Automated Inventory Management Systems and its impact on Supply Chain Risk Management in Manufacturing firms of Pakistan

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***Abstract*— Inventory management is an important task for manufacturing firms of Pakistan. Supply chain risks are considered to be major hurdle in successful accomplishment of today's supply chain management processes. The increasing complexity in business operations results in number of supply chain risks which negatively affects the performance of an organization. This research investigates the contribution of automated inventory management systems in increasing the efficiency of inventory management. This study utilizes four automated inventory management systems which includes Radio frequency Identification (RFID), Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI) and Material Requirements Planning (MRP) and analyses their role as a supply chain risk mitigation strategy through implication of risk management process. This study also determines the moderating influence of employee training and development on the relationship between automated inventory management systems and supply chain risk management in manufacturing firms of Pakistan through the implication of Strategic Employee Training and development model. Multi-method quantitative study is implied for conducting the study. Preacher and Hayes (2007) Process Model 1 on SPSS is used for moderation test.**

Keywords*—*Automated inventory management, Employee Training and Development, EDI, ERP, MRP, RFID and Supply chain risk management.

1. Introduction

The contribution of inventory management in improving the supply chain performance is unquestionable. An organization gain competitive edge in supply chain performance through proper inventory management results in efficient demand forecasting and service delivery [1]. In Pakistan natural disasters, disputes among labors and other environmental factors can cause a serious disrupt or delay in the flow of the three important components of supply chain process of an organization including: flow of material, flow of cash and flow of information which resulted in increased supply chain risks. The increasing complexity in business operations results in number of supply chain risks which negatively affects the performance of an organization [2]. According to Ref. [3] The major cause of uncertainty in the reliability of company's supply chains is the increasing demands and complexity of the globalized business operations and managers considered this uncertainty, a major issue to resolve. There is a negative impact of supply chain risks on the performance of an organization [4]. Supply chain uncertainties are often resulted from poor prediction of materials required, inaccuracy in planning, inventory shrinkage and poor-quality problems. In the presence of supply chain risks, every company involves downturn in its value, sales growth and financial position because of increase in cost. Actively managed inventory with optimal policy for replenishment can act as a safety buffer for reducing supply chain risks [5]. For supply chain risk management organizations restructure themselves by replacing traditional inventory management systems with automated inventory management.

Ref. [6] defined automation as technology-based production of goods and services with the use of computers and application of mechatronics. Ref. [7] defined Automated inventory management systems as technology-based systems used for controlling products and sales in an organization. These systems contribute in improving operational efficiency, replacing manual effort with automation with reduction in cost. These softwares keep track of inventory record with accurate flow of goods, information and money and improved customer service. Automation is a key for the successful management of inventory and managerial resources. Automation in the inventory management systems of manufacturing firms reduces manufacturing lead times, operational cost, labor cost and labor shortage problems with production improvement [8]. Ref. [9] Conducted a study on the operational efficiency of Gianchore tea manufacturing factory of Kenya by the use of automated inventory management systems. Ref. [10] highlighted the case of Sony Ericsson which on March, 2000 suffered $500 million loss in sales due to accidental fire at Phillips semiconductor plant. The plant faced the problem of shortage of stock due to production loss. This negative consequence of supply chain disruption can be prevented with maintenance of inventory levels and other operational elements. Supply Chain Risk Leadership

Council (SCRLC) in August 2011 highlighted the concept of Supply Chain Risk as the possibility of something being likely and consequences of the future events at different points of supply chain management process from raw material sources to end users of the product. There are two main types of supply chain risks, one is external supply chain risks and other is internal supply chain risks. External supply chain risks include demand risk at consumer end, supply risk at supplier end, environmental risk: surrounding economic, social, technological, governmental, cultural, political factors, business risks and physical plant risks. Internal supply chain risk includes manufacturing risks, business risks, contingency risks, planning and control risks and cultural risks [11]. LCP Consulting in 2003 documented a strategy that an organization must be positioned on the basis of appropriate inventory management systems that act as a buffer and neutralizes the effect of external supply chain risks. Ref. [12] in his study highlighted three types of supply chain risks including: financial risk, strategic risk and operational risk. Ref. [13] reported that uncertainties in the supply chain effected about 83% companies in performing supply chain operations resulted in delayed delivery of products, goods and services. The study documented the example of Boeing company that cost 11 billion dollars due to supply chain risks.

(SCRLC) in August 2011 highlighted the concept of Supply Chain Risk Management as strong coordination among inter-organizational activities for directing and controlling end-to-end supply chain of an enterprise with respect to the risks involved in supply chain [14]. Ref. [15] documented that Automated inventory management systems are proved to be effective, efficient and a considerable source of improvement for manufacturing sector through provision of security, risk mitigation and high-quality customer service. The study compared existing inventory management systems with computerized systems include: spread sheet manual systems, barcode, RFID systems and warehouse management systems and highlighted how it contributes in efficient tracking and movement of materials through up-to date information flow. Automated inventory management ensures just in case approach and reduces supply chain uncertainties.

This study utilizes four automated inventory management systems which includes Radio frequency Identification (RFID), Enterprise Resource Planning (ERP), Electronic Data Interchange (EDI) and Material Requirements Planning (MRP) and analyses their role as a supply chain risk mitigation strategy. The study analyses the moderating role of employee training and development on the relationship between automated inventory management systems and supply chain risk management through implication of Strategic employee training and development model. This study also analyses the role of risk management process in the treatment of supply chain risks. Risk management process reduces hurdles in production, problems related to product quality and financial instability through the management of internal and external supply chain disturbances [16].

2. Literature Review

The literature on automated inventory management systems, supply chain risk management is reviewed through the implication of strategic employee training and development model and risk management process model and forms the theoretical foundation for the research framework.

RFID: Ref. [17] defined RFID as an irreplaceable technology used across the supply chain for inventory control by efficient flow of information and physical goods from manufacturers to retailers and to consumer end at real time and location by reducing shortages. RFID technology with effective flow of information is valuable for solving the problems of production management which includes product shortages, delayed shipments and deliveries with cost inefficiencies resulted from poor inventory tracking procedures. Ref. [18] showed the positive effects of RFID automation in supply chain management which includes the improvement in speed and efficiency of visual tracking of required materials and processes with accurate information flow, reduction of delivery errors and shrinkage errors. Ref. [19] proved in their study that RFID is useful for efficient operations of supply chain management of manufacturing Digital Enterprise. RFID is important in manufacturing firms for integration of production processes, provide assistance in planning and scheduling, representing the condition of working equipment, monitoring the movements of stocks, provide accuracy, quality assurance and highly customized services [20]. The study proved the significant contribution of RFID technology in management of supply chain disruptions. The study identified three areas in which RFID can be used for the mitigation of supply chain risks: Accurate monitoring of uncertainties, quick responses to the emerging disruptions and corrective actions based on high quality decision. The study exemplified different cases from the past including: After effects of 9/11 terrorist attacks causes disruptions in many supply chains, namely Ford Motor Company suffered production loss in five assembly plants and Quanta computer, manufacturer for Dell also suffered their supply chains greatly from these uncertain ripple effects. NP Collection, Manufacturers of Finnish apparel and METRO retailers considered RFID valuable for automated replenishment of stocks. The major risk factors associated

with adoption of RFID are lack of experience, specialized skills and abilities required to deal with uncertainties and complexities in the working of RFID.

ERP: ERP is the company's preferred package system which includes automation and integration of all processes of a business by sharing easily accessible information among all the participants of a project in actual time situation [21]. The study proved ERP as important tools for improving organizational performance through coordination among supply chain partners, effective information flow, efficient use of resources and integrated decision making. The study also proved positive moderation effect of technology related factors on the relationship between ERP adoption and organizational performance. Ref. [22] conducted a quantitative study on 44 commercial banks of Kenya and proved that an organization can achieve sustainable competitive advantage through effective implementation of ERP systems. ERP is a key solution to the problems for controlling the inventory of a company [23]. ERP equates the central nervous system of a company which sense information of the position of different units of the business and then transfer it to the other needy parts of the business. The study surveyed 53 organizations in Australia and highlighted the critical success factors that contribute significantly for successful implementation of ERP. Of all the CSFs identified, user training and development is the basic reason for the failure of many projects. Ref. [24] Highlighted the critical factors that affect the successful implementation of ERP systems, one of those is the lack of proper training of employees for proper functioning of ERP systems. The study conceptualized ERP training and education as "the process that offers management and employees proper logic and complete understanding of ERP systems" and proved training of employees an integral factor for effective ERP functioning.

EDI: Ref. [25] conceptualized EDI as a standardized computer system used for transfer of business to business transactions information without manual interference. Ref. [26] documented that EDI systems contributes significantly for supply chain firms, by overcoming supply chain disruptions through sharing of accurate and real-time information regarding supply and demand among supply chain network. EDI is a source of integration for firms in a supply chain network with transmission of real-time information, which improves the responsiveness of supply chain of an organization to uncertain environmental changes [27]. Survey conducted by Malaysian Department of Statistics (DOS) on the rapid increase of the demand of EDI by manufacturing companies ranging from RM 17 billion in 2003 to RM 27.7 billion in 2005 and decreases in 2006 to RM 23 billion and this played an important role for increasing GDP from 45% to 51% in one year (2005-2006) (Economic Review, 2007). Ref. [28] Conducted a study on BIDCO Oil Refinery and studied the part of EDI on the performance of supply chain of manufacturing companies in Kenya. Ref. [29] Conducted a descriptive study on Mombasa Port Cargo Distribution Management for determining the role of EDI on supply chain performance. They also described the importance of employee training and development for efficient working on computerized systems. The main objective of EDI is to improve the operational as well as organizational efficiency of an organization.

MRP: MRP is a standardized system used for the calculation of size of items, subassemblies and the components needed to run efficient production program for producing multiform products [30]. They also documented that MRP system plays an important role in the regulation of speed of inventory outflow which affects the rate of services provided by firm with Just in Time supply of buying and manufacturing orders. Documented the main function of MRP systems: meeting of scheduled production plans by providing components, materials and products and in time customer delivery, maintenance of optimal inventory levels [31]. The study considered the development of a user-friendly software which plays an important role in proper inventory management through proper planning and tracking of required materials. Ref. [32] documented the importance of MRP for manufacturers for precise determination of the amount and time of purchasing and processing of material involving appropriate scheduling for analysing sales and production orders, present inventory flow and future prediction of desired material. Automated MRP Planning systems resulted in effective scheduling for effective management of number of items all over the production facility.

2.1. Models Applied

2.1.1 Strategic Employee training and development model and Supply chain risk management

According to Ref. [7] Computerization of inventory systems is dependent upon use of machines which replaces manual effort with automation, saving time and error free tracking of records. For effective practical implementation, there must be specialized training programs for training of employees operating these systems. strategic training and development are a source for gaining competitive advantage through application of innovative knowledge and building of skillset useful for performing effective operations [33]. Ref. [34] in his book defined employee training and development as infused capabilities of an employee that help him/her in dealing with a task with respect to the occupied designation.

Research defined it in context of operations department as Training, qualification and skill development get along with performance of assigned task to an employee. This study analyses the moderating influence by applying a comprehensive model i-e Strategic Employee Training and Development, developed by Tannenbaum in 2002. It is a process used for designing and implementing technology-based training systems for improving the performance of an organization. Figure 1 shows that process model consisted of four steps.

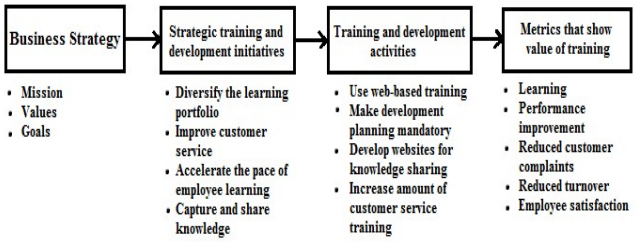

Figure 1. Strategic Employee Training and Development Model

Step 1: Identification of business strategy

The first step considers three components which are mission, values and goals. The company first, establish its mission, values and goals what they wanted to achieve for ensuring effective supply chain performance. For successful achievement of established goals, an organization must be aware of all uncertainties that effect supply chain risks.

Step 2: Identification of initiatives that support Strategic Employee Training and Development

In second step, the company develop initiatives committed to continuous learning by using diversified updated training programs, identification of training needs with employee motivation and sharing of effective knowledge and ideas.

Step 3: Translation of initiatives into training and development activities

In the third step, the company focuses on the activities e.g. e-learning, web-based learning that are helpful in successful implementation of action learning programs.

Step 4: Use standards or measurement systems that determine the value of training

Fourth step includes monitoring and controlling which involve the use of different indicators that serve as standards for measuring performance. Common indicators including: Just in Time, continuous quality improvement, supply chain performance improvement by supply chain risk and cost reduction.

2.1.2 Automation in inventory management and risk management process model

Ref. [35] Designed an automated inventory management system for supermarkets. The study proved that efficient inventory control management systems play an important role in correcting business anomalies. The study also highlighted the difficulties associated with manual inventory control systems including: more time consuming, poor information flow, inaccurate physical counts, inaccurate tracking of daily record and inaccurate browsing of ordering supplies. All these anomalies resulted in supply chain uncertainties, which can be corrected through automated inventory management systems. Ref. [36] Conceptualized supply chain risk management as the process of managing uncertainties in the supply chain by maintaining coordination among the members in a supply chain network which ensures growth, increased profit margins with continuity. This study analysed the impact of automated inventory management system on the supply chain risk management in manufacturing firms by practical implementation of supply chain risk management process. Standard ISO 31000 in 2009 identified the processes of risk management. The figure 2 shows that model has five steps in the risk management process.

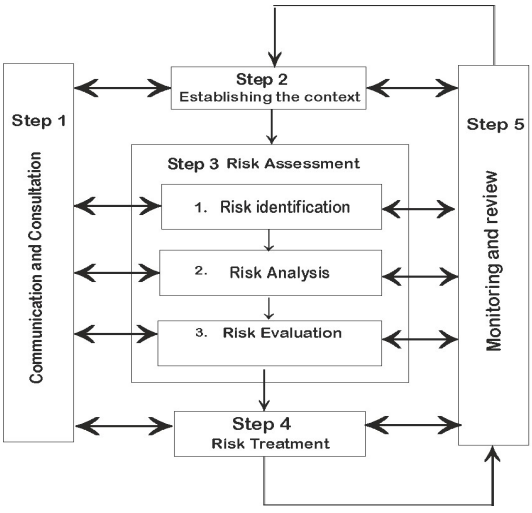

Figure 2. Risk management process model

Step 1: Communication and consultation

Manufacturing organizations that are using automated inventory management systems must involve strong communication and consultation among the members in the supply chain network for coordinating all the inventory tracking activities which consolidates supply chain risks.

Step 2: Establishing the context

The context describes the scope of risk criteria required for the selection of the process. Both internal and external factors define the context for process selection for management of risks in supply chain.

Step 3: Risk assessment

Risk assessment is further divided into three 3 steps which includes risk identification, risk analysis and risk evaluation. In risk identification, all the supply chain risks are identified that are caused by poor inventory management. Ref. [37] documented a survey conducted by Advanced Market Research, a company which surveys global companies and measure the level of risk in their global supply chains with identification of areas that mostly significantly causes risks and also provide advisory services of how to manage businesses in the presence of those risks. The results of survey conducted in 2006 were supplier risk 28%, strategic risk 17%, natural disaster 15%, geo-political events 11%, regulatory risk 11%, logistics failure 10%, intellectual property infringement 7% and other risks 1%. Risk analysis study the major causes and sources of risk, their negative and positive effects and determine the possible consequences. This study considered poor inventory management as one of the causes of supply chain risks in manufacturing firms. Risk evaluation supports decision making based upon risk analysis.

Step 4: Risk Treatment

Risk treatment is the process that focuses on the identification of opportunities for reduction in supply chain risk. This study considered use of automated inventory management systems which include RFID, MRP, EDI and ERP as a source for supply chain risk management.

Step 5: Monitoring and Review

Monitoring involves checking the quality and progress of risk management process in reducing supply chain risks.

The study investigated the impact of four strategies namely, strategy for addition capacity, strategy for channel flexibility, strategy for addition of inventory and strategy for responsiveness of supply chain, applied by Coca Cola Company in Kenya for supply chain risk management. The study proved capacity addition as a useful strategy for risk reduction [38]. The study proved the positive impact of 3 decentralized supply chain management approaches including: sharing of information, decentralized decision making and sharing of risk and rewards on reduction of supply chain complexities and improvement in supply chain performance. Automated inventory management systems can effectively coordinate all three approaches and significantly reduce supply chain uncertainties [39].

2.2. Theoretical Contribution

Diffusion of Innovations Theory

Ref. [40] documented that Diffusion of innovations theory analyses the process of communication of information to individuals or organizations over a period of time for using an innovation. Rogers in his book, conceptualized innovation as a perceived new idea, practice, service or good. The newness refers to the innovation in an application that addresses a need or solve a problem. The adoption rate increases when innovation provides advantage and is more compatible in comparison to traditional practices. The innovation decision is a five-stage process: 1) knowledge, 2) persuasion, 3) decision, 4) implementation and 5) confirmation. This study examines the diffusion of automated inventory management systems including: RFID, ERP, EDI and MRP, through employee training and development and then implementation of these innovative systems for supply chain risk management to obtain a relative competitive advantage in comparison to poor traditional system. Ref. [41] Implied theory of technology diffusion for determining the influence of MRP system, Vendor Managed Inventory systems, Just-in-time approach and barcoding system on the performance of beverages manufacturing companies in Kenya. Ref. [42] Applied theory of diffusion of innovations for examining the adoption of RFID technology in Taiwanese logistics industry. The study also proved the positive contribution of innovation attributes including: relative competitive advantage, level of compatibility, complication, observability and trialability of RFID automated systems with behavioral intention and attitude to use for their adoption.

Resource Based View

Ref. [43] described resource-based view as the optimal utilization of the resources to maximize the productivity. Resource based view motivates the firm towards development of dynamic capabilities for successful adoption of environmental changes, and firm develop its dynamic capabilities through the purposeful creation, extension and modification of its resource base. This study considered the development of physical capital resources as well as human capital resources through training and development of employees for using automated inventory management systems for reduction of supply chain risks. Study applied resource-based view

for determining the relationship between resource utilization, visibility and performance improvement in terms of obtaining resilience and robustness in supply chain management [44]. Ref. [45] Conducted a study on Unga Group Limited for determining the effectiveness of information technology in inventory management and achieving sustainable competitive advantage through implication of Resource-based view in manufacturing companies of Kenya.

2.3. Research Gaps

Previous studies provide a strong theoretical background for supporting the indirect impact of inventory management systems in mitigation of supply chain risks through the management of three important components of supply chain process in different ways. This study determines the direct impact of automated inventory management systems in reduction of supply chain risks through implication of risk management process. Manufacturing sector in Pakistan is highly suffering from supply chain risks and little search have been done on the reduction of supply chain risks. Automated inventory management systems e.g. RFID, MRP etc. are the emerging areas for research in the context of supply chain management. Many studies have proved the importance of employee training and development for efficient working on digital systems but this study highlights the moderating role of employee training and development in supply chain risk management through implication of strategic employee training and development process model for using automated inventory management systems.

3. Conceptual Framework

The study involves quantitative research and developed a conceptual framework to increase the understanding of interrelationships between automated inventory management systems (AIMS), Employee training and development (ETD) and supply chain risk management (SCRM). Figure 3 shows conceptual framework.

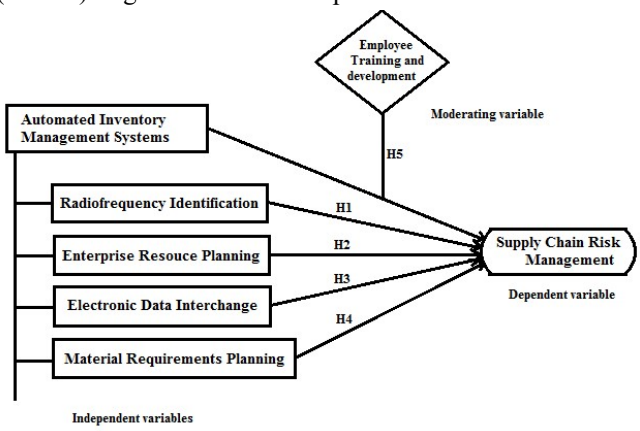

Figure 3. Conceptual framework

4. Hypothesis Development

H1: There is positive relationship between RFID and supply chain risk management.

H2: There is positive relationship between ERP and supply chain risk management.

H3: There is positive relationship between EDI and supply chain risk management.

H4: There is positive relationship between MRP and supply chain risk management.

H5: Employee training and development moderates the influence of automated inventory management systems on supply chain risk management.

5. Research methodology

To test the hypothesis, data collected from 50 manufacturing firms in Pakistan that use automated inventory management systems for the management of inventory. Simple random sampling is used to collect data from a sample size of 400 respondents including vendor manager, production manager, supply chain manager and employees. Questionnaires were adapted from previous studies, designed on a five-point Likert scale. Multimethod quantitative study is used involving questionnaire data collection technique and SPSS quantitative data analysis software. Statistical analysis including: Descriptive statistics of all demographics, Cronbach's alpha is used for reliability analysis of items, Regression analysis and Correlation tests are performed to test the positive relationship between automated inventory management systems and supply chain risk management. Preacher and Hayes (2007) PROCESS model 1 is used to test the moderating role of employee training and development on the relationship between AIMS and SCRM.

6. Results and Interpretation

6.1. Descriptive statistics

The table1 shows the descriptive statistics of demographic traits of sample used in the study. There were 283(71%) males and 117(29%) females including 68(17%) vendor managers, 117(29%) supply chain managers, 136(4%) production managers and 79(20%) employees from small organizations 39(10%), medium organizations 120(30%) and large organizations 241(60%). 44(11%) were self-employed, 152(38%) were government employed and 204(51%) were private employed. The age groups including 21-25 years(16%), 26-30 years(47%), 31-35 years(27%), 36-40 years(9%) and above 40 years(1%) with experience of 1-3 years(18%), 46 years(43%), 7-9

years(30%) and above 10 years(10%). The study including (47%) postgraduates, (42%) graduates and (11%) undergraduates. (35%) were using ERP, (30%) ere using MRP, (20%) were using EDI and only (16%) were using RFID inventory management systems.

Table 1. Descriptive statistics

Gender	**Frequency**	**Percent**
Male	283	70.8
Female	117	29.3
Job Role	**Frequency**	**Percent**
Vendor Managers	68	17.0
Supply Chain Manager	117	29.3
Production Manager	136	4.0
Employee	79	19.8
Organization size	**Frequency**	**Percent**
Small	39	9.8
Medium	120	30.0
Large	241	60.0
Employment Status	**Frequency**	**Percent**
Self Employed	44	11.0
Government Employed	152	38.0
Private Employed	204	51.0
Age Groups	**Frequency**	**Percent**
21-25 years	64	16.0
26-30 years	187	46.8
31-35 years	108	27.0
36-40 years	37	9.3
Above 40 years	4	1.0
Education	**Frequency**	**Percent**
Undergraduate	45	11.3
Graduate	168	42.0
Postgraduate	187	46.8
Inventory Management System	**Frequency**	**Percent**
RFID	64	16.0
ERP	138	34.5
EDI	78	19.5
MRP	120	30.0
Total	**400**	**100.0**

6.2. Correlation

Correlation coefficient indicates the degree and direction of relationship between the two variables. Table 2 shows statistically significant ($p<0.01$) moderate correlation between RFID, EDI, MRP, ETD and SCRM with ($r>0.3$) and ERP shows weak correlation with all the variables ($r<0.3$) except moderate correlation with RFID ($r>0.3$).

Table 2. Correlation

		RFID	**ERP**	**EDI**	**MRP**	**ETD**	**SCRM**
RFID	Pearson Correlation	1	0.357**	0.452**	0.329**	0.421**	0.365**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
ERP	Pearson Correlation		1	0.158**	0.293**	0.217**	0.251**
	Sig. (2-tailed)			0.002	0.000	0.000	0.000
EDI	Pearson Correlation			1	0.382**	0.381**	0.351**
	Sig. (2-tailed)				0.000	0.000	0.000
MRP	Pearson Correlation				1	0.341**	0.283**
	Sig. (2-tailed)					0.000	0.000
ETD	Pearson Correlation					1	0.382**
	Sig. (2-tailed)						0.000
SCRM	Pearson Correlation						1
	Sig. (2-tailed)						

6.3. Reliability Analysis

Then reliability test is conducted to determine the internal consistency of all the items through values of Cronbach's alpha. (Sheridan et al., 2010). Table 3 shows overall Cronbach's alpha for all 30 items is 0.809 which indicates that items form a scale that has reliable internal consistency reliability. The values for ERP, EDI, ETD and SCRM are 0.526, 0.576, 0.509 and 0.609 respectively indicates moderate internal consistency reliability. RFID and MRP indicates fair internal consistency reliability with value 0.486 and 0.427.

Table 3. Reliability Analysis

Variables	**No. of Items**	**Cronbach's alpha**
RFID	5	0.486
ERP	5	0.526
EDI	5	0.576
MRP	5	0.427
ETD	5	0.509
SCRM	5	0.609
Overall	30	**0.809**

6.4. Regression Analysis

Regression analysis play an important role in identifying the nature and strength of influential relationship between dependent and independent variables.

6.4.1 Multicollinearity test

Multicollinearity is a state with high inter-associations among the independent variables which arises when there is strong correlation among the variables. Tolerance is the indicator for multicollinearity and its reciprocal is known as Variance Inflation Factor (VIF). Multicollinearity is acceptable if value of tolerance > 0.1 and the value of VIF < 10. Table 4 shows the acceptable values of tolerance for RFID, ERP, EDI and MRP are 0.703, 0.835, 0.732 and 0.788 respectively and values of VIF for RFID, ERP, EDI and MRP are 1.423, 1.198, 1.367 and 1.270 respectively.

Table 4. Multicollinearity test

Model	Collinearity Statistics	
	Tolerance	VIF
RFID	0.703	1.423
ERP	0.835	1.198
EDI	0.732	1.367
MRP	0.788	1.270

Dependent Variable: SCRM

6.4.2 Regression Analysis Results

In Table 5, R indicates strong positive relationship between all automated inventory management systems and supply chain risk management with 45% correlation between them. The value of R Square is 0.184 indicates 18.4% proportion of variance experienced by SCRM because of changes in AIMS. The value of adjusted R square is 0.194 (19.4%), indicates acceptable model accuracy. The value for Standard error of the estimate is 0.68022 indicates (68%) accuracy of predictions.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.450	0.202	0.194	0. 68022

a. Predictors: (Constant), MRP, ERP, EDI, RFID

6.4.3 ANOVA

ANOVA is analysis of variance. ANOVA predicts the statistical significance of regression model for predicting outcome variable. In Table 6 F = 25.026 and significance level 0.000 (p < 0.001) shows that combination of RFID, ERP, EDI and MRP significantly predicts SCRM.

Table 6. ANOVA Results

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	46.318	4	11.580	25.026	0.000[b]
Residual	182.766	395	0.463		
Total	229.084	399			

a. Dependent Variable: SCRM
b. Predictors: (Constant), MRP, ERP, EDI, RFID

6.4.4 Hypothesis Testing

B-coefficients measure the tendency of how strongly automated inventory management systems influences supply chain risk management. Standard errors determine whether or not the beta values differ significantly from zero. (P<0.05) shows statistically significant values indicates that dependent variable was strongly influenced by independent variable and hypothesis was successfully supported. Table 7 shows that significance value of RFID, ERP, EDI and MRP are 0.000, 0.018, 0.000 and 0.036 (P<0.05) respectively, indicating positive relationship between RFID, ERP, EDI and MRP and SCRM so hypothesis 1, 2, 3 and 4 were supported.

Table 7. Beta Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.322	0.216		6.133	0.000
RFID	0.211	0.058	0.197	3.667	0.000
ERP	0.137	0.057	0.117	2.383	0.018
EDI	0.187	0.048	0.202	3.853	0.000
MRP	0.113	0.054	0.106	2.103	0.036

Dependent Variable: SCRM

6.5. Preacher and Andrew F. Hayes Process Model

Preacher and Andrew F. Hayes, PhD PROCESS model 1(2007) is used to analyze how Employee training and development moderates the influence of AIMS on SCRM. Following are the steps.

Step 1: Creation of uncentered interaction term. Interactions: int_1 AIMS X ETD

Table 8 shows uncentered interaction term where value of lower level confidence interval is 0.0471 and upper level confidence interval is 0.2918 and there is no zero lie between confidence intervals and value of P is 0.0068<0.05 which signifies significant interaction so moderation is significant.

Table 8. Creation of uncentered interaction term.

Model	Coeff	Se	T	P	LLCI	ULCI
int_1	0.1695	0.0622	2.7230	0.0068	0.0471	0.2918

R-Square increase due to interactions

	R2-change	F	df1	df2	P
int_1	0.0088	7.415	1.000	396.000	0.0068

Step 2: Determination of the amount of variance accounted for in the Model.

In Table 9, model summary represents the test of linear moderation of the quadratic effect of automated inventory management systems on Supply chain risk management by employee Training and Development. The values indicate that the variables used in PROCESS model 1 accounted for a significant amount of variance with R (49.28%), R Square (24%), F=59.1861 and P < 0.001.

Table 9. Model Summary

R	R Square	MSE	F	df1	df2	P
0.4928	0.2429	0.4380	59.1861	3.000	396.000	0.000

Step 3: Conditional effect of independent variables on dependent variables at values of moderator.

Table 10 shows the standard deviation below and above the mean which is ± 0.7050. Effect is another regression coefficient which shows the effect of ETD on AIMS and SCRM above and below the mean is statistically significant with p<0.05. There is no zero lie between lower level confidence intervals and upper level confidence intervals indicating that moderation effect is significant, Hypothesis 6 was successfully supported.

Table 10. Conditional effect of independent variables on dependent variables at values of moderator.

ETD	Effect	Se	T	P	LLCI	ULCI
0.7050	0.3701	0.0936	3.9534	0.0001	0.1860	0.5541
0.0000	0.4895	0.0775	6.3132	0.0000	0.3371	0.6420
0.7050	0.6090	0.0843	7.2213	0.0000	0.4432	0.7748

Johnson-Neyman technique This study implies technique to probe the moderating effect of Employee Training and Development on AIMS and SCRM. Table 11 shows that automated inventory management systems is strongly correlated with Supply chain risk management when standardized value for moderator is -1.4361.

Table 11. Johnson-Neyman technique

Value	% below	% above
-1.4361	2.5000	97.5000

Step 4: Plotting of interaction points

Table 12 shows data for visualizing the conditional effect of independent variable on dependent variable. Figure 4 shows that the use of AIMS and ETD increases Supply chain risk management.

Table 12. Data for visualizing the conditional effect

	Below SD	Mean	Above SD
AIMS	2.9022	3.0105	3.1187
ETD	3.0915	3.2608	3.4301
SCRM	3.2808	3.5112	3.7416

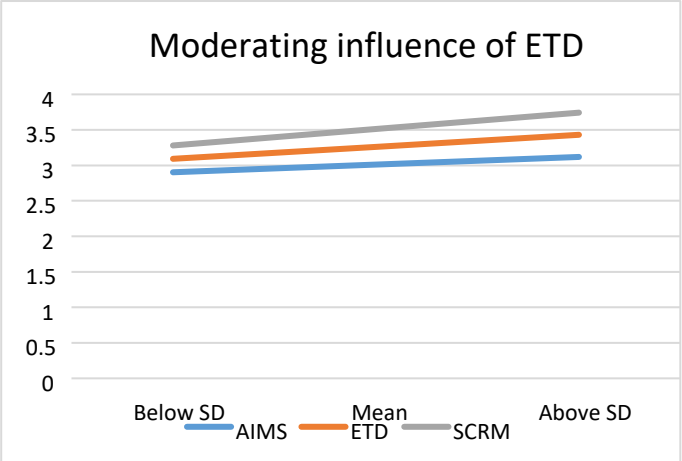

Figure 4. Plotting of interaction points

7. Discussion

This study extends the previous research on supply chain risk management. Although the importance of automated inventory management in improving the supply chain performance is unquestionable, prior research does not take into account their role in supply chain risk management through the moderating effect of employee training and development. This research adds relevance to the study of supply chain risk management through the implication of strategic employee training and development model and risk management process model. Preacher and Andrew F. Hayes, PROCESS model 1 on SPSS, statistically proved the moderating role of employee training and development on supply chain risk management. The results of the analyses lend support to the hypotheses for supply chain risk management.

8. Managerial implications

This study assists managers in supply chain risk management through the use of technology-based inventory management systems and reveals the improvement in supply chain performance by investing time and resources in employee training and development. The skills, abilities and expertise of highly trained and experienced employees can be considered as a source of gaining competitive advantage. Organizations operating in today's business environment have increased their reliance on knowledge–based positions which for supply includes technical logistics knowledge, information technology knowledge, supply chain specialists and they are in constant demand for supply chain talent [46].

9. Conclusion

The main objective of the study was to investigate the relation between automated inventory management systems and its impact on supply chain risk management under the moderating influence of employee training and development. Four automated inventory management systems namely, RFID, ERP, EDI mad MRP are used in the study. Risk management process model and Strategic Employee Training and Development Model are implied. Following the theoretical concepts in diffusion of innovation theory and resource-based theory the study proved that automated inventory management systems can significantly mitigate the risks through focusing on its human capital. Multimethod quantitative study is used for testing of hypothesis. Like previous researches this study proved the positive relationship between automated inventory management systems and supply chain risk management. The study also proved the moderating role of employee training and development on the relationship between automated inventory management systems and supply chain risk management.

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