% of respondents reported integrating PLT into their financial decision-making processes.
Impact on financial performance (cost savings, risk mitigation)	72% of respondents indicated that PLT led to measurable cost savings, while 65% reported reduced risks.
Top financial metrics impacted by PLT	59% cited cost savings, 52% mentioned improved ROI, and 48% highlighted better risk management.
Challenges faced in adopting PLT	45% mentioned data availability issues, 40% cited resistance from finance teams, and 30% highlighted upfront investment costs.

4.2.3. Financial Data Analysis

In addition to the survey, financial data from a sample of companies that implemented PLT in their financial strategies were analyzed. The data compared key financial metrics before and after PLT adoption. The results are shown in the following table

Table 2 Financial Performance Metrics Before and After PLT Adoption

Financial Metric	Pre-PLT Adoption	Post-PLT Adoption	Change (%)
Revenue Growth	5%	8%	3% increase
Operating Costs	65% of revenue	60% of revenue	5% decrease
Return on Investment (ROI)	12%	18%	6% increase
Cost Savings from Sustainability	N/A	10% of total costs	New financial metric
Risk Management	Low	High	Increased risk mitigation

The financial data analysis reveals that companies that adopted PLT showed improvements in key metrics. Revenue growth increased by 3%, operating costs decreased by 5%, and ROI increased by 6%. Additionally, companies reported new financial metrics such as cost savings from sustainability (10% of total costs), and risk management improved significantly.

5. Discussion of Results

The results from this study provide compelling evidence that integrating Product Lifecycle Thinking (PLT) into financial decision-making offers substantial benefits for companies, particularly in terms of cost optimization, sustainability, and risk mitigation. The findings from both the quantitative and qualitative analyses align with several recent studies that have explored the intersection of sustainability, product lifecycle management, and financial performance. This section discusses the results considering recent literature, examining how they contribute to the growing body of knowledge on PLT integration and its impact on financial decision-making.

5.1. PLT and Cost Optimization

The financial data analysis in this study shows that companies that adopted PLT experienced a notable reduction in operating costs and an increase in revenue growth. Specifically, companies that integrated PLT into their financial strategies achieved a 5% decrease in operating costs and a 3% increase in revenue growth. This is consistent with the findings of Miller and Goff (2022), who reported that companies adopting Product Lifecycle Management (PLM) principles, which closely align with PLT, experienced substantial cost reductions, particularly in manufacturing processes. Similarly, Tukker and Jansen (2017) noted that organizations that applied lifecycle costing (LCC) techniques in their financial decision-making could identify inefficiencies in their operations, leading to long-term cost savings.

One of the significant sources of cost reduction identified in this study was energy efficiency, an area that aligns with research by Kolk and Rivera-Santos (2020), who highlighted that energy-efficient technologies implemented during the product design phase could lead to significant cost savings over the product lifecycle. By focusing on energy

consumption during the production and usage stages, organizations can avoid high operational costs and reduce their reliance on non-renewable energy sources.

5.2. PLT and Risk Mitigation

The findings of this study also demonstrate that integrating PLT into financial decision-making helps organizations mitigate risks, particularly those associated with environmental regulations, product disposal, and supply chain disruptions. The case studies revealed that companies who adopted PLT strategies experienced improvements in risk management, particularly in managing environmental compliance and end-of-life product disposal. This aligns with recent research by Geissdoerfer et al. (2017), who argue that PLT allows companies to proactively identify risks related to environmental impacts and regulatory compliance. In their study, companies that accounted for end-of-life disposal and recycling in their financial models were better equipped to avoid penalties and minimize reputational damage associated with non-compliance.

Frosch and Gallopoulos (2020) further support the idea that PLT improves risk mitigation, particularly in industries subject to stringent environmental regulations. Their research highlights how the proactive management of lifecycle impacts allows businesses to better navigate future regulatory changes. The companies in this study reported improved compliance with regulations and better preparation for potential future environmental laws, reducing their exposure to risks associated with environmental liabilities.

5.3. PLT and Financial Performance: Return on Investment (ROI)

The study revealed that PLT integration resulted in a 6% increase in Return on Investment (ROI). This increase is consistent with the findings of Hunt et al. (2019), who found that integrating product lifecycle considerations into financial decision-making led to higher ROI by optimizing resource allocation and minimizing long-term operational costs. By incorporating sustainability into their financial strategies, companies can achieve higher returns on investments in research and development, particularly when investments are made in energy-efficient technologies or materials that lower costs over time.

Moreover, Miller and Goff (2022) found that organizations that adopted lifecycle-based costing methods experienced higher profitability, not only due to cost reductions but also because of the value-added opportunities created by sustainable product innovations. This study's findings reinforce this perspective, as companies integrating PLT were able to leverage sustainability as a competitive advantage, improving both their financial performance and their brand reputation.

5.4. Cross-Functional Collaboration and Organizational Challenges

A key finding of this study was the importance of cross-functional collaboration in successfully integrating PLT into financial decision-making. The interviews and case studies indicated that successful PLT adoption required the involvement of finance, operations, R\ andD, and sustainability teams. This finding supports research by Zhou et al. (2021), who emphasized that PLT cannot be successfully implemented without collaboration between different departments. In their study, they found that interdisciplinary teams were crucial for identifying lifecycle impacts at each stage of the product development process, from design through to disposal. This collaborative approach allows organizations to consider both financial and environmental costs at every stage of the product lifecycle.

However, the study also revealed several challenges associated with adopting PLT. The most significant challenges identified were data availability and resistance from finance teams accustomed to traditional financial models. These barriers are consistent with the findings of Berg (2020), who noted that one of the key obstacles to PLT adoption is the lack of reliable data on lifecycle costs and environmental impacts. This is particularly challenging for companies that operate in industries with complex supply chains and products with long life cycles. To overcome these challenges, Cokins (2020) suggests that organizations must invest in systems that can capture detailed lifecycle data and provide accurate financial forecasts that incorporate sustainability metrics.

The resistance to change observed in finance teams aligns with the observations made by Kallio and Koskela (2020), who found that finance professionals often prioritize short-term financial goals and are hesitant to embrace longer-term, lifecycle-based financial models. This resistance can be mitigated through education and training, which was also highlighted as a critical factor for successful PLT integration in the study by Berg (2020). By investing in training finance teams to understand the value of lifecycle thinking, organizations can overcome resistance and ensure that PLT becomes a central component of their financial decision-making processes.

5.5. Sustainability Metrics and Long-Term Value Creation

Another important finding from this study is that the integration of PLT led to the introduction of new sustainability metrics for measuring financial performance. The survey results revealed that 10% of companies' total costs were derived from sustainability efforts post-PLT adoption. This finding aligns with Nguyen et al. (2020), who argue that sustainability metrics, such as carbon footprint reduction and waste minimization, should be integrated into financial performance evaluations. By incorporating these metrics into financial strategies, companies can create long-term value that aligns with both profit maximization and environmental stewardship.

Tukker and Jansen (2017) also emphasize the role of sustainability in driving long-term value creation, stating that companies that adopt a lifecycle perspective are better positioned to innovate and create products that meet both market demands and environmental goals. The results from this study show that companies adopting PLT not only experienced immediate cost savings but also positioned themselves as leaders in sustainability, attracting environmentally conscious investors and customers.

5.6. Implications for Practice and Future Research

The findings from this study have several implications for practice. First, finance leaders should embrace PLT as a strategic framework for decision-making, recognizing that long-term profitability and risk mitigation are closely linked to sustainability and lifecycle management. Additionally, companies must invest in data systems that track and report on lifecycle costs and environmental impacts to overcome data availability challenges. Finally, organizations should foster cross-functional collaboration to ensure that PLT is effectively integrated into financial strategies, involving key stakeholders across departments.

Future research could explore the specific mechanisms through which PLT leads to innovation in product design and development. Additionally, more studies are needed to explore the impact of PLT on small and medium-sized enterprises (SMEs), as this study focused primarily on large enterprises. Understanding how SMEs can adopt PLT and reap similar benefits would be a valuable area for future exploration.

The integration of Product Lifecycle Thinking (PLT) into Ghana's financial sector offers practical pathways for aligning sustainability objectives with long-term profitability. In the banking and fintech space, applying PLT encourages institutions to consider the environmental, social, and governance (ESG) implications of financial products from conception to termination (Boateng and Essel, 2023). For example, designing microfinance schemes that account for the long-term environmental impact of funded activities can help banks mitigate climate-related risks while fostering sustainable development.

In practice, Ghanaian banks can adopt lifecycle assessment tools to evaluate the sustainability profile of investment portfolios, especially in sectors such as agriculture, renewable energy, and manufacturing (Adomako et al., 2022). This aligns with the Ghana Sustainable Banking Principles, which emphasize responsible lending and resource-efficient financing (Bank of Ghana, 2019). Moreover, fintech firms in Ghana could embed PLT into digital product development to ensure that innovations remain relevant, adaptable, and environmentally sustainable over time.

From a research perspective, there is a growing need to empirically examine the impact of PLT-based financial models on customer retention, operational efficiency, and environmental performance in Ghana. Future studies could explore the role of digital analytics in enabling lifecycle tracking of financed projects, offering predictive insights for decision-making (Nyarku and Ayisi, 2021). Additionally, comparative research between Ghana and other emerging economies could shed light on contextual differences in implementing lifecycle approaches in finance.

Ultimately, the fusion of PLT with Ghana's finance ecosystem holds potential to strengthen resilience, promote innovation, and contribute to national sustainability targets such as the Ghana Green Finance Strategy. This requires collaboration between regulators, financial institutions, and academic researchers to ensure that lifecycle-oriented strategies are effectively designed, implemented, and monitored.

6. Conclusion

This study has provided valuable insights into the integration of Product Lifecycle Thinking (PLT) into financial decision-making. The findings indicate that PLT offers significant benefits in terms of cost optimization, sustainability, and risk mitigation. By considering the entire lifecycle of a product—from design to disposal—organizations can make more informed financial decisions that not only reduce operational costs but also improve long-term profitability and ensure better compliance with environmental regulations. The study also highlights the importance of cross-functional

collaboration, particularly between finance, R\ andD, operations, and sustainability teams, in successfully implementing PLT. However, challenges such as data availability and resistance from finance teams accustomed to traditional financial models need to be addressed for a smooth transition to PLT-based decision-making.

Moreover, the integration of PLT has shown to contribute to risk management, particularly in terms of managing environmental liabilities and regulatory compliance. The financial data analysis revealed that companies adopting PLT witnessed improved financial performance, including increased ROI and revenue growth, alongside a reduction in operating costs. These results suggest that PLT is not just a tool for enhancing sustainability but also a strategic approach to achieving financial success in a highly competitive and environmentally conscious market.

Recommendations

Based on the findings, several recommendations can be made for organizations seeking to integrate PLT into their financial decision-making processes:

- **Invest in Data Systems:** Organizations should invest in robust systems to collect and analyze lifecycle data, including energy usage, waste management, and maintenance costs. This will enable finance leaders to make more accurate, informed decisions and effectively measure the impact of PLT on their financial performance.
- **Foster Cross-Functional Collaboration:** To ensure the successful integration of PLT, companies must encourage collaboration between different departments, including finance, sustainability, operations, and R\ andD. This collaborative approach will help to identify lifecycle impacts at every stage of the product development process, ensuring that financial decisions align with sustainability and long-term profitability goals.
- **Provide Training for Finance Teams:** Finance teams should receive training to understand the long-term value of PLT and the tools, such as Life Cycle Costing (LCC) and Activity-Based Costing (ABC), that can help measure its impact on financial outcomes. This will help mitigate resistance and align financial strategies with broader organizational goals.
- **Adopt a Long-Term Perspective:** Finance leaders must recognize the value of integrating PLT not only for short-term financial gains but also for long-term value creation. This includes considering the financial implications of product end-of-life management, including recycling and disposal costs, which can lead to cost savings and reduced regulatory risks.
- **Focus on Sustainability Metrics:** Incorporating sustainability metrics into financial decision-making will allow organizations to assess the long-term value generated from sustainable practices. These metrics could include energy efficiency, waste reduction, and carbon footprint, helping businesses not only to improve financial performance but also to enhance their brand image and attract sustainability-conscious investors and customers.

By implementing these recommendations, businesses can successfully integrate PLT into their financial strategies, driving both sustainable growth and profitability in an increasingly competitive and environmentally aware market.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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