

**A Systematic Literature Review on**

**Portfolio Management in**

**Manufacturing Sector***Optimizing Strategies: Effective Portfolio Management for the Manufacturing Industry*

**An SLR presented by Nouf & …….**

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**A SYSTEMATIC LITERATURE REVIEW ON PORTFOLIO MANAGEMENT IN MANUFACTURING SECTOR**

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ABSTRACT

The purpose of this paper is to conduct a systematic review of Portfolio management in the manufacturing sector considering both academic and industry-related publications between 2016 and 2023. The systematic literature review methodology is followed using articles from Google Scholar, search gate, Academia, Scoupus, and Springer on a priority basis. A comprehensive study of the literature is conducted to formulate three research questions identified as key challenges of portfolio management. Risk management, supply chain sustainability, and technology's role in operational success are the three main topics presented in this study. The manufacturing risk factor is directly interlinked with the investment plan. Diversification and utilization of risk management tools to overcome the hurdle are identified as useful strategies to avoid risk factors. Supply chain sustainability is fundamental for maintaining the portfolio efficiently. In this study, social, environmental, and economic performance are documented as the three factors affecting the supply chain. Combining digitalization with organizational practices a positive impact is observed on overall operational performance and is found to be productive for the manufacturing sector.

KEYWORDS Manufacturing risk, technology, supply chain, portfolio management, and manufacturer sector.

I. INTRODUCTION

A huge variety of goods and services are necessary for human activity. There are issues with society's social underpinnings, such as the equitable allocation of resources, access to healthcare and education, and so on (Raworth, 2012). The industry is essential to transforming society into one that is sustainable. The move from the old company management model based on productivity to the current one, sustained on competitiveness, was driven by the opening of economies and the ever-increasing presence of internationally oriented enterprises. This encourages more research into ways to find solutions that maximize advantages across a range of operational operations while also addressing consumer requirements and responsibly using environmental resources (Drucker, 2008; Porter, 2009).

Strategic planning must incorporate the ability to combine ideas with the creation of control mechanisms, the association of tangible and intangible functions, aspects of the marketing of manufactured goods, and other factors to address such situations in order to enhance the company's solution portfolio (Aurich, Mannweiler & Schweitzer, 2010; Beuren, Ferreira & Miguel, 2013).

According to Miguel (2008), Slack, Chambers, Johnston, and Betts (2008), Lacerda, Ensslin, and Ensslin (2011), effective product portfolio management is a practical strategy for maintaining competitiveness in the face of ongoing market changes and the choice to keep or remove a specific product from the range of products offered will have both internal and external effects on the business.

The project management community has identified portfolio management as a method for maximizing organizational returns from project investments by enhancing the alignment of projects with strategy and guaranteeing resource sufficiency. Businesses face challenges from customers' more customized needs, which ask for a greater diversity of offerings while still attempting to fulfill environmental standards (Stock & Seligar, 2016). However, offering the consumer a larger range of options means a greater complexity in managing the operations, from product or service creation to end-of-life care. Project Portfolio Management (PPM) is a viable solution for managing the intricacies of multiple projects. PPM is believed to enable organizations to gain a competitive edge by implementing effective business strategies, balancing portfolios, optimizing value, and ensuring sufficient resource allocation.

The ongoing struggle of organizations to innovate and grow their operations through the efficient application of their business strategy is a problem that cannot be avoided. The swift acceleration of technological progress has repercussions for product lifecycles, cost pressures, expectations for improved quality, and the availability of a wider variety of goods and services. Because these advancements bring about elevated demands and an exponential rise in complexity, competent management of the catalysts of innovation is required in order to create a competitive edge. (Oosthuizen, C. et at., 2017)

According to Patton and White (2002), bridging the gap that exists between an organization's strategic plan and its actual execution is absolutely necessary in order to gain and maintain a competitive edge. A number of academic works (including Dietrich and Lehtonen, 2005; Grundy, 2000; Müller et al., 2008) have advanced the hypothesis that project portfolio management (PPM) might be able to provide a solution to this issue. PPM has established itself as a recognised practise area that is essential to the successful execution of strategies. (Oosthuizen, C. et at., 2017)

Studies have demonstrated that good management of a company's portfolio can lead to improved financial performance, higher innovation, and better alignment with the requirements of individual customers (Gao et al., 2019). Unfortunately, many businesses have difficulty putting efficient portfolio management techniques into place. This is frequently the result of a lack of resources, experience, or organizational support.

One study identified that the primary advantages of implementing PPM practices were aligned with business strategies, enhancing decision-making, optimizing resource utilization, and managing organizational risks. However, the primary obstacles to effective PPM practices were internal politics, cultural resistance to change, disagreements regarding a unified project prioritization approach, and insufficient support from organizational management. (Hadjinicolaou et al., 2017).

Managing the compromise between short-term and long-term objectives is one of the most significant issues that manufacturing organizations must face. On the one hand, for businesses to keep their income streams intact and to guarantee that their customers will continue to be satisfied, they must meet their immediate production and delivery requirements. On the other hand, they need to invest in research and development projects with a longer time horizon to create new goods and capabilities that will allow them to maintain their competitiveness over time. According to Gutiérrez and Gronqvist (2017), No matter how diverse your portfolio may be, PPM is crucial in enabling you and your team to track progress toward overarching objectives. Concentrating on individual projects can escalate overhead expenses and result in diminished ROI. In contrast, consolidating project management as a portfolio enables you to prioritize efforts on the appropriate projects at the appropriate time.

According to Anderson (2008), the goals of portfolio management are as follows: to identify goals and objectives, to make trade-offs, to manage risks, to assess portfolio performance, and to meet the organization's goals. Complementarily, in order to accomplish its goals, portfolio management is comprised of the following three primary steps: strategy considerations, individual project review, and portfolio selection (Gabriel et al, 2006). The portfolio's risk should be suitable owing to the portfolio's financial return, which is why risk management is another consideration in portfolio management (Pereira and Veloso, 2009).

Businesses today understand that projects are the means through which their business strategies are implemented, making it clear that picking the right projects is essential to meeting their goals and staying on track. Managers are responsible for selecting and regulating projects, which includes allocating resources, managing project and portfolio risk, and taking into account aspects like strategic alignment. There is a strong correlation between project success and the decision-making process, tools, and capabilities used to pick a portfolio of projects that would most effectively provide the anticipated benefits. Nonetheless, despite these efforts, the major global association for project management, the Project Management Institute (PMI), observed in 2013 that project failure rates remain high.

In order to update the product range, new items must be added, old products must be improved and modified, and outmoded products must be removed. New items are essential for a business to maintain its competitive position in the market (Balachandra, 1997; Poolton & Barclay, 1998; Lynn et al., 1999). While current goods are regularly improved for cost savings and functional enhancements, the percentage of completely new product creation is declining (Barczak et al., 2009). A company's product range may be expanded through mergers and acquisitions without requiring fresh product creation. Situations of this nature readily result in expanding product portfolios, as has been the case in several sectors over the last few decades (Hartog, 2012).

Portfolio management practices can aid in prioritizing and selecting the most appropriate projects to achieve strategic objectives and improve project success rates, which is especially useful given the widespread challenges of resource scarcity and uncertainty management faced by organizations across Australia and the world. The basic goal of MPT, as stated in Harry Markowitz's original 1952 work on the topic, is to optimize a portfolio to provide the maximum potential return for a given degree of risk. It determines the overall risk-return and categorizes portfolios as either efficient or inefficient. (Hadjinicolaou et al., 2017).

II. METHODOLOGY

***A. MATERIAL AND METHOD SELECTION***  
To accomplish our study goals, we conducted a systematic literature review (SLR) concentrating on the top publications disseminating project sustainability research.

In order to explore the most prevalent themes that have been published in the field of portfolio management and the gaps in each theme in the manufacturing industry, this paper presents a systematic literature review of all papers that have been published in top journals and specialized journals in the field of portfolio management.

This thorough literature study aims to give an in-depth analysis of portfolio management methods in the manufacturing industry, with a particular emphasis on recent advancements and trends. The study will be based on a comprehensive search of academic and industry publications, utilizing a systematic approach to identify relevant studies published between 2016 and 2023. The review will identify key challenges and opportunities for companies to improve their portfolio management effectiveness by examining the current state of portfolio management practices in the manufacturing sector. This will be done by examining the current state of portfolio management practices in the manufacturing sector.

The protocol for the systematic literature review of the current research was based on the following steps (Fink, 2014).

***B. FORMULATING THE RESEARCH QUESTIONS***

The first step was selecting the research questions. We created a protocol review to create research questions using the population, intervention, comparison, outcomes, and context (PICOC) technique (Booth et al, 2016). The research questions in this article were

* RQ:1. What is the impact of risk in portfolio management in the manufacturing sector?
* RQ:2. How to maintain sustainability in portfolio management from the supply chain perspective?
* RQ:3. How does technology in manufacturing enhance operational performance, thus portfolio management?

***C. SEARCH STRING***

We attempted to determine if a literature review was necessary for RQs 1, 2, and 3. We acquired early 2016 portfolio management articles after locating publications that mention portfolio management. The search for publications was thus restricted to the years 2016 to 2023. The needed sources, such as websites, article databases, and others, must be chosen to determine the pertinent literature. The sources to be used for searching the articles were first decided, which were Google scholar, search gate, Academia, Scoupus, and Springer. The keywords used for searching literature reviews were ‘Manufacturing risk, technology, supply chain, portfolio management, and manufacturer sector.’

***D. INCLUSION AND EXCLUSION CRITERIA***

The next steps involved using methodical and practical screening criteria to choose the pertinent material from the body of found literature. We developed criteria for the articles' inclusion and exclusion appended below in Table I.

TABLE I

INCLUSION AND EXCLUSION CRITERIA

|  |  |
| --- | --- |
|  | |
| Inclusion Criteria | Exclusion Criteria |
| Articles and academic paper published in English were included. | Those articles published in language other than English were excluded. |
| The publications that were considered for this study have been published between 2016 and 2023. | Papers or articles that were published before 2016 were excluded for this study. |
| Only papers from academic journals were included in the study. | Books, online sites, and gray literature (conferences, reports, technical reports, etc.) were excluded. |
| Only articles published in Google scholar, search gate, Academia, Scoupus, and Springer were included. | Other articles were excluded. |
|  |  |

Then, publications that fit the research question were chosen, and duplicate articles were eliminated. Mendeley's software was employed to arrange the papers for study.

***E. SCREENING OF ARTICLES***

The purpose of this part was to find publications that were pertinent to the review's objectives and the scope of the research questions. A total of 54 articles stood out as the most pertinent. However, after individual analysis, it was necessary to exclude 37 research papers since they were either redundant or unrelated to the study. In the end, 17 papers were chosen for this review. By examining the inclusion and exclusion criteria, readers may comprehend why some publications they are familiar with have been omitted from the evaluation (Booth et al., 2012). Two phases were taken in the analysis of the studies, the first of which was a quick scan of the paper abstracts. It soon became apparent, though, that, in certain situations, examining the article's abstract alone was insufficient and that it would also be essential to assess the work's findings (Rodriguez et al., 2012). Also, the papers were filtered according to their objectives in association with the main topic of the research paper (Fig. 1).

Research Questions

RQ:1. What is the impact of risk in portfolio management in the manufacturing sector?

RQ:2. How to maintain sustainability in portfolio management from the supply chain perspective?

RQ:3. How does technology in manufacturing enhance the operational performance, thus the portfolio management?

Keywords:

Manufacturing risk, technology, supply chain, portfolio management, manufacturer sector

Strings

Academia

Scoupus

Springer

Google Scholar

Articles

(2016-2023)

Research gate

Articles

(2016-2023)

Articles

(2016-2023)

Articles

(2016-2023)

Articles

(2016-2023)

**FIGURE 1**. SLR Flow Diagram

2016-2023

2016-2023

2016-2023

2016-2023

2016-2023

***F. REPORTING AND USING THE RESULTS***

The last step was designed to compile and document the findings. The following qualitative criteria were chosen for a more thorough evaluation and improvement of the work under study:

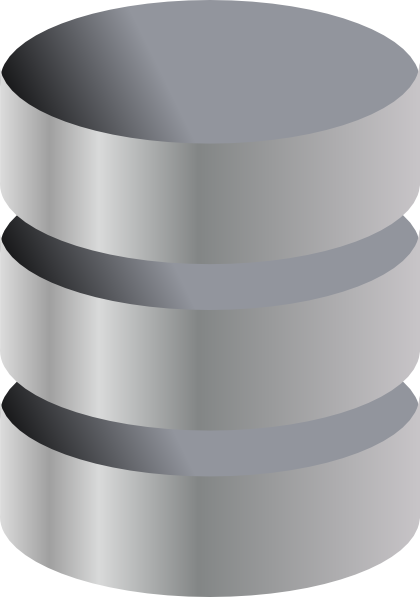
* "Is the research topic clearly stated or is it pertinent to our specific research questions?"
* Are the articles' conclusions trustworthy and pertinent to our research topic?
* Are there any similarities between the goals and objectives of the research and those of our work?

We compared the results from the earlier stages to the original objectives. With the use of this comparison, we were able to highlight the key findings of our study (Ferenhof & Fernandes, 2016).

III. REVIEW OF LITERATURE

Vogel and Lasch (2016) did a research on increasing complexity in manufacturing sector. They have considered it as one of the major issues being faced by the companies during last few years. In high tech market many companies encounter several challenges such as competitive environments, technical innovations, market globalization and changing customer needs. These trends are inescapable and creates complexity. Complexity drivers are considered as the internal and external sources responsible for the complexity. The purpose of this study was to provide an overview of complexity drivers in manufacturing industries. This paper includes the identification, visualization and operation of the complexity drivers. For purpose of clustering complexity drivers they had developed a superior classification system considering the previous systems found in literature. This research also identified the gaps of methodologies in the existing literature. They had concluded the defects of literature that only focused on supply chain and logistics. According to them applied research methods were not discussed in detail.

Shelar (2016) conducted a research study on the operational management techniques in the manufacturing domain. The study analyzed operational disciplines such as Lean Sig Sigma, JIT. ERP, VAE, and TOC and also suggested various opportunities in these areas. Integrated approach possibility was also investigated in case logical development fails to be associated with operational management implementation in manufacturing organizations. The Operational management techniques have become a core of excellence in manufacturing domains.   
These studies can bring a value to result. To ensure valuable market share and high profit an essential requisite for the company is to safeguard the quality of products. Tools such as JIT, lean Six Sigma (Fig. 2), Quality Assurance (QA), and Zero Defect were utilized for adherence of quality and improvements in the product during this study review.



**Growth and Productivity**



**Define**

**Analyze**

**Measure**

**Improve**

**Management Pipeline**

**Control**

**FIGURE 2**. Six Sigma Process

Doorasamy (2017) studied the models and theories which supports successful development of new products for portfolio management practices. This review was based on the selected studies of portfolio management which was summarized and compared with experiences, models and theories of other authors. This study follows qualitative approach rather than quantitative. Development of new products is vital for the businesses to meet the ever changing market conditions and customer’s needs. There are many preexisting models for development of new products the most noticeable among them found in the scientists study is Cooper’s stage-gate process. The model is primarily focused on a customized product development route from idea creation to production and launch of the product In other words, it is a linear picture of the entire process of commercialization and invention that has been simplified. According to a pragmatic approach there is not a complete one stop model for product development. Development of new product and ability to manage the quality and quantity to meet the goal of development makes inevitable product portfolio management. The study shows need to identify the model that applies on particular industry for new product development.

Ye and Hong (2019) worked on implementation of technology for betterment of portfolio management. Production processes needs to improve in terms of flexibility, transparency and adaptability as per diverse customer requirements. In this study cyberphysical systems also known as CPS technology was deployed in manufacturing facilities and equipping sections with adaption capability. The concept of this paper was based on Assets administration shell (AAS) which was proved to be useful for diminishing gaps in communication among the components of 14.0. This paper was mainly focused on the general approach pf AAS as the detailed modules were not defined at that time. This study provided 14.0 stakeholders a high level technology implementation with all the necessary guidelines to develop their own AAS activity and implement it.

Ghobakhloo and Fathi (2019) did a study on the use of information technology in small manufacturing companies. This study provided small firms a method to use their IT resource for developing a new digital system to sustain in a competitive industrial era. The research followed case study methods to gather data of manufacturing firm and demonstrated the voyage from failure to success by using planning and integrating technology in the organization. The study focus on trends of 4.0 industry technologies. The transition of organization traditional methods to IT based solutions and digitalization in small firms of manufacturing sector resulted in enhancement of the firm’s performance. Lean digitized manufacturing system was identified as profitable strategy and also helped in survival of the small company in industrial era. Overall findings of the study suggested that typical manufacturers should incorporate industry 4.0 transition equally in their operational, organizational and technical practices. Superior competitiveness could be attained if digitalization of processes and operations is done in a way strategic planning is successful.

Afum *et al*. 2020 used a mediation approach to find the relation between operational competitiveness, sustainable performance, green manufacturing practices and firm reputation. This study developed a structured questionnaire to achieve stable data from 158 firms belonging to manufacturing sector. All the hypothetical relationships were tested using equation partial least square modelling. The findings of the paper showed a significant positive impact of green manufacturing on three sustainable supply chain factors i.e. economic, social and environmental. However operational performance and company repute didn’t affect the economic performance which was further verified by mediation analysis. Contrarily a mediate relationship was identified between social performance and economic performance with respect to green manufacturing. Moderating variables were not considered in this study.

Flores, L.A., 2020 analyzed the existing relationship between business performance and portfolio management. He conducted a systematic literature review using scientific databases particularly related to management using inclusion and exclusion criteria techniques. Out of 940 articles he screened 66 and did a comprehensive study. He covered different research perspective regarding portfolio management in his work. He had utilized case studies of medium enterprises and showed a qualitative analysis to generalize the results.

Cruz Villazón *et al*. (2020) studied key performance indicators in project-based organizations through the lean approach to carry out these measurements through the use of KPIs metrics. KPIs provide an objective criterion for measuring business activities and project success KPI’s are a remarkably important part of corporate strategy for forecasting, measuring and planning business. Study suggested that KPI’s are used to measure success and aligning the process towards specific objective to achieve organization goals. Solid corporate culture pushes the performance of each objective that impact the strategy implementation .According to the paper there are four main factor that must be taken in consideration to develop KPIs. First aligning activities with objective, second gathering information to improve activities; third monitoring the people and activities involve.

Qayyum and Khan (2021) worked from 199 to 2018 on the international diversification benefits in real estate residential markets. This study was based on data collected from 23 countries. The correlation was figured between stock market and global indexes of real estate. Analysis indicated the benefits of diversification over time regarding portfolio management and positive relation was observed between investments and lower risk potential.

Kerzner, (2022) narrated that Key performance indicators must be controllable and measurable that’s why they should be qualitative and quantitative. KPI’s most important characteristic is that it’s actionable, analyzing that actions can be taken to correct any negative trends.

Zhou *et al.* (2022) studied the application of ICTs in the manufacturing sector and how it improves the overall productivity and commute between systems .According to the literature in this article information technologies can change the way of interaction and how work needed to be done and managed. The paper covers various aspects such as networking, collaborative and autonomous decision making, learning and adaptability of intelligent manufacturing systems. Total of five themes were focused in this study such as mechanism, capacity planning, value creation, resource configuration, logistics and scheduling.

IV. RESULTS

Following research questions were formulated in the methodology section based on literature review and the answer to theses are derived from various research papers and combining the overall research study.

RQ:1. What is the impact of risk in portfolio management in the manufacturing sector?

RQ:2. How to maintain sustainability in portfolio management from the supply chain perspective?

RQ:3. How does technology in manufacturing enhance operational performance, thus portfolio management?

***A. IMPACT OF RISK IN PORTFOLIO MANAGEMENT***

When choosing an investment strategy, the risk is an important factor that needs to be taken into account. The manufacturing industry is particularly vulnerable to hazards, including those related to the economy, politics, and technology.

Risk can emerge from a variety of sources in the manufacturing industry, including shifts in demand, interruptions in the supply chain, modifications to governmental regulations, and technological disruptions. For instance, during a pandemic, a producer of personal protective equipment would see a spike in demand, but they might also be exposed to changes in governmental laws or supply chain disruptions.

1) Diversification

To lessen the effect of specific asset or sector risks on the total portfolio, investments are diversified across a variety of different assets, industries, and locations. It entails investing in a range of assets to distribute risk across many industries, sectors, and geographical locations. Risks related to specific assets or industries can be lessened with the use of a well-diversified portfolio.

Changes in politics, the economy, society, and technology can have a beneficial or negative effect on portfolio management. A sudden surge in product demand, inflation, or a decline in demand are examples of economic risk. Changes in tax rates, governmental policies, trade regulations, etc. are all examples of political risk. Supply chains may be disrupted by technology, or consumer preferences may shift towards a certain product.

Diversification can also help to reduce the volatility of returns in a portfolio. Investing in multiple portfolio manufacturers can reduce the impact of PESTEL factors (Fig. 3).



**FIGURE 3**. PESTEL Analysis (Source: https://springworks.ch/en/pestel-analysis/)

2) Risk management tools

Several risk management solutions are available to reduce hazards affecting portfolio management. According to a study by Wang *et al.* (2018), diversification can improve returns side by side lowering portfolio risk, particularly during periods of market volatility. By choosing the most effective assets that balances risk and return, portfolio optimization can help to reduce the impact of risks on portfolio management, according to another study by Ji *et al.* (2021).

A powerful took such as Hedging can aid in lowering the risk of stock portfolios, especially during periods of market downturns, according to a 2021 study by Cai and Feng. Stop-loss orders and limit orders are examples of risk management techniques that can help to lessen the effect of hazards on portfolio management. Stop-loss orders cause a security to be automatically sold when a specified price is reached. Stop-loss orders and limit orders can help to reduce the impact of market volatility on portfolio management, according to a study by Alcock et al. (2016).

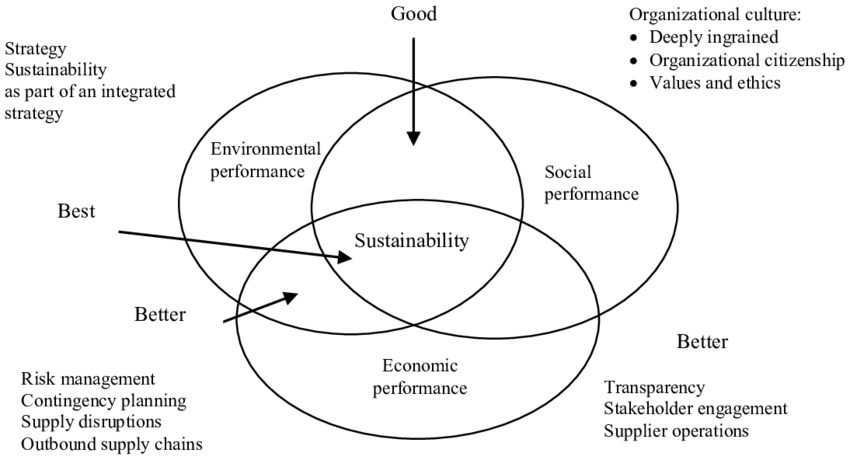
In Conclusion, portfolio management and risk factors are interlinked and have significant impacts on one another. Different methods can be used to reduce and mitigate the risk. Diversification and application of risk management strategies can help investors get more stable returns.

***B. SUSTAINABILITY IN PORTFOLIO MANAGEMENT (SUPPLY CHAIN PERSPECTIVE)***

To maintain sustainability with respect to portfolio management prerequisites include three main factors to be considered i.e. environmental, social, and economic. For maintaining a sustainable supply chain, a managerial person has to consider some factors such as; labor conditions, carbon emissions, and waste management, health, and safety concerns.

Dubey et al. (2017) described the strategic coordination of business tactics and functions within a company across businesses with the supply chain.  De Camargo et al. (2018) described in their study that it is important to identify the risks associated with the supply chain and they can be any kind of risks such as climate change, scarcity of resources, and violation of human rights.

Christopher and Holweg (2017) defined Supply chain management as managing the relationships upstream and downstream with suppliers and customers to deliver high value at lower costs. Based on these definitions another study was found by Carter and Liane (2011) where they developed a framework of concepts having sustainability in relation to SCM. The framework was a triple bottom with 4 different sustainability categories including risk management, strategy, transparency, and culture of an organization (Fig. 4)



**Figure 4.** Sustainability in Supply Chain Model (Source: Carter and Liane (2011)

***C. RELATION BETWEEN MANUFACTURING TECHNOLOGY AND PORTFOLIO MANAGEMENT***

Technology has played a pivotal role in the manufacturing sector and has significantly increased operational productivity. The benefits of using technology are not limited to the improvement of quality but also have a positive impact on portfolio management. Different studies were conducted to find the role of technology in improving operational performance regarding portfolio management.

According to Kumar and Kumar (2018), research using technology in the manufacturing sector has improved productivity and quality along with reducing lead time. According to this study implementing technology can enhance operational performance which in turn benefits portfolio management.

Another study by Zhang *et al*. (2021) supported the role of supply chain management for cost reduction and better management of the inventory thus increasing efficiency. This study found using some technologies such as Barcode scanning and RFID significantly enhanced supply chain management.

A significant study was done by Manresa *et al*. (2021). The study analyzes the extent to which the implementation of new technologies can directly affect operational performance. This work is very extensive in nature depending on the data collection and survey of 101 manufacturing firms.  The European Manufacturing Survey was used to collect data for this research work. The main focus of this section is on how digitalization is related to operational performance as illustrated in Fig. 5.

**H1**

Digitalization

Operational performance

**H3**

**H2**

Organizational practices

**Figure 5.** Relation of Digitalization and Operational Performance

Digitalization was measured by scale score using Cronbach’s α=0.718. The population size consisted of 64% SMEs out of these 25% was in chemical industries, 26% were in food and 20% were single-unit productions. The manufacturing companies on which the study was implemented were of 8 organizational practices.

The study hypotheses were tested and brought a positive outcome on operational performance. Implementation of production control real-time systems had a direct relation to production lead time. A negative effect was shown on a negative performance indicator which represents that companies should implement this technology to have a positive outcome and to reduce the lead production time. The use of digital means for exchanging product data and product life cycle management brought significant enhancements resulting in more timely delivered orders. Quality problems were also minimized as the scrap rate was decreased.

As per the Second hypothesis of the paper organizational practices and operational performance have a positive effect on each other as the production lead time (p = − 107); indicated a reductive effect on lead time. Thus company would need less days for production. The results of the paper were justified by regression analysis as depicted in Table II.

TABLE II

REGRESSION ANALYSIS OF THE DATA COLLECTED FROM MANUFACTURING FIRMS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Production lead time B | Orders on time B | Scrap rate B | Quality complains B |
| *Control variables* |  |  |  |  |
| Firms 50 to 99 employees | 0 | 0.56\*\*\* | 0.4 | 0.31 |
| Firms 100 to 250 employees | – 0.02 | 0.68\*\*\* | 0.44 | 0.4 |
| Firms 250 or more employees | 0.31 | 0.62\*\*\* | 0.37\*\* | 0.3 |
| Food | 0.43\*\*\* | – 0.09 | – 0.25 | 0.26 |
| Textile | – 0.19 | 0.07 | 0.16 | 0.52\*\*\* |
| Chemical | – 0.21 | 0.32 | 0.15 | 0.43\*\*\* |
| Machinery | 0.25 | 0.29 | 0.11 | 0.56\*\*\* |
| Electronic | 0.13 | 0.16 | 0.37 | 0.32\*\* |
| Medium batch | – 0.22 | – 0.08 | 0.15 | – 0.30\*\* |
| *Explanatory variables* |
| organizational practices | – 1.07\*\* | 1.02\*\* | – 0.01 | – 0.34\* |
| Real-time production control system | – 0.21\* | 0.09 | – 0.08 | – 0.04 |
| Digital exchange of product data | – 0.31\*\* | 0.41\*\* | – 0.24 | – 0.15 |
| Product-Lifecycle-Management-System | – 0.01 | 0.27\*\* | – 0.06 | – 0.25\*\* |
| Technologies for safe human−machine | 0.02 | – 0.30 | – 0.40\*\* | – 0.44\*\* |
| In\_ organizational practices and DI \_RealtimeControl | – 0.13 | – 0.23 | – 0.14 | – 0.48\*\*\* |
| In\_ organizational practices and DI \_DigExchange | – 0.71\*\* | 0.26 | 0.12 | -0.19 |
| In\_ organizational practices and DI \_safeHumMach | – 0.28 | 0.05 | – 0.54\*\*\* | – 0.64\*\*\* |
| *Model statistics* |
| *p* value | 0 | 0.01 | 0.03 | 0 |
| F value | 0.33 | 0.74 | 1.04 | 3.01 |
| R square | 0.58 | 0.5 | 0.44 | 0.6 |

The above-mentioned study describes the direct relationship between technological implementation and operational management which in turn adds to the efficacy of portfolio management.

V. DISCUSSION

The manufacturing sector is subjected to multiple challenges when it comes to portfolio management and market risk factor is among them. Managers and shareholders are always concerned about the risks involved during decision-making and investments.

***A. RISK MANAGEMENT STRATEGIES***

Risk impact on portfolio management is studied by reviewing various research studies done so far. In this paper, diversification and efficient utilization of risk management tools such as Hedging is found to be beneficial to mitigate the risk factor. As proven by a study done by Aliu *et al*. (2017) diversification formula for return on equity declined the risk level. Joining manufacturers with suppliers can reduce the risk potential effectively. Considering the Literature and the above mentioned study if the technique of diversifying investment in different portfolios is implemented along with the risk management tools then risk factor can be reduced.

Portfolio managers find risk factors critical as the significant impact is observed on the investment portfolio's overall performance. Market volatility, changing interest rates, and political instability can be considered major challenges that can reduce return rates. A better way to mitigate the adverse effects is by dividing the investment into multiple assets, regions, and even industries as analyzed in Fig. 6.

**Figure 6.** Risk Management Strategies

The data is interpreted by the literature findings to support this fact readings are used to represent this relationship in this graph. The above graph shows an inverse relationship between the risk factor and diversification formula. If the investment is diversified in various portfolios the risk factor is minimized, similarly, the risk management tools also help reduce the risk, however, and if both strategies are applied simultaneously then the overall risk factor is minimal.

Risk management tools are of crucial importance for optimizing performance and reducing risk factors.  Supply chain disruptions, regulatory changes, and equipment failure are the risks of manufacturing sectors that can be handled with tools. Proper management techniques are needed to be followed counter wise the situation can be damaging for company’s reputation. Tools such as predictive maintenance, contingency planning, quality control systems, and predictive management can be useful Zsidisin *et al* (2000).

***B. SUSTAINABLE SUPPLY CHAIN IMPORTANCE AND ITS FACTORS***

Sustainability comes along with supply chain management to maintain a portfolio as per consumer needs. The sustainable mindset of stakeholders is a prerequisite for management and practices. This paper highlights the importance of sustainability to overcome the challenges of production and consumption demand.

Social, economic, and environmental conditions are the three major factors considered in this paper for maintaining a sustainable supply chain. Environmental conditions of a company including all the resources affect the overall sustainability reported by Fritz (2022) in his work.

Sustainable supply chain management revolves around all the components starting with sourcing the raw material to delivering the end products to the consumers. A sustainable supply chain ensures customer loyalty and ethical practices. A balanced portfolio needs a sustainable supply chain. To achieve the desired outcome company supply chain needs to align with risk identification and its management, business strategies, and innovations. According to research, Albino *et al.* (2012) sustainable supply chain can enhance financial stability and performance i.e. reducing carbon footprints and pollution which results in customer satisfaction and also benefits a company's reputation.

Environmental pollution is a hurdle for the production process and possess serious issues for manufacturing companies. Companies’ highest social concerns include human rights safety and occupational safety. Social sustainability is dynamic in nature it is not a constant factor. Most companies are in need to counter the performance and quality that can be affected by social and economic problems.

Another issue of social nature is supplier relationships and the selection of suppliers. The return on investment is dependent on the choice of employees and wages a company offers. To enhance the quality of products and maintain the sustainable supply chain business practices and supplier evaluation is mandatory for the development.

The economic perspective of sustainability revolves around the cost of raw materials and energy. Operation income, net income, and sales are directly linked with costs. Research and development utilize the largest share as quality enhancement and sustainability depends on innovations. Manufacturing companies hold a budget for R&D that can provide long-term profit through the improvement of products and increased sales.

***C. TECHNICAL ADVANCEMENTS AND THEIR RELATION TO OPERATIONAL PERFORMANCE***

In this paper use of technology specifically, digitalization impact is investigated concerning the enhancement of operational performance and how it affects portfolio management. The findings show a direct relationship between technology, organization practices, and operational performance as analyzed in Fig. 7. Organizational practices and human resource development also play an important role in improving operational performance along with digitalization.

**Figure 7.** Relationship between technology and operational performance

The above graph shows direct relationship between technology and operational performance as identified from the literature findings. Implementing the right techniques and use of digitalization in firms can enhance the overall operational performance and reduce the scrap rate.

Reported by Johan (2020) advancements in technology have a significant impact on the operational performance of the organizations and it has greatly helped the organizations transform and enhance their processes to increase the efficiency. If new techniques are implemented then the lead time is reduced which results in more quality products and flexibility in production rates. Analytics tools are used to help companies identify inefficiencies and to target the processes for improvements.

According to research best practices such as Six Sigma, and lean manufacturing adoption can help organizations to improve satisfaction and reduce waste. Organizational practices such as training and empowerment of employees can improve the workforce and ultimately lead to better performance. Berggren *et al.* (2019).

VI. CONCLUSION

Science of portfolio management is still vague to answer the portfolio construction. A well-organized portfolio can generate maximum profit. The results of present study based on systematic literature review highlights importance of risk management when making investment plans. Stakeholders can use diversification formula to ensure the investment safety. Risk management strategies should be employed to avoid any loss or less return on investment. Different portfolios are ideal for investments.

The portfolio maintenance also include sustainability of supply chain that can be achieved by considering social, economic and environmental issues of the firms. Supply chain value and sustainability is attained when all the related personal including managers, policymakers, consultants, educationists and stakeholders adopt the perspective of a system as a whole rather than on individual basis.

The analysis shows firm performance with parameters and the operational performance is enhanced with use of digitalization as the communication gaps are reduced which in turn minimized the time of production and the quality is also enhanced thus the portfolio management is proved to be a success. The use of technology and its benefits also emphasizes the facts that firms and new businesses needs to invest on R&D for long term sustainability.

**VII. RECOMMENDATIONS FOR FUTURE RESEARCH**

* Implementing this study on service sector industries can lead to the exploration of new mediating and moderating variables involved in portfolio management.
* Adding more variables to the present study can define the relationships between digitalization and operational performance in a better way.
* Factors like business strategies, human resource development, tools for risk management, innovation, and adaptability are yet to be explored.
* Different organizational practices can be studied to find the other variable for the successful implementation of technology.
* Supply chain value needs to be studied to understand the way of engaging stakeholders and overcoming sustainability challenges related to production and consumption.
* Diversification, differentiation, and dynamism of both production and service organizations should be studied and used to develop key performance indicators.

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