

Mobilizing Organizational Performance through Robotic and Artificial Intelligence Awareness in Mediating Role of Supply Chain Agility

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Abstract--- Tourism industry is lifeline for Thailand as this sector is contributing a lot in country's GDP. With an increasing flux of tourists, hotel industry is bringing artificial intelligence and robotic awareness in their employees to ensure better performance from all dimensions. Such performance levels are also linked with supply chain agility up to some extent. This paper has aimed to analyze the impact of artificial intelligence and robotic awareness on environmental, operational and economic performance of hotel sector of Thailand. Moreover, mediating role of supply chain agility has also been checked in relationship between the respective empirical linkages. Data was collected from the managing employees of hotel sector of Thailand through a structured instrument and it was then analyzed through confirmatory factor analysis and structural equation modeling. Results have provided the insight that robotic awareness has significant impact of all three dimensions of performance and supply chain agility significantly mediates these relationships in positive direction. This study is novel due to testing supply chain agility as mediator in robotic awareness and performance linkage and also because of taking operational performance as another dimension of performance which was not tested in prior literature. Implications, limitations and future research indications are also given in this study.

Key Words: Artificial Intelligence, Robotic Awareness, Supply Chain Agility, Environmental Performance, Economic Performance and Operational Performance

1. Introduction

The modern area demands for modern solutions and the current organizations are mobilizing their systems according to the demands of the customers [1]. The customers want quick responses and here the requirement of fast-moving systems and quick responses require the systems to change, in this

regard the organizations are introducing in the artificially intelligent systems in order to implement the supply chain agility system to respond quickly to the ever changing and the dynamic environment. In most of the organizations of the modern era robots and artificially intelligent machines are being introduced and installed so that the organizational performance can increase. Supply chain agility in any organization refers to the ability of any organization to respond quickly to the changing requirements of this modern environment [2]. The robotic artificial intelligence-based machinery and systems are being installed in different organizations as these systems mobilize the performance of the organization and also contribute in making the systems fast and quickly growing. The robotic systems are being installed because this makes the organization cost effective as well. The robots are replacing hundreds of the human resource in different organizations [3]. The tasks that were performed by several human beings at a time are now being performed by only one robotic machine at a time which is saving both time and money. This kind of innovation is very important in this modern era where everyone is in need of just in time response and quick actions. This kind of quick system is a requirement of every organization these days. Different organizations in the world are planning upon launching robotic and artificially intelligent systems in their systems in order to increase the efficiency and the speed of response of their firm. The organizations are still in the testing phase where the results will depict whether the robotic or artificially intelligent system is going to be beneficial and cost effective for the firm or not [4].

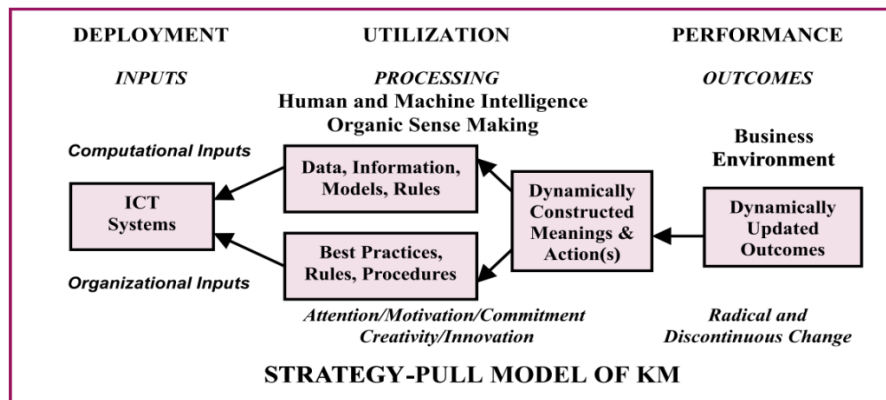


Figure 1: Strategy pull model (source: BIO)

This is the main reason that the analysis and interpretation of such change is important for all of the firms globally that want such change in their system. The main aim of this research is to know about the impacts that robotic systems and artificially intelligent systems will cause on the performance of the organization in which they will be installed. The study's purpose is also to find out that how an organization can respond to the time to time changes occurring in the external environment and the all-time increasing innovation and increasing competition using the concept of supply chain agility, which involves the application of innovative methods in the organization in order to improve the system of an organization and in order to get the organization ready to face the competition and innovation occurring in the external environment [5]. The study has aimed to know about the benefits and drawbacks of the conversion of human resource-based systems to the systems of robot based artificially intelligent systems. The study will be highlighting the advantages and disadvantages of implementation of robotic systems in the organizations. This study will be contributing to the theoretical data in a very significant way by adding in the advantages and the disadvantages of the implementation of the artificially intelligent systems in the organizations and in order to improve the systems of the organization in order to increase the performance of the organization and in order to improve the supply chain system of an organization [6]. This study will also be helpful for those organizations that are planning to implement the artificially intelligent robotic systems in their daily routine setups, this study will set a base for helping in the decision-

making process. There are many studies in the past that have contributed in increasing the knowledge about the advantages and the charms of the implementation of artificially intelligent systems in the organizations but none of such studies have contributed in highlighting the pros and cons of such systems in context of the supply chain agility [7]. None of the studies in the past have contributed to the highlighting of the importance of artificially intelligent systems for the improvement in the performance of the firm and for the cost effectiveness of the firm.

2. Literature review

2.1. Resource Based View Theory (RBV)

Firms operating in the Globalized Era need to respond quickly to the responses received, feedbacks from the suppliers or customers received [8, 33, 38] and most importantly to the external or internal changes whether they are due to environment, economic or strategic. They also need to respond efficiently to the uncertainties and challenges to deal with the received issues and problems in more professional ways. However, due to availability of rich bodies of literature [9] that depends on the practices and functions of supply chain agility [35-36], supply chain management, supply chain performance [37] and other different related domains, resource based view [10] is considered the best approach to more clearly understand the abilities and capabilities of supply chain agility. Relevant theoretical and conceptual views [11] regarding resource based theory of the researchers, makes the reader to understand when and how organizations create agility, adaptability and alignment along with

the use of IT capabilities. As distinct supply chain properties gains sustainable competitive advantages because RBV has highlighted the significance resource heterogeneity including, allocations, independency, utilization and imitability in creating capabilities for the appropriate achievement of competitive advantage. Wernerfelt [12] RBV develops a connection between the abilities of supply chain agility and efficiency of organizational mobilization network or performance that further gains the competitive advantages.

2.2. Artificial Intelligence and Robotic Awareness Relationship with Environmental Performance

Studies by Brougham and Haar [13], suggest a common idea that is developing in every organization, related to organizational mobilizing performance, where more artificial intelligence (AI) is used instead of manual labor or manual based machinery. As studies [14], researched about the efficiency and affectivity of artificial intelligence in the form of a robotic style or robotic awareness, the outcomes of the AI are quite positive and affective in the field of operational firms or which also improves the organizational performance. As per researchers [15], who think that industries and organization are rapidly advancing with the help of automation technology and machinery that further includes AI and robotics, these all are considered the part of the industrial revolution. Globalization and increasing use of advanced technology has forced many industries, firms and organization to deal with the entire world at the same time, for that purpose advanced form of technology has to be introduced in these fields that would preferably, influence the performance of the environment or the surrounding. Theorists like [16], while studying RBV in the course of robotic awareness and use of AI, where they clearly analyzes about AI, automation and robotics technologies that hospitality business are strategically implemented as essential corporate functions for solving multiple daily management tasks. These management tasks further influences the efficiency of environmental performance because with the continuous change in the technology there is always a change in the environment performance. Moreover, many researchers [17] believe that emerging of constantly changing environment causes the diversity

in advanced technology which enables many various organizations and industries to use AI for the automation solution to create a more personalized profile which might also helps in lowering the businesses labor costs. Thus, the following hypothesis is proposed:

H1: Artificial intelligence and Robotic awareness has a significant impact on Environmental performance

2.3. Artificial Intelligence and Robotic Awareness Relationship with Economic performance

As per studies by [18], AI and robotic awareness is increasing with the development in time due to advanced AI lodging system, which develops further well-established working relationships related to increasing productivity and reduced costs attributed to the replacement of human labor with the use of robotics machinery. Studies by [19] analyzes, that greater AI and robotic awareness or use can also increase the economic cost and economic performance, as new technology and advanced technical methods requires bundle of financial assets. These financial assets can further promote the use of artificial intelligence in various industries and organizations. However, it is a fact that replacing manual labor with the robotics invention will largely decrease the labor costs for an organization or industries that will produce a positive impact on the economic conditions of the organization. Therefore, studies by [20] develop a relationship between the use of AI and robotic awareness and economic performance. Thus, the following hypothesis is proposed:

H2: Artificial intelligence and robotic awareness has a significant impact on economic performance.

2.4. Artificial Intelligence and Robotic Awareness Relationship with Operational Performance

According to recent studies by [21], the introduction of AI robots into the workplace of an organization may inadvertently cause psychological damage to employees and their emotional feelings related to a sense of feeling in a workplace that depends on their belonging and dedication towards operational performance of the employees. AI robots highly affect the performance of operations strategies and approaches regarding the working employees. Nevertheless, employees feel acquainted with their workplace of an organization so when their position

is being taken, they might suffer mentally, physically and emotionally. Use of AI and robots can turn over the mindset and intensions of the employees along with the technological development. Studies by [22], suggest that workplace job profiles, hours worked, employee relationship and with co-workers and managers are significantly affected by the AI and robotics awareness. Thus, the following hypothesis is proposed:

H3: Artificial intelligence and robotic awareness has a significant impact on operational performance.

2.5. Mediating Role of Supply Chain Agility between Artificial intelligence/Robotic Awareness and Environmental performance

As per studies by [23], RBV plays an important role in creating the mediating role of supply chain agility (SCA) between the two variables of AI and robotic awareness and environmental performance. SCA influences the use of AI and robots in organizations or industries, to efficiently perform the management tasks in less time. This however, produces an effective impact on the environmental performance of the organizations and firms [24]. Ongoing technological development regarding AI and robots automation enables the industries to establish a significant impact on the environment or condition of the workplace that facilities the performance of employees. However, supply chain agility [25] responds to high level of organizational support, its adaptability and alignment with the high level of organizational commitment and psychological attachment of the employees with their working environment. Thus, the following hypothesis is proposed:

H4: SCA has a significant mediating role between the relationship of AI/robotics awareness and environmental performance.

2.6. Mediating Role of Supply Chain Agility between Artificial intelligence/Robotic Awareness and Economic performance

According to a research by [26], that enhances the role of the mediator of the supply chain agility that confirms the liability and capability of performance by the organizational and employees. Though, AI robots are implemented on the global scale by the

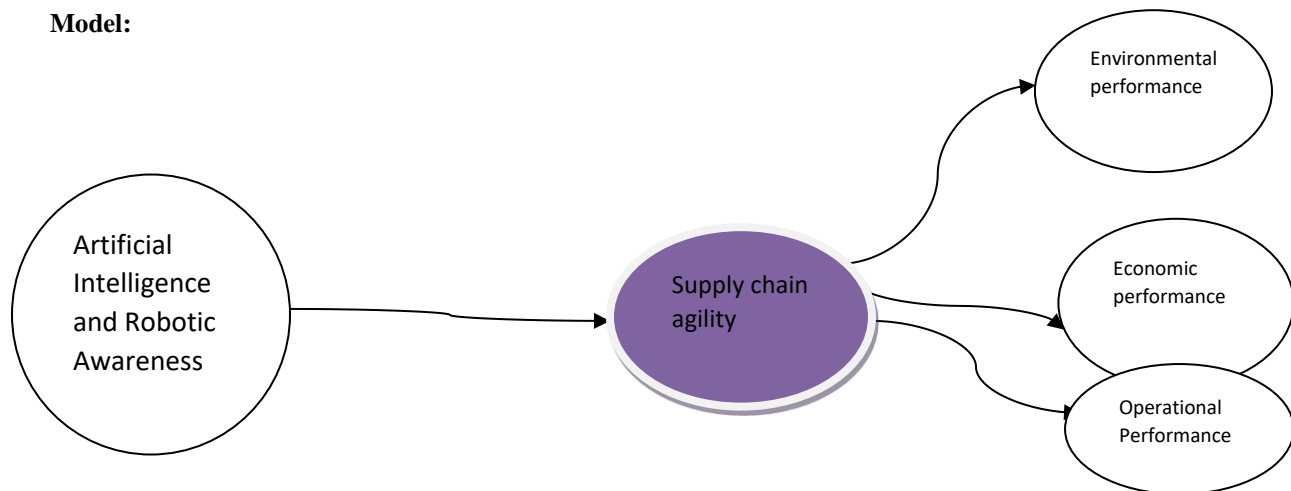
organizations and manufacturing sector of firms, this means that manual employees has to be replaced with the artificial machinery, that will further effect the economical performance of the manufacturing sector related to various industries. Economic performance [27] can be positive if cost value of the employees can be saved by implementing the AI with a workplace, however on the other hand economic performance can decrease because implementation of the AI robots needs a lot of investment to install latest technology that would support the efficiency and affectivity of this artificial machinery. Moreover, the impact of AI robots on the economical performance can be affected when it will cause massive unemployment that would be displaced by robotics and the emerging AI revolution. Thus, the following hypothesis is proposed:

H5: Supply chain agility has a significant role between the relationship of AI and robotics awareness and economic performance.

2.7. Mediating Role of Supply Chain Agility between Artificial intelligence/Robotic Awareness and Operational performance

As per past studies by [28], mediating role of SCA plays a vital role on the development of two variables like AI robots automation and operational performance. Through SCA we can have a clear idea of the contribution of AI robots automation in influencing the operational performance related to form performance and agility performance. Theoretical and conceptual evidences of RBV make it clear that world is becoming more technology-driven as the matter of fact AI and robots automation can easily displace about 45% of the employees from the working place which will have a significant effect on the operational performance [29]. Recent studies by [30] have demonstrated the impact of the rapid development of modern robotics and AI influence on employee's attitudes and behavior in the related workplace. Therefore, agility might influence the risks of collaborative robotics awareness and implementation of AI in the domain of operational performance. Thus, the following hypothesis is proposed:

H6: SCA has a significant mediating role between the relationship of AI and robotics and awareness and operational performance.

Model:**3. Research methodology****3.1. Population and sampling**

The traditional approach such as face-to-face interaction of employees and guests have been changed completely. In today's workplace, automation technologies have been used by many hotels such as self-service check-in-kiosks and mobile service requests for enhancing the organizational performance. Researcher selected the luxury hotels of Thailand as the population for this research study. Many hotels of Thailand used robotic guest service for minimizing the cost and enhanced operations efficiency. Researcher selected the peninsula Bangkok and tower club at lebua as sample hotels for this study. Further, researcher collected the data from employees of the hotels about the impact of robotic and artificial intelligence on organizational performance and respondents have been selected by using purposive sampling techniques because only they can better communicate about the organizational performance. In sampling, [27] idea has been used for selecting the sample size, according to this idea number of questions*10 provide with the accurate figure of sample size. Researcher has been distributed 350 questionnaires among the employees of both hotels of Thailand, out of which 40 responses have been discarded due to the missing values. Researcher considered only 310 responses valid because rest of responses have been deleted as they were invalid.

3.2. Data collection procedure

In this research study, data collection method has been used is questionnaire. Questionnaire is structured and composed of closed ended questions

which were related to the items of this research study. Before implementing the questionnaire to whole sample, researcher has to convert the English language of questionnaire into Thai language in order to collect the data from managers of Thailand companies. After that content validity of scale has been checked by incorporating the feedback, which has been collected from the other authors and industrial practitioners. The finalized questionnaire has been administered by both online and self-administered techniques. Researcher tried to rectify all the queries regarding the questionnaire.

3.3. Analysis of validity, reliability and common bias

For the analysis of reliability, two criteria have been examined such as Cronbach's α which has to be greater than 0.70 for achieving the satisfactory level of internal consistency and composite reliability must has to exceed the 0.70 in order to achieved desirable level of items reliability. As far as the validity is concerned, both convergent validity and discriminant validity has been assessed by AMOS but criteria to examined them are different. For convergent validity, three criteria have been examined such as (1) items loading has to be greater than 0.70, because [26] states that its values were stronger at 0.78 or at above, (2) composite construct reliability which has to be greater than 0.80 and (3) average variance extracted and its threshold range is greater than 0.50. Coming towards discriminant validity, it has to be exceeded when compared with the inter-correlated coefficient of remaining constructs.

Common bias has been conducted in the study, when same measures used for the evaluation of the independent and dependent variables. In this research study, risk of common bias has been generated as the similar subjective measures used for the variables such as artificial intelligence, organization performance and supply chain agility. In order to test the common bias presence or absence, Harman's single factor test has been used by researcher. In this test, researcher observed whether single factor used for accounting of the most of variance. If single factor used for accounting of 50% of variance then the common bias has been existed. Results report that 16% of variance accounted for by single factor and 87% of variance accounted for by multiple factors. Therefore, inexistence common bias has been ensured by the test results.

3.4. Hypothesis testing

Hypothesis testing is considered mandatory as researcher decide on the bases of test results whether hypotheses accepted or rejected. For hypothesis testing, structure equation model has been used and it runs on AMOS. Further, covariance-based approach has been used by AMOS in order to run the diagnostics of SEM. Hypotheses have been tested by performing two steps, first one is to checked the standardized path and second step is to checked significance of influenced path. After that researcher assessed the acceptance or rejection status of the hypotheses on the bases of outcomes achieved by performing above mentioned steps.

3.5. Measures

Artificial intelligence and robotic awareness were measured from the scale of [20], and four items were taken to measure it on a seven point Likert scale, supply chain agility and EP was measured by Eisenberger and Huntington scale (1986), with the modification according to the present study and these were also measured on a seven point Likert scale. ECP and OP were measured by four items on a seven-point Likert scale by [26].

4. Empirical results

4.1. Demographical results

The study was conducted in Thailand and data was collected from small and medium enterprises of

Thailand. It was collected from 350 participants and the number of respondents was 301. The associations with the help of a self-organizational questionnaire were analyzed by using SPSS and Amos. It is very important to conduct the prerequisite analysis in order to check the reliability, normality, and validity of the data. The researcher applied the frequency distribution test in order to check the respondent profile. The findings showed that 115 males and 186 females participated in this study. 23 of the participants had graduation degree, 141 respondents had done post-graduation. Whereas, 127 respondents had master's degree and 10 had another degree. The participants included 231 people in age range 21 to 30 years, 49 people in age range 31 to 40 years, 19 people in age range of 41 to 50 years and only 2 participants were of age more than 50.

4.2. Descriptive Statistics

4.6. Structural Equation Modeling

Structural equation modeling is a multivariate regression analysis which is used mostly in primary data to settle the hypothesis of the study at the same time. SEM provides the facility of direct regression test and indirect regression test in a single structural model. Following table shows the results of structural equation modeling;

Table no. 1 is showing that there is no outlier in the given data as the maximum values lie in the threshold range of 5-point Likert scale, as the skewness value is somewhere between -1 and +1 which is the threshold range of normality assumption and so the data is normal and is valid to go for further testing.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
AIRA	301	1.00	5.00	3.5548	1.13170	-.756	.140
SCA	301	1.00	5.00	3.5942	1.07065	-.891	.140
EP	301	1.00	5.00	3.4589	1.12656	-.557	.140
ECOP	301	1.00	5.00	3.5872	1.10796	-.831	.140
OP	301	1.00	5.00	3.5900	1.06422	-.879	.140
Valid N (listwise)	301						

Table 2. Rotated Component Matrix

	Component				
	1	2	3	4	5
AIRA1					.771
AIRA2					.817
AIRA3					.817
AIRA4					.807
SCA1		.711			
SCA2		.765			
SCA3		.837			
SCA4		.834			
SCA5		.833			
SCA6		.822			
SCA7		.806			
EP1	.817				
EP2	.874				
EP3	.879				
EP4	.881				
EP5	.887				
EP6	.887				
EP7	.867				
ECOP1				.805	
ECOP2				.836	
ECOP3				.873	
ECOP4				.802	
OP1			.772		
OP2			.795		
OP3			.797		
OP4			.820		
OP5			.804		

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

4.3. Rotated Component Matrix

The table 2 is showing the RCM values, almost all of the indicators are showing the factor loading more than 0.7, it means that all of the indicators are eligible to be added in the further hypothesis testing because all factor loadings are in suitable threshold level and in a suitable and valid range. moreover, there is no

cross-loading data shown in RCM so, data is good to go for further testing.

Table 3. Convergent and Discriminant Validity

	CR	AVE	MSV	MaxR(H)	SCA	OP	EP	ECOP	AIRA
SCA	0.952	0.741	0.365	0.955	0.861				
OP	0.933	0.735	0.372	0.972	0.571	0.857			
EP	0.965	0.798	0.249	0.985	0.499	0.495	0.893		
ECOP	0.937	0.787	0.354	0.987	0.523	0.524	0.441	0.887	
AIRA	0.938	0.791	0.372	0.990	0.604	0.610	0.384	0.595	0.889

4.4. Convergent and discriminant validity

The results of convergent and discriminant validity show that the overall model is a good fit because the composite reliability of each variable is more than 70% and average variance extracted is more than 50% while the discriminant validity shows that

loading of each variable discriminates from others. Every variable has maximum loading with itself as compared to with others so these validities prove the authenticity of collected data.

4.5. Confirmatory Factor Analysis

Table 4. CFA

Indicators	Threshold range	Current values
CMIN/DF	Less or equal 3	2.077
GFI	Equal or greater .80	.866
CFI	Equal or greater .90	.963
IFI	Equal or greater .90	.963
RMSEA	Less or equal .08	.060

The value of CMIN is less than 3, the value of GFI is greater than .80, the value of CFI is greater than .90, the value of IFI is greater than .90 and the value of RMSEA is less than .08 so all of the values are in the

valid threshold range and so the current data is valid and is good to go for further testing techniques. Below is the screen captured CFA:

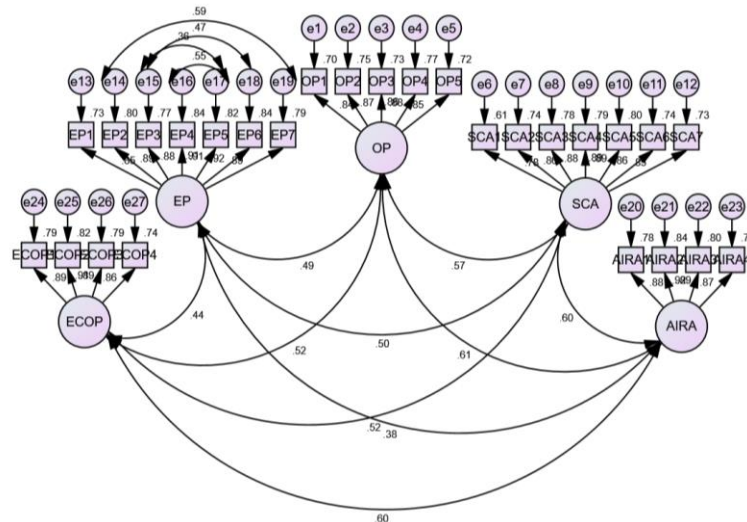


Figure 1: CFA

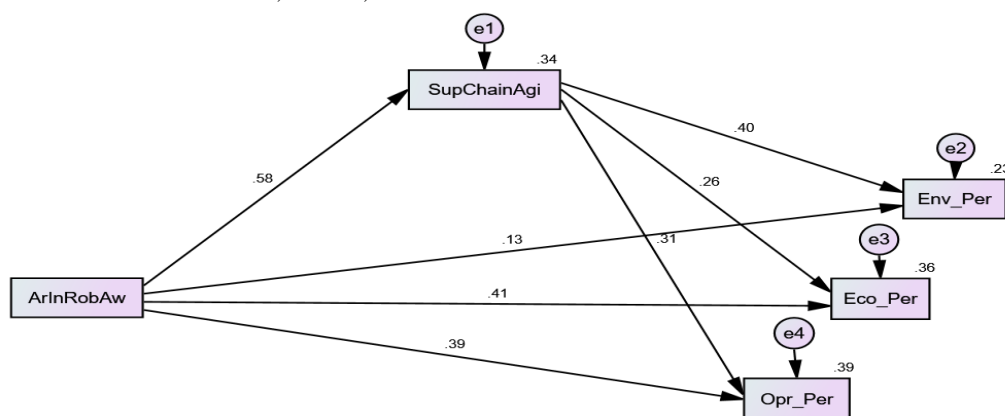
Table 5. SEM

Total effect	AIRA	SCA
SCA	.581***	.000
OP	.573***	.312***
ECOP	.563***	.260***
EP	.361***	.396***
Direct effect	AIRA	SCA
SCA	.581***	.000
OP	.392***	.312***
ECOP	.412***	.260***
EP	.131*	.396***
Indirect effect	AIRA	SCA
SCA	.000	.000
OP	.181*	.000
ECOP	.151*	.000
EP	.230**	.000

4.6. Structural Equation Modeling

The total effect of AIRA is 58.1%, 57.3%, 56.3% and 36.1% on SCA, OP, ECOP and EP respectively so SCA, OP, ECOP and EP will increase by 58.1%, 57.3%, 56.3% and 36.1% respectively with 1 unit increase in AIRA. The total effect of SCA is 31.2%, 26% and 39.6% on OP, ECOP and EP respectively. The direct effect of AIRA is 58.1%, 39.2%, 41.2%

and 13.1% on SCA, OP, ECOP and EP respectively. effect of SCA is 31.2%, 26% and 39.6% on OP, ECOP and EP respectively. the impact of AIRA on OP, ECOP and EP is 18.1%, 15.1% and 23.0% respectively so, OP, ECOP and EP will increase by 18.1%, 15.1% and 23.0% with 1 unit increase in AIRA. All of the impacts are positive and significant.

**Figure 2: SEM**

5. Discussion and Conclusion

5.1. Discussion

This study is completed with the goal to know about the relationship between Artificial Intelligence and Robotics awareness (AIRA) and Environmental Performance (EP). The Aim was to know about the

relation between AIRA and Economical performance (ELP).[31] The aim was also to know about the association and impact of AIRA on Operational Performance (OP). Another goal of this study was to have knowledge about the mediating role of Supply Chain Agility (SCA) between AIRA and EP, AIRA

and ELP, AIRA and OP. This study stated some hypothesis. The first hypothesis suggested that there is a significant impact of AIRA on EP. This hypothesis was accepted.” Gaurav S Sukhatme” stated that AIRA proved beneficial in manufacturing industries around the world. Companies with moderate AIRA have beaded their rivals. The reason was this behind acceptance of this hypothesis another hypothesis suggested that AIRA has a significant impact on ELP. This hypothesis was also accepted. “Cuneyt Dirican” who is a researcher and professor at T.C Arel University suggested that AIRA provided the knowledge about efficient production and delivery system. Companies have adopted artificial intelligence and robotics in their manufacturing sectors and enhanced economic performance [32]. The third hypothesis suggested that the impact of AIRA on OP was positive. This hypothesis was also accepted. According to the “Boyoon Jung” for quality processed supply chain and integrated performance of different department related to the distribution of finished goods, you must need the AIRA. The fourth hypothesis recommended that SCA significantly mediates between AIRA and EP. This hypothesis accepted as well. “Soonhong Min” investigated and suggested the positive mediating role of SCA between AIRA and EP. Through AIRA the companies took positive steps towards less waste and effective production. Hypothesis number fifth suggested that SCA positively mediates between AIRA and ELP this hypothesis was accepted as well. “John T Mentzer” explained in that research that there is the significant mediating role of SCA between these two variables. Sixth and last hypothesis recommended that the mediating role of SCA between AIRA and OP was significant and positive. This hypothesis is accepted. “John T Mentzer” suggested that OP activities improved by those companies who have effectively used AIRA and took benefits and increased their SCA capabilities [33].

5.2. Conclusion

The objectives of this study were to know about the impacts of AIRA on EP, ELP, and OP. The aim was also to know about that how significantly SCA mediates between AIR and EP, and OP. This study is completed by collecting data from three hundred people, 301 were valid, of luxury Hotels in Thailand.

The data was collected through questionnaire. All of the hypothesis which were stated in this study was accepted due to their positive and significant relationship across different variables.

5.3. Implications of the Study

This study has significantly contributed to literature. This study enhanced the literature material about this topic. This study also contributed towards the practical field. People can get significant knowledge about the relationship of AIRA with EP, ELP, and OP, and mediating role of SCA between AIRA and EP, ELP and OP. The different authorities can find a different and positive suggestion for improving this sector.

5.4. Limitations and Future Research Indications

The drawback of this study is the small sample size. Future researchers can take a large sample of more than 300 people in order to get suitable data. This study conducted in Thailand by selecting different luxury hotels in Thailand. This study can be conducted outside Thailand in order to give suggestions to improve the products and services around the globe. Tool for data collection was questionnaire. Future researchers can use more than one data collection tool.

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