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Optimizing Inventory Management Performance Through a Mediated Perspective of Demand Uncer-tainty: Business Models for Supermarkets

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ABSTRACT

The study provides awareness to the industries and stakeholders about information management systems that have revolutionized supply chain management techniques. Traditional methods have been replaced with faster and more reliable information systems, where we use big data to forecast future needs and enhance inventory management performance. The integration of information management systems with inventory management gives way to new possibilities of successful supply chain. It enhances predictability and information sharing along with forestalling the situation of out-of-stock. We employ non-probability sampling to gather information (n=350) from managers and supervisors and related staff of supply chain & inventory management using the questionnaire. This study will benefit supermarkets as it discusses different aspects of information technology. Supermarkets will be able to analyze their IT system better and evaluate the weak areas. As this research also deals with demand uncertainty so supermarkets will be able to synchronize their IT needs with uncertain demands from the customer side. The regression results show that material requirement planning system, vendor inventory management, and warehouse management system have a significantly favorable impact on the inventory management performance. The findings of this study will help supermarket supply chain managers optimize their supply chain management techniques. This study examined the direct relationship between information technology system performance and inventory management performance, which will help the inventory managers improve the supply due to the effects of demand uncertainty. This study highlights the importance of understanding the antecedents of Information technology in inventory management to combat demand uncertainty. The response to demand uncertainty from the customer's side will reduce costs and delays, which will serve the customers with more satisfaction and beneficial.

Keywords: Demand Uncertainty, Inventory Management Performance, Vendor Managed Inventory, Systems, Material Resource Planning System, Warehouse Management Systems.

INTRODUCTION

In Swift advancements in information technology along with the increasing competitive pressure in the global corporate era have brought supply chain planning as a leading force of business practices of Services as well as manufacturing organizations [1]. Nevertheless, some small businesses do retain a manual paperwork approach in different tasks but for larger businesses, innovative techniques are mandatory to be adopted [2]. Currently,

businesses involve complex and longer supply chains with higher expectations of stakeholders [3,4]. For a successful supply chain, it is essential that associated organizations work together and collaborate in an efficient way [5]. The information systems have made this collaboration effective because it expedite the processes and help to achieve error-free records. An important thing to understand is the insignificance of a single department to make the supply chain free from flaws, but it is a joint effort to optimize each node of the channel.

Looking at firm-level evidence [6,7], declining prices have considerably enhanced organizational performance, including financial performance. This has led to extensive discussion of the effect of information technology on productivity in the literature [8,9,10]. There isn't enough research, meanwhile, on how information technology affects supermarkets' ability to manage their inventories when demand uncertainty plays a mediating role. The basic concept of vendor-managed inventory is that the supplier is responsible for inventory management at the customer's site [11] as buyers have to deal with a range of products while suppliers have a limited variety. Therefore, they have better knowledge and can estimate the needs of the buyer more effectively. In order to manage the buyer's inventory, information about inventory levels, product related cost, promotional activities and expected demand have to be made available to the supplier [12, 13], which is done through modern technology. Information systems also aid in the planning of materials. This part of the information technology system is known as material resource planning (MRP) System. It is a computer-based information system that assists in thorough planning production and is designed for successful assembly operations. When a product is purchased or manufactured, the MRP system makes it available just before it is required by the next stage. According to [14] it can track orders throughout the manufacturing process and help associated departments make the right decisions about supplies.

Warehouse management system (WMS), which largely regulates the storage and flow of materials throughout the supply chain channel, is the third component of information technology system. WMS tracks the movement of products using (AIT) automatic identification technology, which may include barcode scanners, wireless LANs, and perhaps radio-frequency identification. There can be a picking platform in the warehouse management system with a mobile computing device installed in it. Such devices enable different nodes to share information and make the right decision about the transportation of the products.

This research uses inventory management performance as a dependent variable which has four main aspects: (1) the supplier/vendor relationship; (2) the ordering/purchasing procedure; (3) the sales management process; and (4) the management of client relationships. All these aspects are integrated together to get a comprehensive picture of overall inventory management performance [15, 16]. Following [17], it can be understood as cost minimization and profit maximization along with customer

satisfaction. The fact that the phrase "inventory" has two faces is crucial. Both an asset and a liability, it. Despite being one of the major problems in supply chain management, demand uncertainty can be difficult to control when prior demand data is not available. 5 Modern techniques of supply chain management have deduced a solution by maintaining a record. Though the demand of a customer may vary with time, no one can perfectly control it. Nevertheless, it can be improved by keeping an eye on the past and the present's shifting conditions. Long-term or short-term uncertainties are both possible. Long-term unpredictable demands include seasonal variations, production rate adjustments over an extended period of time, and price changes of the finished product or raw materials. The word "short term" might refer to daily processing fluctuations, hurried orders, canceled orders, failure of any equipment, etc.

As the performance of supply chains is mainly deteriorated by bullwhip effect, it is highly important to minimize it. Even if inventory level or demand fluctuates little, their effect gets amplified throughout the chain due to lack of information. Information technology also improves agility and reduces cycle time by achieving better efficiency and delivering products at proper time [18, 19]. On these lines, as supermarkets directly deal with fickle demands of end-users so this research may help them improve inventory management performance by anticipating unexpected needs of customers.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Information technology has revolutionized our markets by filling the gaps and fulfilling customers' Needs. Experts develop new software and better equipment that is utilized by the general public on a daily basis [20]. Today, a variety of businesses rely on information technology for e-commerce platforms to streamline operations and increase profit. One method that helps businesses make wise and timely judgments is data mining. According to [21] information technology has become a part of strategic planning of different business organizations. It is implemented from a single point of sale to entire organizations in which specifically developed software (ERP Solutions) is installed to cater multidimensional needs of the companies. These elements include managing people resources, the supply chain, accounts, and customers. material requirement planning systems, vendor inventory

management, and warehouse management systems are three different aspects of information technology that are covered in this section 2.1 to 2.3 [22].

Material Resource Planning and Inventory Management Performance

First generation centralized computing systems were developed in 1960s [34]. Later in 1970s, the experts included the requirement planning of parts or products as per demanded by master production schedule in these computing systems. Through these modifications, second generation systems called MRP II were developed. In 1980s, material requirements planning was further transformed into manufacturing resources planning which is not the part of this research. Material requirement planning system helps develop coordination among different departments like human resource, purchasing, marketing and production. Further, it enables them to achieve a common business strategy [35]. The history of materials requirement planning dates back to 1960s and 70s. Material requirement planning enabled the stakeholders to plan in accordance with future product requirements rather than reordering [36]. Applying management accounting theory, reordering depends upon the historical usage of the [37]. Nowadays MRP is used in industries as an extended version and is known as ERP (Enterprise Resource Planning) System. [38] Investigate some insights of MRP systems with certainty. They provide some guidelines for choosing between safety lead time and safety stock. According to [39], the MRP system bases its projections on real orders and forecasts of client demand. Furthermore, this strategy avoids expensive mistakes, surplus waste, and material shortages. This system also determines the effect of requirements on the manufacturing capacity. [40] Realize limited scope of MRP as it does not reckon the limited capacity of machines. They further suppose that lead times are fixed. So, these researchers used a new approach by integrating capacity planning into MRP.

One of the main problems with MRP discussed in previous literature is the capacity constraint. [41] Investigate finite capacity MRP while using a variable "lead time" based on total time of processing, batch size, and setup time. Once the job schedule is done, they start minimizing capacity problems either by using alternative machines or adjusting the job timings. Later, they utilize an improved version called TOC-MRP, which is superior to finite capacity MRP [42]. Additionally, [43] incorporate capacity constraints and use varying lead time lengths in their MRP model development. They compare the resulted resource allocation and inventory carrying cost with the ones derived from traditional model of materials requirement planning. This comparison reveals that the new proposed model produces better results of schedule along with decreased inventory carrying cost. In contrast to the existing literature, [44] derive closed- form robust quantities of orders to facilitate existing system, including MRP system. [45] Present a method to control inventories. He also introduces an MRP-dependent specific request method which helps practitioners to supply the quantity ultimately required to achieve the production plan. Following [46], advanced technology like MRP and Barcodes has aided organizations to achieve a competitive edge. This discussion reveals the role of material requirement planning systems in inventory management performance. Additionally, material need planning is anticipated to improve inventory management performance. However, none of the research offer any data from Pakistan to support this assumption. This gap prompts us to formulate the following hypothesis.

H_1: *The Material resource planning system has a significantly positive impact on inventory management performance.*

Vendor Inventory management System and Inventory Management Performance

For better vendor-managed inventory, retailers and vendors have begun to engage in cooperative agreements [23]. Apart from these agreements, special electronic data interchange (EDI) systems are designed to facilitate point-of-sales. Nowadays, the concept of VMI has transmitted from retaining to the industries [24,25]. Vendor-managed inventory still involves a lot of information sharing despite all of these changes. Successful replenishment decisions are greatly influenced by the information that is shared with the supplier about inventory levels, promotional activities, costs, and anticipated demand [26]. This phenomenon prevents sub-optimization for both players. In this context, [27] reveals that a pre-active supplier can reduce his/her lead time by receiving the required information early. Similarly, the removal of the echelon from the supply chain minimizes delays in the flow of information and material which ultimately takes out one source of distortion in the way of a successful decision [28]. On this line, [29] propose a vendor-managed inventory model to: (1) manage both quickly deteriorating raw materials and (2) slowly decaying finished goods. They try to determine the ideal cycle for product replenishment. They also include the improved frequency of raw material replenishment in their model. In a two-stage supply chain, [30] similarly contributes to their work by using an integrated strategy. One producer and many buyers are part of this combined supply chain approach. Inventories were degrading at all levels despite this chain's consistent manufacturing and restocking cycles. [31] Use a supply chain with a single vendor, a single retailer, and a VMI warehouse close by. They also introduce a freshness clause and reveal a significant impact of the freshness clause on the decision of bothering the retailer and the vendor. Working on similar lines, [32] proposes a model to deal with special sale offers. Using this model, they develop optimal quantities for shortages and orders when such a sale offer is available for perishable items. Following [33], adoption of the VMI system by Wal-Mart (American

multinational retail corporations) and Procter and Gamble (multinational consumer goods corporation) encourage other big companies to do the same, e.g. Texas Instruments, HP, and Motorola, etc. This demonstrates that vendor-managed inventory is anticipated to have a favorable effect on the effectiveness of inventory management. However, none of the research offers any data from Pakistan and Oman to support this assumption. This gap *motivates* us to develop the following hypothesis.

H₂: *Vendor inventory management System has a significantly positive impact on inventory management performance.*

Warehouse Management System and Inventory Management Performance

Modern technology has changed the ways of warehousing [47]. In 1990s, warehouses were considered to stock different items at larger scale only. These changing trends indicate that warehouse management a system is a critical factor to compete in the market by reducing lead time and cost along with capturing customer attention. Some companies use manual paperwork systems to manage their warehouses. [48] Conduct research to aid small companies improving their warehouse management system by providing them automated information sharing system. This system enables managers to make quick and successful decisions along with avoiding invalid data. Working on the warehouse management system, [49] reveals that products are stored in the warehouse for comparatively shorter period of time. Considering these requirements, warehousing has been automated to enhance throughput rate and productivity and decrease order processing cost. Due to the rapid demand, implementation and functionality of warehouse management systems is growing fast. In 1998, this growth rate was 30 per cent and is expected to grow further. [50] Comparing warehouse management system, [51] report that tailor-made warehouse management systems take longer time than standard systems. Also mention that both tailor-made and standard warehouse management systems are successful. They further discuss that complex warehouse management systems include variety of items, number of processes and nature of processes. However, more comprehensive warehouse management requires better planning and control. They further reveal that it is also a challenge to provide warehouses management staff with the right information at the right time.

Accordingly, [52] recently conducted a case study to highlight the benefits and drawbacks of a warehouse management system in a selected firm that provides transportation and logistics services. The cost of staff, material identification, and equipment handling are only a few of the features of the warehouse management system that are examined. Their findings show that the usage of warehouse management systems has increased the logistic chain's overall efficiency while also lowering overall logistic costs. Working on a similar study, [53] identifies some challenges and opportunities for the utilization of product intelligence paradigm in warehouse management system. They further identify some benefits in controlling and scheduling storage location assignments, along with facilitation of picking operations. Considering all this, an automated warehouse management system is the need of today's warehouses [54,55]. Automated system controls storage and movement of the products which further enhances the level of security.

H₃: *Warehouse management system has a significantly positive impact on inventory management performance.*

Inventory Management Performance

According to [56] findings, inventory control efficiency can be increased even while there is a definite demand for these products despite a partial improvement in demand visibility. Their investigation also made the significant discovery that the targeted items' production planning cycle and replenishment frequencies have a significant impact on visibility [57]. Examine the relationship between vendors and customers and reveal that vendors have a more inclusive and broader view. They consider themselves as alliances or partners. Whereas customers view this relationship as a preferred-supplier arrangement. Information technology also affects the nexus between relationships and success. Customer relationship management is another factor of inventory management performance. The interaction between relational information processing and customer relationship management in this setting is moderated by technology [58]. Extending this strand of literature, [59] tests the proposition that information technology improves profitability by increasing sales or reducing operating expenses.

Their results suggest that information technology improves profitability in a better way by enabling revenue growth rather than cost reduction. Looking on the financial aspects, [60] reveals that inventory management is a complex task since larger inventory creates cost but on the other hand, it enables customers to be more flexible in purchasing decisions. [61] Recommend that information and communication technology has influenced inventory control system as it has made it easier to evaluate risk factors in inventory management. Summarizing, inventory management influences overall performance of a firm [62]. Additionally, these researchers discover that the cost of capital has an impact on how inventory management and business performance are related. Further, in this context, [46] recently suggest that organizations should focus on "up to date ICT tools" by including ERP, MRP, RFID, Bar-coding and DRP in their systems. Due to such modernization steps, companies are expected to save costs and earn better profits through elimination of waste and reduction of inventory holding. However, this relationship depends upon the demand uncertainty which is discussed in the next section.

The Mediating Role of Demand Uncertainty

Nowadays, market trends change quickly, and resultantly, companies need an efficient and adaptable supply chain to deal with customers' uncertain demands [1]. There are various sources of uncertainty, and depending on how quickly they have an impact, these demand uncertainties can be divided into short-term and long-term uncertainties [63]. When product demand fluctuations are not dealt with properly, it could cause customers to be dissatisfied, followed by loss of market share and high inventory cost [64]. [65] Examine the demand uncertainty with price maintenance and propose some demand conditions to achieve inventory equilibrium. Proposed two strategic possibilities at the organizational level to counter demand uncertainty. These strategic possibilities can either take the position of a shaper or an adapter. In case of being sharper, the company works on demand distribution to limit the downside risk and retain upside potential

Therefore, the demand-side uncertainty and supply-side disruption are very important while designing the supply chain [66]. Looking at the quantitative aspects, [67] introduces a mathematical model to integrate financial consideration with supply chain decisions under demand uncertainty. This model is useful for supply chain managers. Existing literature also incorporates the investment aspect in the demand uncertainty. For instance, [68] claims that the demand uncertainty undermines the response of investment which deteriorates the capital accumulation. This effect is common in the firms that cannot reverse their investment decisions quite easily. [69] Investigate these phenomena from supplier's perspective—a pulp mill.

Their results indicate that the introduction of a merchandising yard between the mill and the suppliers helps mitigate demand and supply problems and enables the mill to continue its production. Further, this helps to satisfy customers and improve their net annual profit. Considering all this, the demand uncertainty increases at the downstream of a supply chain [70]. Recently, [71] describes two strategies to overcome demand uncertainty: (1) inventory substitution, and (2) probabilistic selling. Although both are operationally disparate, their common aspect is combating uncertainty in customers' demands. They both encourage customers to quit some specific demand in order to enhance demand substitution. This discussion reveals the mediating role of demand uncertainty in the relationship of information technology (VMI system, MRP system, and WM system) and inventory management performance. To the best of our knowledge, none of the studies provide any empirical evidence on this fact from Pakistan. Therefore, this gap motivates us to develop the following four hypotheses.

H4: *Demand uncertainty significantly mediates the relationship between the material resources planning system and inventory management performance.*

H5: *Demand uncertainty significantly mediates the relationship between vendor-managed inventory and inventory managed performance.*

H6: *Demand uncertainty significantly mediates the relationship between warehouse management systems and inventory management systems*

Conceptual Model

Considering all this, the conceptual research model for examining how the performance of inventory management is affected by the material planning system, vendor inventory managed system, and warehouse management system is shown in Figure 1.

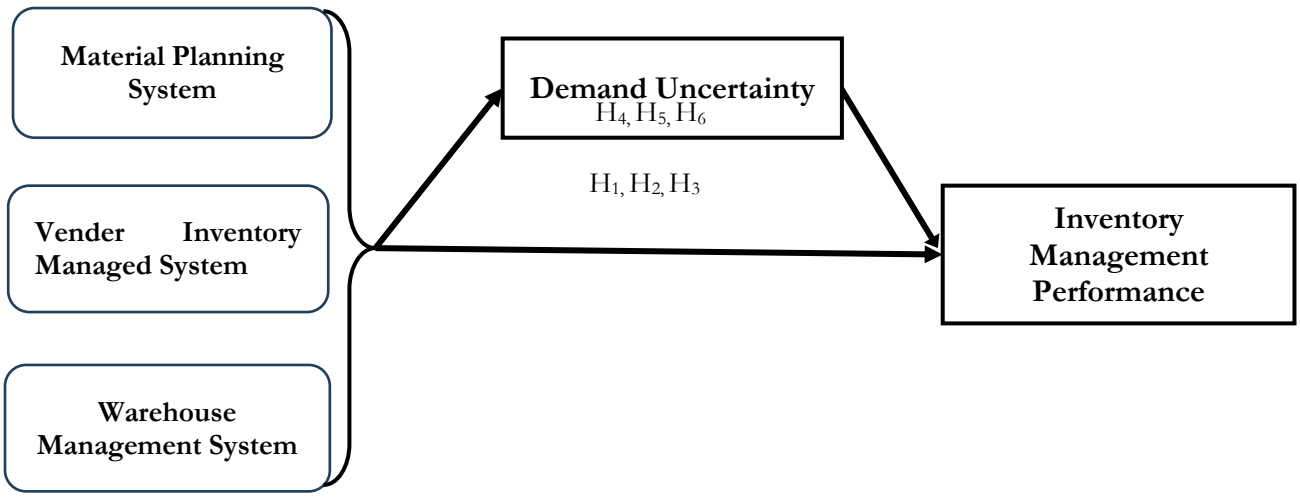

Figure 1: Research Framework

RESEARCH METHODOLOGY

Research Design

For this purpose, a quantitative approach offers effective ways, especially regression analysis. As a result, we used a quantitative strategy that included correlation and regression analysis. Additionally, we used reliability analysis after applying descriptive statistics. Following these informal interviews, we conducted personal surveys to get the responses to our questionnaires.

Measurements for the Variables of the Study

The instrument (questionnaire) is designed for the natural work environment and was conducted by the managers and supervisors and related staff of supply chain & inventory management.

Sample and Data Collection

We gathered this cross-sectional data from these participants during various time periods, primarily following the completion of the literature review. Due to the limited availability of the supply chain & inventory management managers, supervisors, and related staff at the chosen supermarkets in the western and north-eastern major cities (Lahore, Peshawar, Islamabad, Karachi, and Faisalabad) of Pakistan, we had to spend four months collecting the data. The selection of supermarkets is based on the inventory management procedures and the needs of these procedures for their efficient business operations. a region of Pakistan. We distributed 380 questionnaires to the supply chain managers and supervisors of supermarkets in the country's northeast using a convenience sample technique that does not need random selection. We could not get any responses due to the unavailability of the participants. Finally, we collected 355 responses from the supply chain managers and supervisors. However, out of these 355, only 350 responses were workable.

All responses were collected using the self-report measure, which uses a five-point Likert scale with the values of very low extent, little extent, moderate extent, considerable extent, and very great extent. We used 23 questions to examine the effects of material requirement planning systems, vendor managed inventory systems, and warehouse management systems on the effectiveness of inventory management in the key markets in Pakistan's north-eastern cities. For this investigation, we applied regression analysis. Following our conceptual model (Figure 1), we estimate the following regression model in step one.

$$IMPi = \beta 1 + \beta 2VMIi + \beta 3MRPSi + \beta 4 + \varepsilon i \quad (1)$$

The terms material planning system, vendor managed inventory systems, and warehouse management system, respectively, are used. And these make up the study's independent variables. IMP indicates inventory management performance which is used as a dependent variable for this study. We used Equation 1 to test our first three hypotheses. Then, in the second step, we extend our analysis by incorporating the interaction terms by incorporating the demand uncertainty in Equation 1.

The extended model is given in Equation 2.

$$IMPi = \beta 1 + \beta 2VMIi + \beta 3MRPSi + \beta 4WMSi + \beta 5(VMIi)(DUi) + \beta 6(MRPSi)(DUi) + \beta 7(WMSi)(DUi) + \varepsilon i \quad (2)$$

Where DU indicates the demand uncertainty. The rest of the variables are defined under Equation. These estimates from β5 to β7 enable us to test hypotheses 4,5, and 6.

RESULTS AND DISCUSSION

Demographics of the Respondents

We started our analysis through descriptive statistics and reliability analysis. Table1 presents the frequency and percentage of respondents. Table 1 reveals that 70.28 % respondents are male and 29.72% of the respondents are female. Further, Table 1 presents the respondents' educational levels. These statistics indicate that most of the respondents are college graduates. More directly, 60.85% of respondents have 14 years of education. The bottom half of Table 1 indicates that 6.57% respondents have a higher qualification. However, 16% of respondents have an intermediate qualification.

Table 1. Descriptive Statistics

Variables	**Number of Items**	***Cronbach's Alpha***
Gender	*104*	*29.72%*
Female	*246*	*70.28%*
Male		
Education	*56*	*16.00%*

Intermediate	*213*	*60.85%*
College Graduate	*58*	*16.58%*
16 Years of Education	*23*	*6.57%*
More than 16 years of Education	*23*	*6.57%*
Total	*350*	*100%*

Note: *According to the Pakistani educational system, intermediate is the 12 years of education, and college Graduation is 14 years of education.*

Reliability Analysis

It is advised to perform the reliability analysis first, then go on to the correlation and regression analysis. We focused our analysis on measurement scales and the constructed items that go along with them. Amongst many, [72] reveals that an acceptable value of Cronbach's Alpha 0.70. Table 2 is quite revealing in different aspects. In particular, these statistics indicate that the instrument is reliable. After ensuring the reliability (Table 2), we extend the analysis to correlation and regression.

Table 2. Reliability Analysis

Variables	**Number of Items**	***Cronbach's Alpha***
Material Requirement Planning Systems	*4*	*0.88*
Vendor Inventory Management System	*4*	*0.78*
Warehouse Management System	*4*	*0.85*
Demand Uncertainty	*3*	*0.89*
Inventory Management Performance	*5*	*0.84*

Correlation Analysis

Table 3. Correlation Analysis

Variables	MRP	VIMS	WMS	DU	IMP
MRP	1				
VIMS	0.42*	1			
WMS	0.54*	0.24*	1		
DU	0.48*	0.52*	0.76*	1	
IMP	0.36*	0.64*	0.66*	0.58*	1

Note*. MRP, VIMS, WMS, DU, and IMP indicate material requirement planning, vendor inventory management Systems, warehouse management systems, demand uncertainty, and inventory management performance, respectively. *Significance level is 0.1 (2-tailed). **Insignificant relationship.*

Regression Analysis

Table 4. Regression Analysis

		Demand Uncertainty					Inventory Management Performance				
Variables		***β***	***R²***	***Adjusted R²***	***T***	***P*-Value Significance**	***β***	***R²***	***Adjusted R²***	***T***	***P*-Value Significance**
Step-1	MRP	0.63			13.92	.000					
	VIMS	0.58			12.68	.000					
	WMS	0.44	0.059	.049	9.86	.000					
Step-2	*DU*						0.52	.092	.083	12.65	.000

Note*. MRP, VIMS, WMS, DU, and IMP indicate material requirement planning, vendor inventory management Systems, warehouse management systems, demand uncertainty, and inventory management performance, respectively.*

Table 4 presents the coefficients, R-squared, Adjusted R-squared, and P-values, respectively. These statistics enable us to decide about the hypotheses of the study. A closer inspection of the second row Table 4 reveals that material requirement planning has a significant positive impact ($\beta 1 = 0.63$; $p < .05$) on the inventory management performance. The value of the coefficient indicates that a unit increase in vendor-managed inventory increases the

inventory management performance by 0.63 units, ceteris paribus. These results are in line with the existing literature [27, 26,29]. These results indicate that a pre-active supplier can reduce the lead time by receiving the required information early. Further, consistent with our results, [28] suggests removing different levels from the supply chain management. Moving now to the second hypothesis, the vendor inventory management system has a significantly positive impact ($\beta 2 = 0.58$; $p < .05$) on the inventory management performance. The value of the coefficient indicates that one one-unit increase in vendor inventory management system increases the inventory management performance by 0.10 units, ceteris paribus. These results are in line with the existing literature [42, 43]. For instance, [45] proposed the MRP-dependent specific request method which helps practitioners to supply the required level of quantity to achieve the production plan. By focusing on our results, the test statistics fall under the rejection region, indicating that we have enough evidence to reject the null hypothesis. Therefore, the material requirement planning system has a positive, statistically significant impact on the inventory management performance. Turing now to the third hypothesis which states that the warehouse management system has a positive impact on the inventory management performance. Table 4 indicates that material requirement planning has a positive and statistically significant impact ($\beta 3 = 0.44$; $p < .05$) on the inventory management performance. The value of coefficient indicates that one one-unit increases in material requirement planning increases the inventory management performance by 0.52 units, ceteris paribus.

These results are in line with the existing literature [52, 53,54]. The possible reasons for this positive impact can be the reduction in material identification costs and equipment handling costs. On the similar veins, [48] conducted research to aid small companies in improving their warehouse management system by providing them with an automated information sharing system. This system enabled managers to make quick and successful decisions along with avoiding invalid data. Considering all this, our results suggest that the warehouse management system has a positive impact on the inventory management performance. Moving now to the mediating role of demand uncertainty, where the fourth, fifth, and sixth hypothesis states that demand uncertainty mediates the relationship between material requirement planning, vendor inventory management system, warehouse management system, and inventory management performance. The interaction coefficient ($\beta 4$, $\beta 5$, and $\beta 6 = 0.52$; $p < .05$) and this way, demand uncertainty mediates the relationship between material requirement planning systems, vendor inventory management system, warehouse management systems and inventory management performance.

Accordingly, the uncertain demand would disrupt the future planning also see [77] In this way, the mediating effect of demand uncertainty can be understood. One of the possible reasons of this alteration is the supply disruptions (also see [74,75] It causes extra inventory and reduces sales at retailing outlets also see [76] Consequently, demand-side uncertainty and supply-side disruption are very important while designing supply chain [66]. Hence, Table 4, according to the result, all our hypotheses are accepted.

LITERATURE LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Although researchers have tried to cover the maximum supermarkets of the north-eastern and western (Lahore, Peshawar, Islamabad, Karachi, and Faisalabad) region of Pakistan as it does not cover international countries. Therefore, the results cannot be implemented to other countries without carrying out more investigation and analysis. Another possible limitation is the fact that this research covers major areas of Pakistan. Nonetheless, there is a possibility that remote areas need special attention in supply chain management due to lack of development and resources. So, this research does not cover special needs required by such areas. In future, researchers can work on other factors of information technology like distribution resource planning in this framework. The scope of research can also be shifted from supermarkets to other types of business. Another aspect for succeeding researchers is influence on cost of above-mentioned variables.

CONCLUSION

This research aims to investigate the impact of material requirement planning system, vendor inventory managed systems, and warehouse management systems on inventory management performance of supermarkets in Pakistan's major cities located on north-eastern and western (Lahore, Peshawar, Islamabad, Karachi, and Faisalabad) part of the country. Our results suggest that the variables of information technology (material requirement planning system, vendor inventory managed systems and warehouse management systems) have a positive and statistically significant impact on the inventory management performance. Demand uncertainty can affect this relationship, except for the warehouse management systems. Results indicate that it is better to invest in vendor inventory management systems and material requirement planning systems as they both can save excessive cost. Unexpectedly, high or low demand from customers can deter the establishment of a successful

supply chain. Nevertheless, proper, and early information sharing is expected to improve this problem efficiently. Further, investment in modern technology can enhance initial cost but this cost along with some other associated benefits can be recovered in the long run. The results of our study recommend that supermarkets in Pakistan should invest their resources to enhance technological abilities. It would help them reduce communication along with amelioration in information sharing. Reduction in demand uncertainty is also recommended as it affects the performance of inventory management. Adoption of modern technology would not only help vendors get early information but also make quick and reliable replenishment decisions. Furthermore, it would reduce lead times as well.

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