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IMPACT OF LEAN WAREHOUSING ON BUSINESS PERFORMANCE IN FIRMS IN RETAIL INDUSTRY OF PAKISTAN; MEDIATING ROLE OF WAREHOUSE OPERATIONAL PERFORMANCE AND SUPPLY CHAIN COMPLEXITY (A STUDY OF QUANTITATIVE ANALYSIS)

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ABSTRACT

Current work has emphasized on how warehouses improve the business performance overall. Hence, lean principles have moulded in enhancing warehouse operations. The central idea of this thesis is to analyse the relations amongst lean warehousing, warehouse operational performance, supply chain complexity and business performance.

A questionnaire was distributed to warehouse related employees in the retail industry of Pakistan in order to gather insights about the waste reduction initiatives carried out and to thereby test the hypothesis developed. It was known that lean warehousing impacts business performance, improving it overall and both warehouse operational performance and supply chain complexity mediates this relation. The instrument acts as a guide for warehouse managers to obtain insights on how to reduce waste in their setting. The outcomes also inform them how supply chain complexity can impact their business performance and how to overcome it through lean warehousing. This will eventually impact their business performance. The particular research creates an instrument for measuring wasteful activities taking place in warehouses and offers a view into evolving lean warehousing.

INTRODUCTION

1.1 Background of the Study

The concept of lean, as proposed by Danese et al. (2017), has changed from merely a system used in the production sector of firms (for instance, Just in Time) to a user-centric system that is generally used by all in any operations of the organisation. Hence, the notion has evolved from just an approach that removed waste and variability at the manufacturing facilities to a widely used system that manages two major things in the firm- the internal aspects and the ones external to it such as the supply chain (Hines et al., 2004).

According to Swenseth et al. (2016), the utilization of lean in the logistics is to enhance all the functions and flows (for example, material and information) from one end to another in order to improve quality, reduce waste and cost and enhance its flexibility.

One major element of lean has been highlighted in the research of Berger et al. (2018), that since it aims to reduce waste, lean influences performance as well. Thereby, it is important to look into the studies narrating this issue; the common factors are to be found and differentiated and conclusions are to be drawn

to contribute to the existing theories with respect to the field.

Warehouse operations help firms a lot in managing and the storage of items, particularly when they are striving in a competitive environment (Pereira, 2021). To have a n effective flow, they are vital to be present in the supply chain. However, some warehouses are not optimised enough as they are involved in non value-adding activities.

Panwar et al. (2017), went on to say that such activities give birth to operational waste as they don't contribute to the enhancement of the customer satisfaction or warehouse operational performance. Due to this, finding and eliminating such factors have become a major problem in enhancing the efficiency of warehouse workflows and the network.

A research by Hoole (2005), examined that supply chain complexity arises due to the outcomes of several minor unrelated decisions taken by the firm, over time that leads to outdated operations or activities that don't serve the firm's current needs. In lieu of this, Chand et al. (2022)'s study highlighted that the main drivers which reduce performance levels are schedule instability, disruptions and substandard verdicts. The respective element, taken as conditional mediator in the study, affects associations amidst lean warehousing and performance (Bozarth et al., 2009). Factors such as those inside and outside to the supply network are considered where the disruptions are caused. Supply chain complexity negatively mediates the relation amidst lean warehousing and performance, some researchers such as Soliman and Saurin (2022), proposed that there are a few positive ones bringing light to two kinds of supply chain complexity-strategic and dysfunctional. However, the element is found in every firm and cannot be ignored from the supply chain domain.

1.2 INTRODUCTION

In the research of Villarreal (2016) and Shah and Khanzode (2017), lean is the most influential managerial theory. For long, firms have tried to implement methods and tools that would streamline their functions and workflows, basing them on the perspective of lean.

In order to successfully implement the concept of lean, firms have to understand "waste", which is referred to as those functions that are zero profit to the organisation. In other words, it can be described as those materials, apart from the required ones, that are not essential to perform any activity. As discussed earlier, lean emphasises mainly on the production plan of the firm, but now this Japanese ideology is being used in a wider range of industrial sectors.

Much importance has been given to the waste reduction practices in the subject of supply chain management. Researchers like Salhieh et al. (2018) had focused on lean transportation, Drake et al. (2013) had proposed the idea of lean purchasing and Myerson (2012) had emphasised on lean supply chain.

However, researchers such as Gu, Goetschalckx, and McGinnis (2010), Sharma et al. (2015) and Shah and Khanzode (2017) objected that the coordination of lean with the warehouse operations had not been given much importance as compared to other areas therein. The vitality of lean in warehousing is demonstrated in the research of Pires et al. (2017) and Satyam et al. (2017) who put forward that through it, the refinement of the overall logistics will be achieved; be it upstream, downstream or the distribution channels.

Warehouses can be described as a means of wasteful places because of the complex functions they undergo. The methodologies and tools of lean ideology are utilised to enhance the internal functions of logistics (Dotoli et al., 2015). Hence, there is a possibility to identify the non-value adding elements of the warehouse and eliminating them. A definition can be given to such methods; a particular set of tasks undergone in a firm to enhance the effectiveness of the structure.

The study takes help of the resource-based view (RBV) theory, originally proposed by Barney (1991), that the firm's ability to gain competitive advantage and higher levels of performance is through the utilisation of internal resources; avoiding the wasteful activities in the warehouse operations will enable the business to enhance its overall performance.

The previous work of scholars on lean warehousing have mostly focused at the benefits of the implementation of similar methods in the workflows of the warehouse to decrease the

lead time and expense therein. Nevertheless, there is little work on the framework to evaluate the initiatives of waste elimination methods in the respective sector.

Hence, introducing such a method is vital, as application of any lean warehousing practices should begin by examining the current situation of the wasteful elements in the warehouse (Sharma & Shah, 2016).

As mentioned above, the definition of lean has evolved from the Toyota Production System and is expanding to major production organisations in either developing or developed countries. There is a well accepted concept that lean enhances performance, which is not absolutely correct; other factors that may impact the association amidst lean and performance are not accounted for. One element, proposed by Akin et al. (2022), is supply chain complexity which is known as the concerning matters in the supply chain.

According to Prater (2001), supply chains, worldwide, are ever changing and complex in nature and in lieu of this Akin et al. (2022), proposed that the international linkages of upstream and downstream elements with respect to the flows of information and relations are complex. The research is through the concept through the help of the graph theory-based approach; the concept describes the supply chain complexity by the level of nodes that are present in the network. This demonstrates that the higher the nodes, the more the supply chain is vulnerable to problematic issues.

Such chains have to interact with several suppliers and customers worldwide (Bier et al., 2021). Even though the adverse impact of the particular variable is well known, individuals in the firm face challenges in identifying the mechanisms through which it influences the business performance.

Lean practices adopted in the supply chain such as those in the warehouses, enable businesses to create a coordinated relation with the providers and also create alternatives in order to prevent risks that develop complexity. Moreover, Suri (2016), suggested that few elements may or may not be strategic; for instance, enlarging the customer segment is linked with higher profits even though it increases complexity. Whilst the previous studies regarding the respective element has particularly emphasised on dysfunctional complexity such providing outcomes like quality issues, disruptions and lack of resilience, strategic supply chain complexity can be linked with outcomes like product variety, higher profits, technological enhancements and better customer service.

Hence, an important question is raised by Chand et al. (2022), regarding the mechanisms by which the variable impacts the relation between lean warehousing and performance-particularly to elaborate the “why” and “how” of the relation. Knowing how the relation between the two is influenced can lead to examining complexity levers with major influence, to enhance the performance (Hoole, 2005).

The research explores how the supply chain complexity determines the business performance by examining two mechanisms; mediation and moderation. The latter emphasises on the lean and complex notion, where lean methodologies are applied in a higher complex environment of supply chain. The former, looks into the relation where there are unintended outcomes of supply chain complexity. This could either positively or adversely be linked to business performance depending if it's either dysfunctional or strategic.

The complexity that is inevitable in the business environment, reduces the performances of businesses. Also, lean practices in the warehouse increases some elements of complexity which brings either favorable or an adverse influence on performance; optimising the picking strategies for instance, may actually enhance the business performance demonstrating opportunities obtained from the complexity (the technological aspect) may outweigh the disadvantages.

The literature demonstrates that increasing the complexity does not mean that there will be negative outcomes in the performance of the business. Emphasising on the particular perspective, the research created an integrated model that will include various variables and mechanisms involved with business performance.

1.3 SIGNIFICANCE OF RESEARCH

The present research extends previous research by examining the relations between lean warehousing and business performance at the supply chain level. Furthermore, it explores this relation within the context of warehouse operational performance and supply chain complexity highlighting whether these two elements will facilitate or strengthen/diminish the relation respectively. The results will be beneficial with regards to reducing wasteful activities being taken place in the warehouse and which impact the business performance with regards to not aiding them achieve their objectives.

1.4 Research Gap

In a warehouse setting, there are operations being taken place that lead to the achieve the objectives of the business and enhance their performance. However, in some cases, there are wasteful activities that take place which impact the said performance. The element of lean warehousing existing in the supply chains has influenced the business performance. The research will examine how this happens.

1.5 PROBLEM STATEMENTS

The principles of lean have been used in Asian markets, specifically in the logistics and manufacturing sectors. In nations such as Indonesia, Malaysia and India, methodologies of the respective concept have positively impacted the performances of business; by increasing efficiency and lowering expenses (Samarrokhi et al., 2015; Nawanir et al., 2013). As Pakistan continues to enhance its economy, industries like retail, must adopt effective management methods like lean to sustain competitive advantage. Research on lean in the country's retail industry is scarce, particularly in the domain. However some firms do put this in practice and therefore this research will analyze the research gap:

- How does lean warehousing influence the business as well as the warehouse operational performance?
- How does the predictor warehouse operational performance and supply chain complexity mediate the relation amidst lean warehousing and business performance?
- What is the impact of supply chain complexity on the relation amid lean warehousing and business performance?

1.6 OBJECTIVES OF RESEARCH

- To clearly define the concepts used (lean warehousing, warehouse operational performance, and supply chain complexity) and to evaluate the influence of lean warehousing and warehouse operational on the performance of the business.
- To obtain consensus on important queries to be comprised in a questionnaire for perceptions of lean warehousing.

1.7 PURPOSE OF RESEARCH

The research aims to examine a search structure that analyses warehouse operational performance and supply chain complexity as facilitators of the influence of lean warehousing on intentions to performance.

1.8 Limitations of Research

While carrying out the research there were various limitations that were encountered. The main one is that the topic is not common for many people in the retail industry; the concept of "lean" may have been adopted by firms but they are not aware of the particular word and only some examples and data was gathered through an explanatory research. This led to a reduction to the targeted population as well as sample size that decreased respondents and participation in this research, although we choose convenience sampling techniques where there are no restrictions but still this is a problem. Time constraint is also a limitation for this study that we are not able to collect more data and information for further implications. More limitations are the financial support and the security purpose results in lacking resources as many research papers have restrictions of payments so we are not able to gather more knowledge in reference with our research.

1.9 Thesis Structure

The following sections of the particular research will be in the manner. Section II will be in-depth literature over the respective subject. Section III, will demonstrate an in-depth interpretation of the methods used in this study. Next, section IV shows the results and section V looks into the

implications of those outcomes. Section VI concludes the research with the constraints and recommendations.

CHAPTER 02: LITERATURE REVIEW

2.1 Lean Warehousing and Business Performance

As proposed by Hopp and Spearman (2021), lean is a multi-dimensional concept that is used to enhance the workflows while reducing waste, based on the principles of just in time and synergistic methods aimed on minimising the lead time. Reducing waste can be described in several ways, however researchers acknowledge that it is obtained by developing an organisation that mainly emphasises on lowering products and lead time.

Recently, supply chain management researchers have been taking interest in the warehouse operations in their studies regarding retail and logistics (Pires el al,. 2017; Hübner et al., 2016); such as Rexhausen (2012) and Battista (2014), suggested that the management of warehouse can be defined to using the resources in the warehouse such handling equipment, loading and off-loading workflows, inventory and workforce in an optimal manner and making sure that innovative practices are used throughout.

Defoneska (2015), argued that, the reduction of non value- adding items in any form, in each production cycle will better the productivity and thereby decrease the overall expenses of the firm. This would also lead to enhanced customer service and satisfaction, resulting in improved business performance. From the customer side, who uses the offerings of a business, value can be described that activity of paying for the benefit he or she will receive from the item.

In the nutshell, Ayeni et al. (2016), proposed that lean methods are based on increasing satisfaction at lower costs, considering the quality of the offerings.

Lean warehousing is an ideology that needs systematic, constant, measurable and sustainable enhancement of the warehouse activities with the complete participation of all the partners involved (Dehdari, 2013). Furthermore, as per Vlachos and Bogdanovic (2013), a warehouse is in place to add value to the consumer by giving benefits- making the offerings available at the right time and place. However, the respective area can give birth to wasteful tasks.

The particular concept can be described as the elimination of non value-adding things in upstream and downstream supply chains, on the basis of the location and activities of the warehouse for catering to the customer demand (Jeffery & De Visser, 2014; Vinas, 2013).

These storage places face several difficulties that managers at the warehouse should be well known of and strive to resolve them. As proposed by Gu et al. (2010) and Sudding (2021), some of them are outdated operations, lack of quality measures, increased labour charges, unpleasant warehouse layout design and incorrect data regarding the products stored.

According to Berg et al. (1999) and De Koster (2017), if firms don't overcome these hurdles, they can give undesirable outcomes in the form of increased costs, reduced effectiveness and performance that would lead to lower customer satisfaction levels.

Picincu (2019), emphasised over the point that these places play a major role in impacting whether the consumers can obtain the firm's offerings in time. They lead in better control over the products and are thereby essential to improve the business operations.

Since lean methods bring effectiveness and productivity, a lean warehouse offers consumers products of highest quality. Some methods in the research of Pawliczek (2022), are six sigma, Kaizen and lean have shown major changes in the distribution sector; several pieces of research demonstrate the management of lean in warehouses a study by Bevilacqua (2019), depicted that it enabled minimising the time taken to store and pick products in a warehouse.

The perception of lean has been associated with the benefits it adds in the performance of the business in the work of (Peralta et al., 2020); even Mackelprang and Nair (2010), provided much information in his research regarding the relation between the two. In the thesis, they examine that lean is an abstract variable, with several aspects. Further, it is expensive to use it as it needs major modifications of current activities (Jacobs et al., 2015).

Hence Birkie (2016) and Tortorella et al. (2017), suggested that its vital to know the significance of the methods through which lean is linked with performance measures. Many studies were taken place with the aim to recognise the influence of lean warehouse methods on business performance in manufacturing and even service industries such as proposed by Andelkovic (2017), Reich (2018) and Andres Lopez (2015), suggested that it results in better production mechanisms, cost reduction, consumer satisfaction and improved performances mainly in the lead time. Likewise, if a firm is operating a warehouse solely, and has reduced levels of wasteful activities it will face higher levels of performance than its competitors such management of dynamic consumer demand and market requirements, accurate data flow and traceability, enhanced picking strategies and the like.

Hence the hypothesis:
H1: Lean warehousing has a positive relation with business performance.

2.2 LEAN WAREHOUSING AND WAREHOUSE OPERATIONAL PERFORMANCE

As suggested by Pereira (2020), storage places are vital for firms specially operating in competitive supply chains for managing and keeping inventory. Sudding (2021) and De Koster (2017), goes on to say that they are important for smooth flow of materials therein. Wasteful activities arise from several operations that do not offer any benefit to the consumer. Such tasks are called 'muda' as per the Toyota Production System (Jungheim, 2021; Karlsson et. al., 1996). As the warehouses have been known as places that create waste in the domains such as assembling, pricing, product packaging and labelling lean is implemented to reduce such wasteful activities (Jafari et al., 2016; Gracia et al., 2004). Not only this, according to Bozer et al. (2012), residual activities are also found in waiting, transportation, motion, over-processing, faults and overproduction Olesen et al. (2015), set forth, to reduce such activities, the kind of waste being there has to be identified. This is because according to the literatures of (Christiansen, 2015; Karlsson et al., 1996; Panwar, 2017; Warnecke et al., 199; Salhieh et al., 2018), lean has been given much emphasis and has been defined as a notion that is beyond a vital element to complete an operation.

Theres' a strong ideology that lean adds to the operational performance (Cua et al., 2001). The results are, as discussed earlier, in the form of work productivity, reduced cost, better quality and shorter lead time (Holweg, 2007; Shah & Ward, 2007). In the research of Hale Kaynak (2002), Cua et al. (2001) and Laugen et al. (2005), the association between lean operational performance of the warehouse has been thoroughly examined and confirmed. The respective element enables the warehouse to sustain their competitive advantage in the industry by managing inventory levels, enhancing picking and storing practices (Sharma & Shah, 2016).

De Koster (2007), discussed that the major activities in a warehouse are collecting, stocking, selecting, packaging and dispatching. These tasks lead to increased costs and impose a challenge to maintain the quality standards while keeping costs lower (Frazelle, 2016; Faber et al., 2013). The operations are described below:

Receiving: This refers to the offloading and examination of products to make sure that the right quantity and quality is received by the customer. This task entails sorting each item received from the provider and workers takes a large amount of time on this, causing waste. Using proper tools, having larger space, number of employees and accurate product data helps in reducing waste.

Put-away: This task refers to the movement of products from the receiving segment and placing them in appropriate locations. A proper view of the warehouse and space requirements enable to reduce waste in the activity

Picking: This task commences once an order is placed with the firm; the relevant items are retrieved from the locations and prepped for shipping. The factors like training and knowledge of the locations are vital. Apart from this, correct data, order numbers structuring and the like will reduce wasteful events.

Dispatch: The activity entails to ship the products to the customer; the products are packed using appropriate packaging materials

and labelled. They are then delivered to the respective consumers.

Reducing wasteful activities from the above mentioned operations will enhance the warehouse operational performance. Moreover, a research by Rafaela et al. (2022), demonstrated via a report that the lean methods aided in determining and categorising them. This allowed the firms to keep track of all the problematic areas and gave a view of the tools to use in order to resolve the issue; such as utilising standardisation in designing warehouse layout. In lieu of this, Pacheco (2023), indicated that the particular method determined and categorised the main wasteful elements in the warehouse. The research also showed that by lowering the time taken in the warehouse added value in the operations and performance.

By utilising such methods businesses determine and quantify the effect of the wasteful activities in operations. The research also adds to the literature of the enhancement of knowledge and study on reducing the waste in the warehouse operations.

2.3 THE MEDIATING ROLE OF WAREHOUSE OPERATIONAL PERFORMANCE

Performance is described as the capability of the firms to use their resources in an optimal manner that enabled them to obtain their aims, using competitive strategies such in flexibility, speed, quality, delivery and cost (Sharma & Modgil, 2019). Furthermore, Ghobakhloo et al. (2018) proposed that the operational performance of the warehouse then affects the firm's performance (for example satisfaction levels and market share).

Warehouse operational performance can be defined as those quantifiable elements of the business's outcomes such as turnovers, reliability and life cycle. The firm always aims at obtaining these by being flexible, offering better quality and reducing cost.

Increased levels of performance in the warehouse operations usually means that the firm can witness effective workflows as compared to its rivals. This will increase their performance, overall (Nawanir et al., 2013). Further Yang (2016), proposed that the performance of the warehouse may lead to increased economic performance, which would result in market share and profitability.

The concept is supported by a theory known as the resource-based view, which puts forth that the firm has the capability to use its resources effectively which can define its competitive advantage (Eng, 2016). Thereby, a positive link amid warehouse operational performance and business demonstrated through the hypothesis

H2: Warehouse operational performance has a positive relation with business performance

2.4 SUPPLY CHAIN COMPLEXITY

Studies on the variable are derived from wider literature particularly in the domains of supply chain management and complexity ideology which had divided the element into two.

The basis of this is supported by the graph theory- based mechanism that refers to complexity in the supply chain through the arc and nodes either directly or indirectly connected to the organisation. Further, Sharma et al, (2020), proposed to use social network examination and mathematical methods to understand the concept which is accurate in analysing larger supply chain systems.

Even though current studies have evolved the mechanism and definitions of the above mentioned theory, it offers data on handling the complexities in larger settings. Researchers like Aitken et al. (2016), Bozarth et al. (2008), Chand et al. (2022) and Gerschberger et al. (2017), have emphasized on the complexities in the supply chain; derived from views of Simon (1962) and Casti (1979), the variable is described as the dynamic and detailed challenges demonstrated by the operations, items and associations that build the supply network. The later is created by the number of partners such as suppliers or customers, that should be handled well and the former is created by the uncertainty in which the supply network responds to the changes that take place due to the dynamic relations. This is considered as a variation in any element that may cause major disturbance in other elements present (Manuj and Sahin, 2011).

The study has encouraged several researches evaluating the impact of upstream (supplier inclusive), downstream (consumers) and inside the plant complexities. As per Tobias et al.

(2014), upstream challenges relates to the hurdles in the markets, where the facility can face uncertain and several providers. It is based on the number of providers and their respective levels in the chain, the place they decide to offer their services as well as the relations the firm holds with the members (Chand et al., 2022)

In lieu of this, Bode and Wagner (2015) referred the vertical challenges as several levels in the supply network and the spatial hurdles to location of the network, both of which are vulneto higher risks.

In the research of Akin Ates et al. (2021), it was examined that upstream hurdles are linked with higher costs, data requirements, lower supplier tiers, complexities in attaining steady input from the providers and higher chances of risky events. Moreover, these challenges include various cultures, institutional environment, languages, increased research costs in different supply networks, challenges in creating cooperative relations, and lower probability of obtaining desired supplier services.

Furthermore, there are logistical difficulties linked to the international nations provided for, several transportation methods, infrastructure issues of supplier location (Prater et al.. 2001). With regards to the challenges faced inside the supply chain, Chand et al. (2022) proposed some factors like several and a variety of elements and items, operational issues, and difficulties linked with handling the life cycle of the products. An essential domain of the internal challenges of the supply network relates with the customization, product variety and detailing of items manufactured by the facilities (Tobias et al., 2014).

These challenges give outcomes in higher inventory levels, lower scheduling effectiveness, increased chances of quality issues and major probability of late services. As per the researchers Akın Ateş et al. (2022) and Flynn and Flynn (1999), these hurdles are due to the relations internal to the supply system, kinds of operations and communication barriers.

The reasons that lead to challenges in downstream supply chain involve the several consumers, customization and the dynamic customer demand (Chand et al., 2022). Expanded customer base is linked with increased change over time and reduced volumes per run. This leads to decreased productivity in the mechanisms that manage the customer; the wider customer range leads to holding higher levels of goods along with cash to cash cycle time and costs.

A distinction can be made; for instance, according to Jacobs et al (2015), B2B organisations face lesser challenges in their downstream supply networks since they handle a small number of consumers intimately that don't have changing needs. On the other hand, B2C organisations face more challenges in the respective domain since they handle several customers with dynamic needs.

The factors that lead to reduced performance levels linked with supply networks involve structural ones. The latter increases the chances that an upstream operation will not achieve the goals of the downstream one (Gerschberger et al., 2017). The former makes attaining essential data challenging, reducing the potentiality of the management to be predictable. As proposed by researchers such as Bode and Wagner (2018), Bozarth et al. (2008) and Shou et al. (2017), the difficulties in the supply chain are found to adversely influence the systems and facilities.

The analysis made by Akin Ates et al. (2022) demonstrated that the effect is on the delivery capabilities, flexibility and quality via higher cost of manufacturing, distribution, communication, quality issues and the like. The research examined the relation between downstream challenges in the supply network and performance which resulted in a negative one. However the study concluded by showing a positive link between performance (for instance financial) and challenges faced inside the supply network. They suggested that much understanding is needed to identify the influence of these hurdles on the performance.

Anyhow, the study by Sparrowe and Mayer (2011) introduced two systems for defining the role of complexity in supply networks in the relation amid lean warehousing and business performance. Theoretical designs are appropriate when the study is based in a specific segment and links existing theories (Barratt et al., 2010; Gephart, 2004; Rungtusanatham et al., 2005). The concept demonstrates that the business performance linked with lean in the supply chain is adversely impacted by the hurdle levels and the individuals therein should

collaborate lean practices to lower down these issues.

The next mechanism of mediation posits that lean in the warehouse may be tied with increased levels of difficulties which may cause hindrance in creating favourable outcomes in the performance. Hence, the amount of lean along with its limited influence on performance of the business makes its application questionable.

2.5 SUPPLY CHAIN COMPLEXITY: THE CASE FOR MEDIATION

The perspective, as per Chand et al. (2022), posits that there is an unintended impact on performance. Lean in warehouses is a difficult intervention that needs improvement of various methods and processes, increasing the complexity internally (Soliman and Saurin, 2022). The implementation leads to the collaboration of all the elements and the changing of behaviours that are found in the firm, influencing the objectives, and bringing unwanted results. This leads to higher levels of challenges.

According to Prater et al. (2001), the initiatives taken to apply lean practices leads to overall complexity which reduces its ability. Hence, the role of mediator is on the basis of the concept that it can lead to higher levels of challenges in the supply network. Also, several features that aid the objectives of lean also lead to difficulties in the supply network. Thereby, the firms that are in the position to handle these challenges may face benefits as compared to those that emphasise only on preventing them.

Since organisations look out for increased profits, Mariotti (2007) and Menezes et al. (2021) pointed out in their research that they have multiplied all aspects such as markets, providers, items, consumers, locations and facilities. Even though such scenarios lead to higher profits, it is not shown in the profitability. Therefore, a conclusion can be derived from the relation of the mediator; the researcher defined the issues rising where expanded markets, several items and different channels are considered due to their favourable influence on market and sales performance. Despite this, the issues in the supply network can negate these benefits.

For instance, Saunders et al. (2021) investigated that late deliveries of items that are utilised in the making of several items, led to disruptions in the manufacturing process and in turn caused delays in the providing services. With the dynamic customer needs and the delays, the firm faced shortages instead of improved performance. To avoid lean from causing these issues, Soliman and Saurin (2022) suggested that facilities should be flexible in the form of extra products which raises internal difficulties. In a report it was examined that lean needs higher time and resources to handle the challenges. Ever changing hurdles like demand variation, longer lead time from unreliable suppliers, uncertainty in scheduling can lower the performance of lean practices (Birkie and Trucco, 2016). As per Schemenner and Swink (1998) these issues make it harder for individuals in the warehouse to plan beforehand or make decisions about production operations.

The simulated outcomes of the work by Closs et al. (2007) showcased the order fulfilment rate was adversely impacted by the downstream issues involving varying market needs, variety of products and workflows in any planning period. These outcomes can influence several tasks that are dependent on the same elements and the difficulties hence lead to performance issues (Inman and Blumenfeld, 2014

Hence there are various means through which lean in the warehouse can raise the complexity; examples like disruptions in process, lower ability of competition and other service issues. Hence, the lean methods may be linked with lower performance levels. The examination is done on the basis that such practices lead to higher dysfunctional supply network issues.

As per Turner et al. (2018), the respective element is an unnecessary one for the attainment of firms objectives; since it does not enable a facility from receiving highest performance and hence should be reduced whenever possible. Whilst, the strategic issues in the supply network have proven to be profitable to a business. When lean practices raise strategic issues, the outcomes with regards to performance outweigh the costs. Moreover, the strategic element is used to complete the firm's strategies; few examples proposed by the researcher are more customisation,

involvement of worldwide supply chains and larger customer base. This shows that, if managed well, the challenges coming from lean mechanisms in the warehouse can positively influence performance. Thereby, the mediating impact of supply chain complexity on the relation amidst lean warehousing and performance can either be negative or favorable (Blome et al., 2014); based on it being dysfunctional or strategic as per Soliman and Saurin (2022).

In case of moderation, the practices of lean in the warehouse works efficiently where the levels of complexities are lower (Tortorella et al., 2017). For instance, according to Jacobs et al. (2015), those firms that operate in higher dynamic environments and handle increased variations. Such scenarios are less likely to support lean methods and make the performance vulnerable to negative impact.

When the hurdles in the supply network are lower, the positive outcomes of lean warehousing are reflected in the business performance. However, when the adverse outcomes outweigh the positive ones, the business should take initiatives such as introducing new production lines, expanding distribution channels or adding new handling materials Menezes et al. (2021). This back-up plan shows that contextual elements define the performance of firms with respect to lean principles. Tortorella et al. (2017) hinted that since the complexity in the network is exogenous as a moderator, executives are not in the position to manipulate in the short run. For instance, warehouses that work on the pull model look to have items beforehand. Even though these models try to limit replenishment items on the basis of current demand, they can attain unpredictable workflows in the operations when need is dynamic. Hence, pull models operate well in surroundings that are predictable i.e., lower downstream complexity.

Suri (2016) introduced a concept of how the downstream issues change lean methods into a push model that leads to larger inventory levels. Likewise, when consistent workflows try to create flows of materials systematically before the demand is obtained, they can flounder in increasingly challenging environments unless the difficulties are managed through planning and controlling strategies. Further, since some firms have predictable demand, they are in the position to analyse where to practice lean methods in the warehouse to meet their requirements Jacobs et al. (2015). Such organisations have well established relations with the consumers, who find the usage of lean techniques beneficial for them in terms of quality.

The moderation impact is backed up by studies; for instance, Tobias et al. (2014) put forth that the complexity in the supply network moderates the relation amid performance and data transfer; Gimenez et al. (2012) proposed that the critical items need complex supply networks, that then need more flows of data therein. Also, such systems need increased levels of collaboration to obtain the performance decided as compared to simpler systems. The data with respect to issues is extremely problematic to trace in a complex setting, causing issues to occur in the entire system without being identified (Bode and Wagner, 2015). Moreover, even though an organisation may try to prevent the issues in the supply network and enhance the flows of data by reducing its several providers, challenges in the upstream as per Lu and Shang (2017), are frequently shown in the form of reduced business performance.

In this manner, the problematic areas in the supply system may also be able to define why the performance benefits from lean implementation are not as per expectations (Mackelprang and Nair, 2010). For instance, Qi et al. (2009) demonstrated that lean and agile practices respond differently on the basis of the internal complexity of supply systems. Lean in the warehouse is linked with enhanced performance in businesses having functional products. This variation of lean internal, downstream or upstream has been shown through wider secondary information. Azadegan et al. (2013) proposed that the changing environment adversely moderated the relation amid lean warehousing and performance. Since the setting becomes more complex its becomes challenging to integrate operations and create relations to variations therein. Evaluating product data, Eroglu and Hofer (2010) suggested that relation between the above mentioned variables varies by sectors. There existed a U-shaped (inverted) link

between lean and performance; the researchers examined that this due to some warehouses, already having challenges, can become very lean. For specific or defined complexity, lowering inventory levels, raises the cost and outweighs the benefits such as savings.

Lu and Shang (2017) examined the same relation between the two variables which they associated with bounded rationality. Further, it was mentioned that the executives do not have the needed ability to handle these challenges and their verdicts may not be up to the mark specifically when they are stressed. Hence, the complexity can only enhance performance up to a specific point after which it diminishes. Another point they examined was the U-shaped association amid changing challenges and performance, as the challenges faced are the outcome of availing benefits that in turn enhances performance.

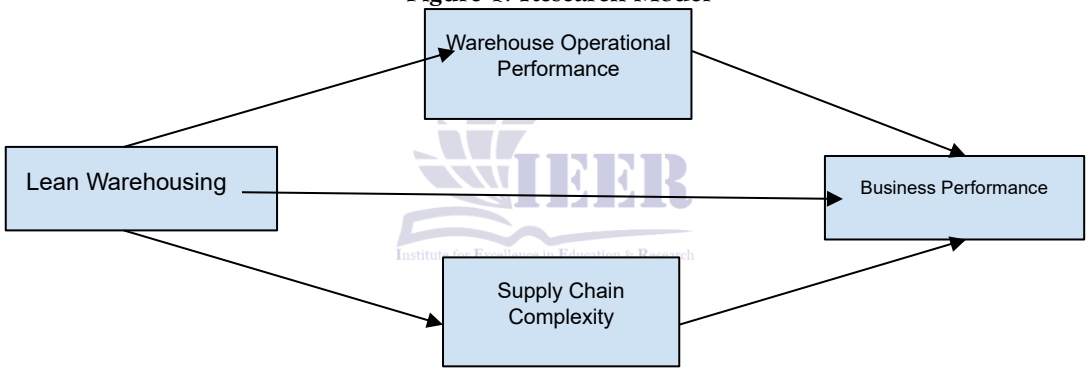
In short, as per the moderation concept, the complexities already present in the supply network and in the firm reduces the ability of the individuals to determine and respond to complex scenarios which is essential in handling difficulties associated with lean. As these challenges increase, integrating lean in warehouses becomes extremely difficult, lowering performance levels of the business.

Hence, by capitalising on the above concept a hypothesis is developed which is as follows:
H3: Supply chain complexity mediates the relation amid lean warehousing and business performance.

2.6 Research Model

The research model in Figure 1 below demonstrates the hypotheses created above in the literature review:

Figure 1: Research Model



METHODOLOGY

This section entails the details regarding the methods that will be used when the research will be conducted.

3.1 RESEARCH APPROACH

Based on the available research on lean warehousing and business performance, a quantitative study is the best way to see if there is a connection. Any potential association between the variables will be organized and interpreted using statistical results. To solve the research questions, this piece of work utilized a quantitative case study method. The data gathered through quantitative methodology was used on the target population; surveys to showcase the influence of lean warehousing on business performance. According to Peter and Olson (1983), the hypothesis is developed before testing and generating the results in deductive research. The deductive study starts with a solid theoretical foundation and the presentation of indicators (Danermark, 2001). In explanatory design, researchers first collect quantitative data and analyze it, then create qualitative data based on the quantitative data, which then provides quantitative results with a better understanding. The process of involves using numerical data or exploring questions that are further required in qualitative data (Creswell et al, 2003). To establish relationships and findings, the explanatory design is used. The approach we are taking in this study is deductive, where an already developed theory is used for further research, and explanatory, where a lot of information is already known, and then further explanation is provided in the study.

3.2 Research Design

Research design demonstrates the body of research methodology. The problem statement of our study will determine the type of design for our research. The research design is a component of research methods and approaches selected by a researcher. An effective research design makes sure that there must be minimum bias in data and maximize the accuracy of the collected data. The error margin is very low, and the researcher gets the desired outcomes. Correlational research strategy is utilized to determine links amid two or more variables. This design aims to check whether there is a positive relation or negative relation among the variables. The design of this study is correlational, the non-experimental design where we are interpreting the impact of lean warehousing activities in the retail industry on enhancing business performance.

3.3 Sampling design:

The retail industry of Pakistan has more than 2.5 million shops in it, offering basic products such as clothing, food, beverages and the like (Pakistan Country Commercial Guide, 2024). It was difficult to cover all the retail companies in the retail sector that are our target population. Therefore, the companies that are taking advantage of lean warehousing in the Pakistan market are selected to be studied as a sample for this research. The target population for this survey and research were employees at managerial, mid and lower level who are working in warehouses in the retail industry because they know more about the concept of lean practices. A sample of 105 responses was collected from the target population. The sampling technique used was non-probability-convenience and purposive in particular because of the cost, degree of use, benefits, and time restrictions and also because a specific kind of characteristics of the sample were responding to the survey i.e., warehouse employees. Social media websites such as Facebook, Whatsapp were used to reach out to the employees in the retail industry of Pakistan through convenience sampling.

3.4 Instrument of data collection:

The influence of lean warehousing on warehouse operational performance, supply chain complexity and ultimately on business performance was assessed by selecting a questionnaire as the primary method of collecting data. The questionnaire was developed on google forms. The demographic part of the questionnaire asks respondents for their name, designation and years of service gender. The questionnaire had more than 56 questions (see Appendix) and was broken down into seven sections (respondent profile, lean warehousing, business performance, warehouse operational performance and supply chain complexity). The respondents were given a 5-point Likert scale to answer the questions (1 = strongly disagree; 5 = strongly agree).

3.5 Procedure of data collection:

A questionnaire was adopted as a tool of data collection. The data was collected specifically from the employees working in warehouses in the retail sector because our research is basically about the effect of lean warehousing on business performance in firms of the retail industry of Pakistan. At first, we identified and approached the target people in our family, friends, and social circles to fill out the questionnaire and then used their contacts and references to reach out to the others to get the desired number of responses. The survey is designed in such a manner that it has a separate section of dimension covering all four dimensions of lean warehousing. Our primary source of data is the valuable responses on our questionnaire whereas, we also reached out to some research papers that are published in HEC recognized journals.

3.6 Statistical techniques:

To analyze, interpret, and present the findings, the data was examined using the following statistical techniques. Descriptive analysis is conducted to answer a phenomenon by questioning what, when, how, who and where. It is used in this research to describe samples to identify causal effects (GILLETTE 1984). Structure Equation Modelling (SEM) is a statistical technique through which the relations amidst independent and dependent variables is analyzed. The respective methodology was used due to the convenience of distributional assumption, capability to take up small samples and to systematically measure the questions

(Hair et al,. 2014 and Oyewobi et al., 2017). Since there was a time constraint, not all the questions were analysed and the ones that were used were mentioned along with their code in the tables below. The data gathered was analysed via SmartPLS. The research model in Figure 1 above shows the rectangular boxes that refer to the relevant indicators and the straight arrows indicate the relation amidst them. Jointly analyzing for any error in measurements, linear causal relationships among all variables of the research model are examined through SEM (Hancock et al., 2019). Reliability analysis helps you to understand the features of measured variables and the elements that make up the scales. Through the process of reliability examination, a commonly used scale reliability variables are obtained along with the data regarding relations amongst the individual items therein. Validity analysis ensures that the methodology used to calculate the result was effective or not. If the research done is very valid it tells that the results obtained link with the properties, characteristics, and variables included in the research paper. It is harder to evaluate the validity of a research paper but is also very important. The methodology used in the research paper must be valid to achieve an accurate result.

3.7 Ethical considerations:

The following ethical issues were put into consideration while performing this research: Confidentiality of respondents' profiles was considered. Respondents were free to decide to participate in the research and no pressure was built. No private questions were asked in this research. No information connected to the respondent is written in the paper. The survey collects data through very generalized questions.

RESULTS AND FINDINGS

4.1 Measures Utilized

The study was carried out to investigate the variables shown in Table 1 in the retail industry namely, business performance, warehouse operational performance and supply chain complexity through the impact of LW that is the independent variable.

The items lean warehousing, were adapted from the works of Kembro et al. (2017) who suggested that the questionnaire be built via Delphi method. In such scenarios, the warehouse operators' recommendations add to develop the appropriate methods. Researchers belonging to the management domain have used the respective technique for a long time; in the field of logistics we have the works of Melnyk et al. (2009), Piecyk and McKinnon (2010) that have used the technique at large. The method was particularly used since lean warehousing is a complex subject to study that requires the contribution of several experts regarding the wasteful activities being taken place in the warehouse (Kembro et al., 2017). Through a series of consensus, the items were gathered.

Business performance is the theory that's been mostly used in the domain of business. According to Nawanir et al. (2013), scarce literature has been found with respect of the management of business and as lean methods have been used in the fields of service and production, the usage of non-financial elements are beneficial in such studies

(Hines et al., 2004; Salheih et al., 2018). Therefore, the particular research will adapt the subjective items used by Wall et al. (2004) to examine the constructs of BP.

As per Faber et al. (2017), several functions are being carried out in the warehouses today such as taking orders, putting away, storing items and other activities like distribution along with packaging and customization. Hence, the warehouse operational performance comprises several domains. Researchers namely Stank et al. (1994) and Collins et al. (2006) have measured the variable by creating standards but found it difficult to gather accurate information. Furthermore, for every element that is added in the analysis, the support of cases will be required to create useful results. De Koster and Balk, (2008) have mentioned that another difficulty faced will be the similarity of warehouses under study. Thereby, the respective research will adapt the tool suggested by De Koster (2012) to examine WOP on a qualitatively.

The items of SCC covers domains such as lead time variability, delivery time, number of suppliers and international buyings. Further, it consists of factors internal to the organizations such as components variability, number of items, processes and the like. Then there are statements related to downstream operations

like consumers, demand patterns and product life cycle changes (Bozarth et al., 2009).

Table 1: Measures Utilized

Codes	Variables	Items	Source
LW	Lean Warehousing	22	Kembro et al. (2017)
BP	Business Performance	06	Wall et al. (2004)
WOP	Warehouse Operational Performance	15	De Koser (2012)
SCC	Supply Chain Complexity	05	Bozarth et al. (2009)

4.2 Demographics

The respondent for this survey includes 105 people associated with the retail industry. The sampling population was derived using a non-probability sampling procedure. The respondents of the survey were 71% male and 28.6% female. Out of them, 30.4% belonged to the managerial position, 18.1% were middle level warehouse operators, 24.8% were the low level ones and the rest such as incharge, assistant managers, material control officer comprise 24.8% of the respondents. Most of the participants (42.9%) have worked for 1-3 years, followed by those (39%) who have 2-6 years of duration of service and the rest have worked for short duration such as 13.3% for 7-10 years, 0.9% for less than 1 year and 3.8% for more than 10 years. All the respondents work in a warehouse environment providing insights about the practices and activities taken place in therein, relevant to the subject of research.

Table 2: Demographics

Items	Classification	Sample Amount	Percentage
Gender	Male	75	71.4
	Female	30	28.6
Designation	Employee	26	24.8
	Top-Level Manager	32	30.4
	Mid- Level	19	18.1
	Others	26	24.8
Duration of service	1 – 3 years	45	42.9
	2-6 years	41	39
	7-10 years	14	13.3
	Less than 1 year	1	0.9
	More than 10 years	4	3.8

4.3 Validation of the model

First, the model is examined in the PLS-SEM in order to demonstrate how hypothetically accurate the items load on the construct. It consists of examining how well each variable is linked with the main concept it demonstrates. This relation showcases how the variable predicts the theory they are connected to (Hair JF, Ringle CM, Sarstedt M 2014). The analysis consists of looking into the reliability of each question, reliability of each variable, internal consistency (composite reliability and Cronbach alpha). Next the validity of the construct (loading) and the convergent validity is examined which consists of AVE. Lastly we check the discriminant validity with either Fornell-Larcker criteria or the HTMT (Hair J, Hult GTM, Ringle C & Sarstedt M, 2014).

A confirmatory factor analysis was carried out to examine the outcomes in our measurement model. As a general rule, if the values are > 0.7, then the survey is developed accurately. Since most of the values of outer loadings shown in Table 3 are >0.7, we can deduce that the participants have given consensus (Cannon, 2001). The measurement of the outer loadings in our study ranged from 0.715 to 0.889 which

shows the relation amidst constructs and the variables.

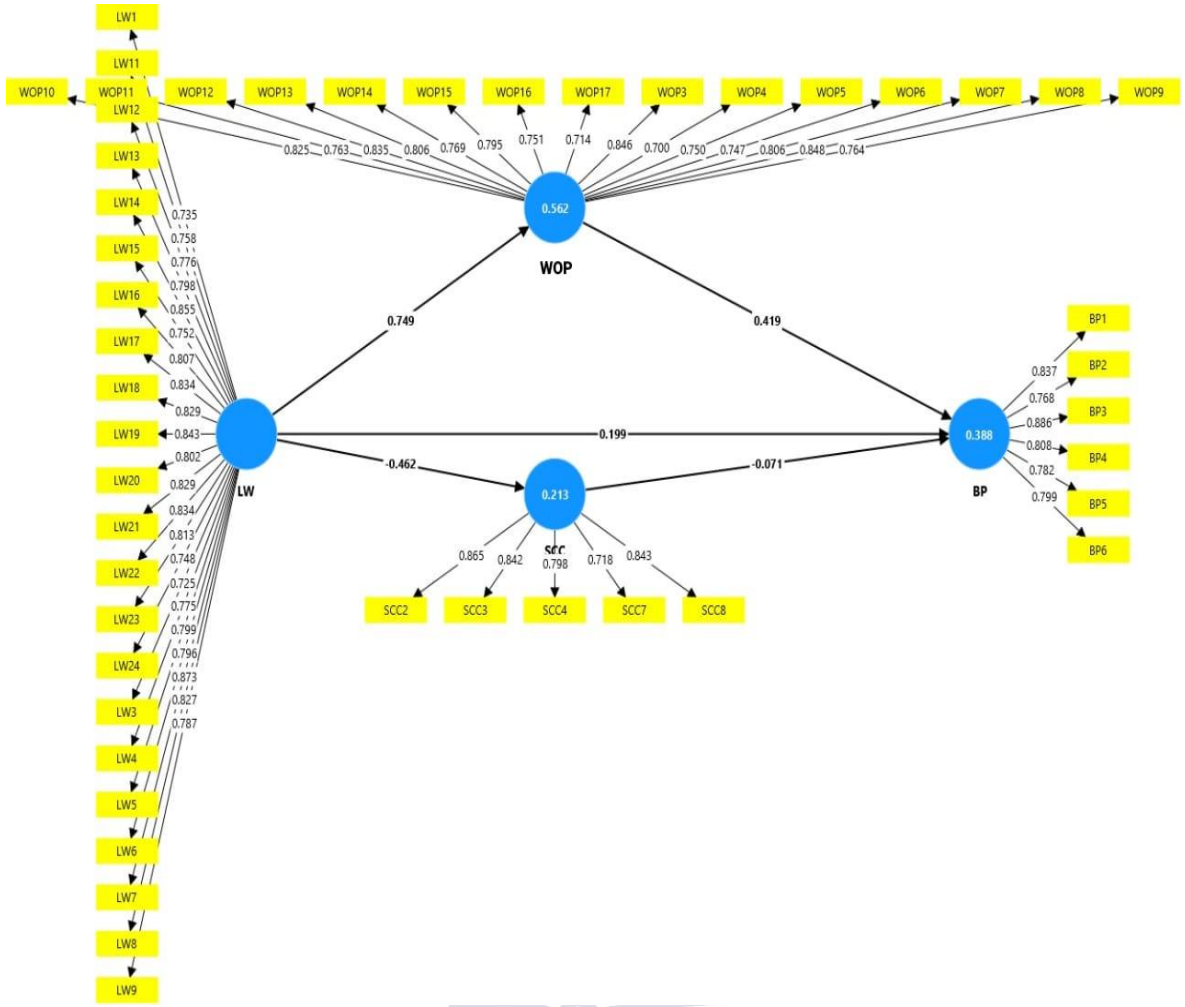
Further we carried out the reliability and validity test to analyse if our survey is reliable and valid to provide as the basis of our study. Cronbach's alpha, RHO C and AVE are the tools used in the Table 3 below. The cut threshold for the first two indicators is above 0.7, demonstrating that all our variables are ideal. Moreover, the cut threshold for AVE is more than 0.5 and all since all our variables have values > 0.5, we gathered overall valid responses. This also means that there lies perfect consistency between the constructs of our model and it is valid (Gefen, 2005).

Table 3: Reliability and Validity

Construct	Questions	Outer loadings	Cronbach Alpha	Rho C	AVE
LW	LW1: As a warehouse manager/employee, you are involved with your purchasing department in specifying and agreeing the packaging, items per carton, carton per pallet, and labeling requirement	0.735	0.973	0.975	0.641
	LW3: You specify a time schedule for the suppliers to make the delivery	0.725			
	LW4: You receive a notification from the suppliers/shipper before a delivery arrives at your warehouse. (ASN: advanced shipping notification)	0.775			
	LW5: You are able to plan the correct equipment (forklift, trollies, powered trucks, and pallets jacks) to use in unloading before the delivery arrives	0.799			
	LW6: You are able to plan enough labor to unload the delivery before it arrives	0.796			
	LW7: You are able to plan sufficient space to unload the delivery before it arrives. You	0.873			
	LW18: There is sufficient space at the loading bay to stage the loads	0.829			
	LW19: Truck arrivals are subject to a system in the shipping area	0.843			
	LW20:The picked orders arrive at the loading bay in the sequence in which they will be delivered	0.802			
	LW21: We have grids marked out on the warehouse floor at the despatch area to replicate the floor area of the largest vehicle	0.829			
	LW22: Vehicles at the despatch bay do not wait a long time until the despatch team is ready	0.834			
	LW23: At our warehouse, the checking of vehicle papers at the despatch bay ensures the match of the SKUs to the right vehicles	0.813			
	LW24: Despatch operator checks and inspects that picked SKUs and quantities are correct	0.748			
BP	BP1: We have superior quality of service compared to our competitors	0.837	0.898	0.922	0.663
	BP2: Our profitability has exceeded our competitors	0.768			
	BP3: Our revenue growth rate has exceeded our competitors	0.886			
	BP4: Our market share growth has exceeded our competitors	0.808			
	BP5: Our customers are satisfied with our company's delivery lead-time compared to our competitors	0.782			
	BP6: Our overall competitive position is better than that of our competitors	0.799			
WOP	WOP3: The layout prevents major cross flows	0.846	0.955	0.959	0.613
	WOP4: Material is moved over the shortest/best possible distances	0.700			
	WOP5: Double handling is prevented and appropriate product carriers are used	0.750			
	WOP6: SKUs are stored on their right locations	0.747			
	WOP7: Appropriate (non-)splitting	0.806			

	inventory is in bulk and forward pick stock applied				
	WOP8: There is an effective process management for introducing new SKUs, getting rid of non-movers, and internal relocations	0.848			
	WOP9: The organization of the picking process is well-designed without obvious improvement possibilities	0.764			
	WOP10: Storage and receiving processes are monitored and controlled on-line	0.825			
	WOP11: The response to mistakes and errors is immediate	0.763			
	WOP12: Ratings are for customer satisfaction and shipping errors are displayed	0.835			
	WOP13: The material handling systems are used, the racks and the product carriers in good operating condition and are well-maintained	0.806			
	WOP14: A right balance has been struck between order customization, process flexibility and efficiency	0.769			
	WOP15: Receiving and shipping processes, and inventory levels are tuned with suppliers and customers	0.795			
	WOP16: This is a warehouse you would like to work in	0.751			
	WOP17: The air quality is good and noise level is low in warehouse	0.714			
SCC	SCC2: All of our customers desire essentially the same products	0.865	0.875	0.908	0.664
	SCC3: The average life cycle of your products is high	0.842			
	SCC4:Our total demand, across all products is relatively stable	0.798			
	SCC7:We can depend on-time delivery from our suppliers	0.718			
	SCC8:You purchase a huge percentage from your home country	0.843			

Figure 2: Model with Outer Loadings



4.4 Discriminant Validity

To analyse this, Fornell and Larcker (1981) was used; it was done by making a comparison of square root of each AVE in the diagonal to the correlation coefficients (off diagonal) for each construct in the relevant columns and rows. The Table 4 below demonstrates that discriminant validity at every level had been developed amidst the reflective constructs. It vividly showcased that a strong correlation amongst the constructs can be detected via Fornell Larcker criteria.

Table 4: Fornell Larcker Criterion

	WOP	BP	LW	SCC
WOP	0.783			
BP	0.604	0.814		
LW	0.749	0.545	0.801	
SCC	-0.518	-0.380	-0.462	0.815

4.5 Hypothesis testing

To check the impact of our variables we check the P-values column. According to Fisher (1925), a value more than 0.05 is considered to have no impact while a value less than 0.05 is considered to have a significant impact. The theoretical model is justifiable by the related test results as shown in table 5 below. Precisely, lean warehousing shows the influence it exerts on other variables such as business performance and warehouse operational performance.

As proposed in the literature above, hypothesis (H1), which posits that LW has a positive effect on BP, is true as the p-value (0.282) falls within the acceptable range. This result indicates that warehousing practices positively influences

business performance by streamlining operations, reducing costs, and enhancing efficiency.

The hypothesis (H2), states that WOP mediates the relationship between LW andBOP, is fully supported with significant p-values for both paths. Specifically, LW positively impacts WOP (p-value 0.000), which, in turn, positively affects BP (p-value 0.024). These findings underscore the critical role of enhanced operational performance as a conduit through which lean practices improve overall business outcomes.

The hypothesis (H3), which suggests that SCC mediates the relationship between LW and BP, is partially supported. While LW significantly impacts SCC (p-value 0.000), the pathway from SCC to BP is not significant (p-value 0.481). This implies that while lean practices can simplify supply chain operations, their effect on business performance through this mediator may be limited or require further refinement.

Table 5: Path Coefficient

	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
WOP -> BP	0.429	0.185	2.258	0.024
LW -> WOP	0.755	0.051	14.669	0.000
LW -> BP	0.197	0.185	1.077	0.282
LW -> SCC	-0.473	0.066	6.948	0.000
SCC -> BP	-0.067	0.101	0.705	0.481

DISCUSSION AND CONCLUSION

5.1 Conclusion

The research's theme is to implement lean warehousing practices in the warehouses in order to improve business performance. Hence, the key focus is whether LW has an impact on business performance. As per the survey conducted, LW initiatives have a major influence on the warehouses in the retail industry and the employees in the respective setting can identify the wasteful activities and benefits of lean. There is a strong relation between the variables proposed in the hypothesis of the research.

Following are the research's main results:

- The constructed model has a lot of strength.
- The responses are valid and dependable
- LW has a significant effect on the performance of the organization.
- Warehouse operational performance mediates the relation between LW and BP
- Supply chain complexity mediates the relation amidst LW and BP
- The discriminant validity of the test has been proven.
- Lastly, the warehouses in the retail sector should implement LW efforts to improve their business performance.

5.2 Implications:

Even though the current literature recognises the nature of warehouses in improving the effectiveness of business performance, there is a need for in-depth analysis. The particular research adds to the implementation of lean initiatives to eliminate wastage in the warehouses and it's been obtained via recognising various kinds of waste and by measuring it through questionnaires. The importance of examining lean in the warehouses in retail industry is that performance betterment will be demonstrated in the network (Pires et al., 2017; Hübner et al., 2016; Abushaikha, 2018). It will also be showcased in the entire distribution channel (Satyam et al., 2017). Hence, the research adds on the current literature by looking into the relations amidst the several performance relations and including lean warehousing with warehouse performance and supply chain complexity. Understanding the link between LW in a warehouse and other variables such as warehouse operational performance and supply chain complexity that has the capability to better entire business performance (Grant, 1991; Rexhausen et al., 2012; Eng, 2016).

The current research differs from the others; through the results of the mediation, it provides a comprehensive view of the methodologies of waste in warehouses and the performance of firms. Moreover, other works on the respective subject are based on qualitative perspectives such as reports on the practice of lean initiatives and the standards of improvements on results (Sharma and Shah, 2016; Dotoli et al., 2015). Our research is different since it examines the performance relations logically by showcasing a method for

assessing the reduction in wasteful activities. As per Pires et al. (2017), Frazelle (2002), de Leeuw and Wiers (2015), Bozer and Britten (2012), there are many categories of warehouses and the basics of lean warehousing do not vary by the category, the analysis of this research can be applied to most of the warehouses.

This research also provides some real-life connotations for managers in the warehouse. The given tool acts as a guideline to know which lean methodologies can be used to enhance the operational performance of the warehouse. This tool is best used in the warehouses as proposed by the experts in this field. For instance, it aids the managers to know where the waste is coming from and how to use the wasteful practices in the most effective manner in the functions of the warehouse mentioned above.

Continuous input to remove such practices leads to the betterment of warehouse operational performance and hence impacts the firms' performance in the same way. Therefore, this means that retailers, through the deployment of lean warehousing, can improve their functionality upstream as well as downstream. The enhancements in the supply network are essential in the retail sector, particularly in the emerging ones because of their complex nature (Satyam et al., 2017). The consequence is that it leads to profitable performance of the businesses (Pires et al., 2017; Hübner et al., 2016; Satyam et al., 2017).

5.3 Recommendations

Other people who were indirectly involved in the research, recommended that distributing the questionnaire to other regions increases not only the sample size but also the variances amongst the respondents that affects the data collection procedure. Furthermore, considering more variables to the study can provide more results for in depth analysis such as:

- **Maturity:** The usage of lean initiatives, in Pakistan, can also be associated with maturity of the industry. We examine that the retail industry, which has been present in the nation for long, the use of modern methods is quite advanced. Other industries such as pharmaceutical-chem and manufacturing-steel are slowly adapting these practices. Moreover, the family-owned firms are not in the phase of adoption of lean. As the industry matures, more focus is given on the waste-reduction practices to achieve a competitive edge.
- **Technology:** The more the technological aspect present in the industry, the higher the chances of implementation of lean practices is evident. In the retail sector, deploy technology to streamline operations such as using robots in warehouses, RFID, machine learning, internet of things to analyse data, expedite processes and manage the inventory therein.
- **Export Orientation:** The higher the variable for the respective industry, the higher the adoption of lean practices. This is because firms in the retail industry of Pakistan want to achieve global goals and make initiatives to better the performance of the firm itself in terms of cost and the like and the economy overall.
- **Internal Rivalry:** When firms face competition in the local markets, they make initiatives to remain at the top; the retail sector not only faces international but local competition. This leads them to adopt waste-reduction practices to sustain their competitive edge in the market and be of first preference to customers.

In conclusion, the lower implementation of waste-reduction initiatives in the retail industry of Pakistan, is concerning. The respective sector will have to focus over this in order to compete internationally. Lean warehousing can improve productivity and therefore the rivalry of the industry particularly since most of the companies only store commodity items. The retail sector is of modernization and needs lean practices to achieve a competitive edge in the international and local markets.

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APPENDIX- QUESTIONNAIRE

#	STATEMENTS	RATING				
LEAN WAREHOUSING – Taken as IV (Kembro et al., 2017) – DOI: https://doi.org/10.1016/j.ijpe.2017.06.032 The Items were used after the third round of Delphi method, suggested by the author.						
1.	As a warehouse manager, you are involved with your purchasing department in specifying and agreeing the packaging, items per carton, carton per pallet, and labeling requirement	1	2	3	4	5
2.	You ask your suppliers to send deliveries with the most suitable packaging for you	1	2	3	4	5
3.	You specify a time schedule for the suppliers to make the delivery	1	2	3	4	5
4.	You receive a notification from the suppliers/shipper before a delivery arrives at your warehouse. (ASN: advanced shipping notification)	1	2	3	4	5
5.	You are able to plan the correct equipment (forklift, trollies, powered trucks, and pallets jacks) to use in unloading before the delivery arrives	1	2	3	4	5
6.	You are able to plan enough labor to unload the delivery before it arrives	1	2	3	4	5
7.	You are able to plan sufficient space to unload the delivery before it arrives. You always have stock-keeping units (SKU) master data available, e.g. for new products, that you are able to store and handle these products appropriately?	1	2	3	4	5
8.	You perform cross-docking operations when possible or needed	1	2	3	4	5
9.	It is easy to identify deliveries from suppliers (product, description, pack quantity)	1	2	3	4	5
10.	You do carry out inspections and quality checks on most of the goods received. In other words, you do count and identify 100% of the received products	1	2	3	4	5
11.	You usually breakdown deliveries into smaller or lager increments (pallets to cartons or vice versa) for storage based on data collected from customer orders. In other words, you do not require deliveries from your supplier in the normal selling quantity in order to increase the speed of throughput and simplify picking. (You do not order in logistics units)	1	2	3	4	5
12.	We have a system (computerized or warehouse manager) which allocate product locations prior to offloading and instruct the operator as to where to place the goods	1	2	3	4	5
13.	You notice any delays in put-away because of labor or equipment being occupied or missing	1	2	3	4	5
14.	The rack configuration is flexible enough to accommodate size of pallet received from suppliers	1	2	3	4	5
15.	The put-away team work adjacently with the picking team	1	2	3	4	5
16.	You create a time schedule to separate the operations of the put-away and picking team	1	2	3	4	5
17.	The put-away process follows an ABC-structure of the warehouse (A-articles close to good-in/good-out area; C-articles very far away within an aisle?	1	2	3	4	5
18.	There is sufficient space at the loading bay to stage the loads	1	2	3	4	5
19.	Truck arrivals are subject to a system in the shipping area	1	2	3	4	5
20.	The picked orders arrive at the loading bay in the sequence in which they will be delivered	1	2	3	4	5
21.	We have grids marked out on the warehouse floor at the despatch area to replicate the floor area of the largest vehicle	1	2	3	4	5
22.	Vehicles at the despatch bay do not wait a long time until the despatch team is ready	1	2	3	4	5
23.	At our warehouse, the checking of vehicle papers at the despatch bay ensures the match of the SKUs to the right vehicles	1	2	3	4	5
24.	Despatch operator checks and inspects that picked SKUs and quantities are correct	1	2	3	4	5
Business Performance– Taken as DV (Wall et al., 2004)- DOI:10.1111/j.1744-6570.2004.tb02485.x						
1.	We have superior quality of service compared to our competitors	1	2	3	4	5
2.	Our profitability has exceeded our competitors	1	2	3	4	5

3.	Our revenue growth rate has exceeded our competitors	1	2	3	4	5
4.	Our market share growth has exceeded our competitors	1	2	3	4	5
5.	Our customers are satisfied with our company's delivery lead-time compared to our competitors	1	2	3	4	5
6.	Our overall competitive position is better than that of our competitors	1	2	3	4	5
Warehouse Operational Performance – Taken as Mediator (de Koser, 2012)- Extracted from a Book.						
1.	The facility is clean and has a good work atmosphere	1	2	3	4	5
2.	The work processes are ergonomically well-thought over	1	2	3	4	5
3.	The layout prevents major cross flows	1	2	3	4	5
4.	Material is moved over the shortest/best possible distances	1	2	3	4	5
5.	Double handling is prevented and appropriate product carriers are used	1	2	3	4	5
6.	SKUs are stored on their right locations	1	2	3	4	5
7.	Appropriate (non-)splitting inventory is in bulk and forward pick stock applied	1	2	3	4	5
8.	There is an effective process management for introducing new SKUs, getting rid of non-movers, and internal relocations	1	2	3	4	5
9.	The organization of the picking process is well-designed without obvious improvement possibilities	1	2	3	4	5
10.	Storage and receiving processes are monitored and controlled on-line	1	2	3	4	5
11.	The response to mistakes and errors is immediate	1	2	3	4	5
12.	Ratings are for customer satisfaction and shipping errors are displayed	1	2	3	4	5
13.	The material handling systems are used, the racks and the product carriers in good operating condition and are well-maintained	1	2	3	4	5
14.	A right balance has been struck between order customization, process flexibility and efficiency	1	2	3	4	5
15.	Receiving and shipping processes, and inventory levels are tuned with suppliers and customers	1	2	3	4	5
16.	This is a warehouse you would like to work in	1	2	3	4	5
17.	The air quality is good and noise level is low in warehouse	1	2	3	4	5
18.	The environment is attractive to work in					
SUPPLY CHAIN COMPLEXITY– Taken as Mediator (Bozarth et al.'s, 2009) – doi:10.1016/j.jom.2008.07.003						
1.	The warehouse serves a large number of customers	1	2	3	4	5
2.	All of our customers desire essentially the same products	1	2	3	4	5
3.	The average life cycle of your product is high	1	2	3	4	5
4.	Our total demand, across all products is relatively stable.	1	2	3	4	5
5.	We seek short lead times in the design of our supply chains.	1	2	3	4	5
6.	Our company strives to shorten supplier lead time, in order to avoid inventory and stockouts	1	2	3	4	5
7.	We can depend upon on-time delivery from our suppliers.	1	2	3	4	5
8.	What percentage of purchases come from your home country?	1	2	3	4	5