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Is it Time to start Trusting Robots for better Supply Chain Performance of Thailand's Automobile Industry? Mediating Role of Human-Robotic Interaction Dimensions

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The use of robots has become common in the automobile industry as automation is very necessary for automobiles. The purpose of this study is to determine the impact of robotic trustworthiness on the Supply Chain Performance of the automobile industry of Thailand. Besides, it also studies the mediating role of human-robotic likeness, robotic intelligence, perfect automation scheme, and positive robotic effect in this regard. The data for the research was gathered by conducting a survey questionnaire in which questions related to robotic trustworthiness were asked. The survey included about 448 employees belonging to the automotive industry of Thailand, out of which 55.8 percent were males, and 44.2 percent were females. The techniques like KMO, confirmatory factor analysis, descriptive statistics, and structural equation modeling were applied to analyze the collected data and test the validity of the hypotheses. The outcomes of the study showed that all the hypotheses were accepted, except for the last one. The research suggested that robotic trustworthiness plays a significant role in enhancing the Supply Chain Performance of the automobile industry. Besides, human-robotic likeness, robotic intelligence, and perfect automation techniques also play an important mediating role in this case. Thus, it is recommended that future researchers should broaden the variables of the study and use different techniques to test the hypotheses.

Key words: *Robotic Trustworthiness, Supply Chain Performance, Human Robotic Likeness, Robotic Intelligence, Perfect Automation Scheme, Positive Robotic Affect.*

Introduction

In the field of Human-robot interaction (HRI) the research used to design, evaluate and understand the systems of systems that used by the humans. Recently, robots used in professional, industrial as well as in the services of personal nature because it became integral part in everyday life of human with artificial intelligence's development (Cameron et al., 2015). Although, system of automation significantly improved but the system without the lack of trust by users that decided about system and gave decision that it cannot be used. Therefore, in understanding the perception of human the trust is consider as key factor in the field of robotic and automation and along with interactions of human with robotic systems. In Thailand, the automotive industries were established in 1950s. In Thailand, the businesses of automotive cars start from importing trucks and cars to meet the demand of vehicle in country from overseas. Now, worldwide the major manufacturer in automotive is consider Thailand. Meanwhile, such cluster of automotive in Thailand enhance and improving when investment start from foreign countries in respect of automotive companies, which gave the result formation of automotive group in suppliers of automotive which later become cluster. Moreover, literature about the trust on robots have a lot of gap that no previous study undermine the authority and capacity of robot in relation with human was elaborated (Gallimore, Lyons, Vo, Mahoney, & Wynne, 2019). Thailand is emerging economy and its automobile industry is well known industry of the Asia. Following table 1.1 show the expectancy of Thailand to adopt automation in term of robotic in manufacturing which is 30 percent in 2018 and enhance to become 50 percent in coming year of 2022.

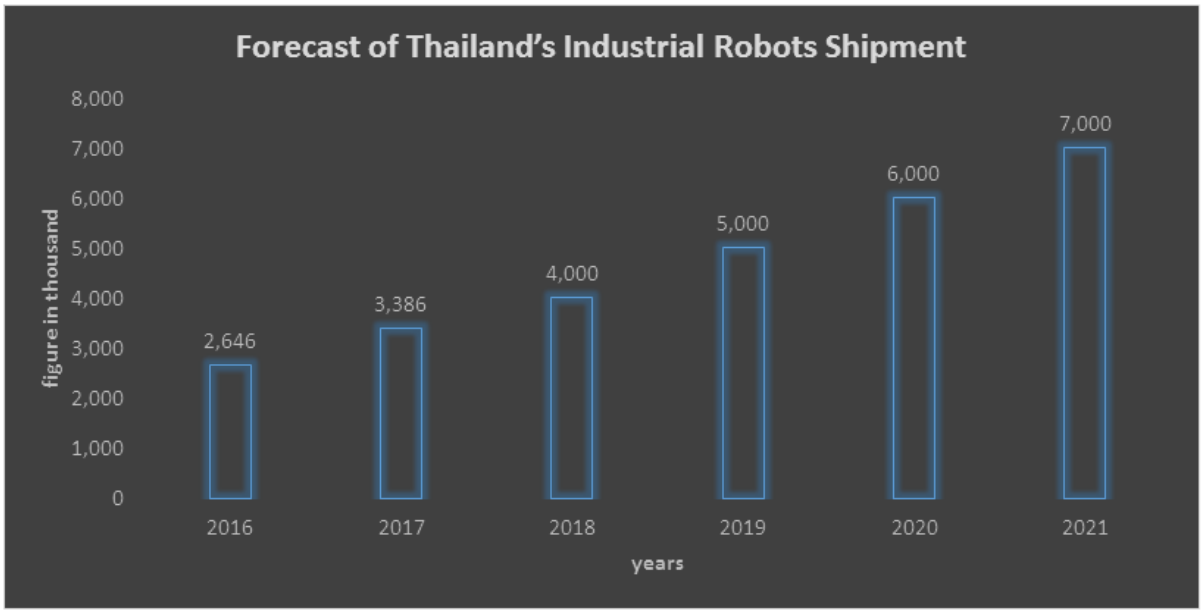
Table 1.1: Thailand's Expectations over the Next 5 Years1

Thailand's Expectations Over The Next 5 Years1		
share of Manufacturers Adopting Automation	**2018**	**2022**
	30 %	50%

Source: Thailand board of Investment (report on Thailand automation and robotics)

Individuals that use robotic system and known about them have influence in term of trust; this facts differentiate the expectation of the individuals if they have same context regarding use of robots. Second, considering the scheme of cognitive the robotic system established when it have trust model from human. The trust model is affected by the context of manipulation as well as attributes of the robot. Like that, robot have higher trust if it symbolizes and act like human (Fink, 2012) but if he does not do same as human then have lower trust (Prakash & Rogers, 2015).

Figure 1.1. Forecast of Thailand's Industrial Robots Shipment



Source: Thailand board of Investment (report on Thailand automation and robotics)

Figure 1.1 show the graph of robots shipments from 2016 to 2021, which means robotic system have not been reduced but it will enhance and overcome the manufacturing cost. A number of studies was done in which context and attribute related to effects of robots or system of automation along (Lyons & Guznov, 2019) with ways in which emotions impact robot was discussed.. First, schemes of human cognitive have a complex impact in machines on trust (S. M. Merritt, Unnerstall, Lee, & Huber, 2015). Now it become essential to understand the interrelationship multidimensional among the factors that affecting the trust in Human Resource Interaction, including the correlation as well as mediating and moderating effects (K. J. Kim, Park, & Sundar, 2013), which necessitates trust examination predictors in sets of multiple interconnected variables. This study is carried out to understand the trust extent on the system of robotic that further improve the Supply Chain Performance of the automobile industries (Saengchai & Jermsittiparsert, 2019). Over the past half a century, in robotics as well as in automation the dynamic advances have been transforming both business along with society. In companies, the productivity increase on the production floor initially through the robotics and Automation; such productivity utilized the simple technologies. To understand the factors in system of 1robotic that effect trust while particularly human are harness intentionally by capacity and authority of the robotic system, this field dis under research to understand and find out human robotic interaction with robotic worthiness. The basic objectives which formulated on the behalf of statement of study are:

- To analyze the factors that affect human-robotic interaction
- To examine the impact of human-robotic interaction as a mediator on Supply Chain Performance of automotive industries in Thailand.
- To examine the robotic worthiness in Supply Chain Performance of automotive industries of Thailand.

The scope of the study is that in competitive world, the sustainability and success achieve with low labor cost and effective methods. With robotic system, in the processes of manufacturing the innovation easily practice and products develop with new techniques. (Khompatraporn & Somboonwiwat, 2017). In present time, robotics system have major challenge sand that is human trust on him and this is become top issue as social as well as technically. This study highlight the human trust on robotic system and show the impact of this trustworthiness on Supply Chain Performance in automotive industries (Schaefer, Chen, Szalma, & Hancock, 2016). After the introduction, literature review will be discussed in section 3. Then methodology will be elaborated in part 3 of the study. The analysis will be performed and mention in section 4. Finally, section 5 includes discussion and conclusion of the study.

Literature Review

Structural Equation Model (SEM)

This study used structural equation model as a base which is analysis tool of statistical multivariate which measuring the latent variables which are unobserved and measured with multiple indicators and also identifying the relationships between variables. This model use analysis of multiple regression and factor analysis as combine which further used to analyze the relationship in structural form between latent construct and measured variables. structural equation model also includes path analysis (PA), partial least squares-path modelling (PLS-PM) and confirmation factor analysis (CFA) (Kline, 2015). Furthermore, the advantage of structural equation model is that it is being simultaneously able to estimate the dependencies as multiple and mutual. In addition this model also for these relationship grasp the latent variables and to understand the size of effects either it is direct or indirect. Therefore, in modelling of behavior and cognitive analysis it is used as importantly and that modelling require causal relationship (Lowry & Gaskin, 2014). The structural equation model (SEM) proceeds mainly in two stages; the first one is validating the proposed models and then second is fitting the structural model. In this first of all designed the mode; that based on empirical research and then that models which proposed are verified in terms of the model's suitability with the help of using the indicators such as Root Mean Square (RMS), the Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Tucker Lewis index (TLI) and Normed Fit Index (NFI). In the final verification that passed the model, is the degree of effect as direct or indirect between variables is checked. A model is regarded as acceptable if the NFI exceeds 0.90, GFI exceeds 0.90, CFI exceeds 0.93, and RMS is less than 0.08. In developing our proposed model,

it was necessary to consider a specific position of a trust in Human Robot Interaction based on findings of the previous research (W. Kim, Kim, Lyons, & Nam, 2020).

Robotic Trustworthiness Effect on Supply Chain Performance

The time when human trust on system of robot either they accept or reject by human depend upon the trust's antecedents (Billings, Schaefer, Chen, & Hancock, 2012). The untrusted system of robotic cannot be accepted by public and this lack of trust issue is a major concern in challenges of social as well as technical base rather than the performance and designing of robotic (Schaefer et al., 2016). In human robot interactions, number of factors have been proposed in various studies that relate with robotic trustworthiness (Schaefer et al., 2016). While, in context of interpersonal when the trust come under the main focus then the facets of integrity, ability and benevolence could apply also to a setting of human robot interaction (HRI) (Calhoun, Bobko, Gallimore, & Lyons, 2019). Furthermore, van den Brule, Dotsch, Bijlstra, Wigboldus, and Haselager (2014) investigated that the behavior and performance style of robots also affected the trustworthiness. Similarly, Castro-González, Admoni, and Scassellati (2016) evaluated that the robots of social level mainly based on trustworthiness, honesty, fairness and reliability.

H1: Robotic trustworthiness have significant effect on Supply Chain Performance

Robotic Trustworthiness Effect the Supply Chain Performance with Mediating Role of Human Robotic Likeness

In life of humans, the robots become an essential part with artificial intelligence development that utilized for personal, professional and industrial services. For these benefits, it become a part of research that evaluate the system of robots, its designs and understand how it worked; this all come under the criteria of Human-robot interaction (HRI) (Cameron et al., 2015). The characteristics of the robotic along with automation system such as dependability, error control, faith and predictability become the base of Trust. So, in such case the Trustworthiness assessed with the help of benevolence, integrity and ability (Calhoun et al., 2019). Similarly, Schaefer et al. (2016) explained that it is most well-known that human being is familiar with other human beings in term of interacting with each other , that is why with the help of human's function and shapes that imparting to robot which make the interaction of human and robot more easier and effective (Schaefer et al., 2016). In teaming of human machine a most key driver is identified as Human (Lyons et al., 2020). Therefore, metric of evaluation become a point that every researcher study and want to know, such metric highlight the factors regarding the likeness and reaction of human towards robot. Although, the trust that come in human robot interaction affected by a number of attempts in which likeness of human is one of the them. Meanwhile, it is known that a very little effort done which gave the factors such as similarity

of robot with human affect the trust of human on robot and such factors have mediating role in establishing worthiness of robot in Supply Chain Performance of organizations. K. J. Kim et al. (2013) investigated that whether assigning a role of caregiving had an effect as psychological on the user at Human Robot Interaction. Studies described that factors those influencing the trustworthiness include level of automation/function, perceived intelligence and human-likeness (Castro-González et al., 2016) .

H2: Robotic trustworthiness improve the Supply Chain Performance with mediating role of human robotic likeness

Robotic Trustworthiness Effect the Supply Chain Performance with Mediating Role of Robotic Intelligence

The robotic ability highlights its intelligence level and quality. In addition, competencies and skills also compromise in ability which, with in some extent of domain, enable a party to highlight the influence which related with robotic competencies for human resource interaction under specific purposes context. Robot with their intelligence highlight the Benevolence which refers to that perception through which trustee get good results by the actions of a trustee, apart from any motives of profit, with including synonyms like supportiveness, loyalty, caring and openness. The third concept is Integrity that come under the robotic intelligence, it is explained as the perception of the party that is trusting that it consider that the trusted party will be have honest characteristics and also adhere to an acceptable set of principles. These factors come under the robotic intelligence which further strong the worthiness of robotic system and impact on the human robot interaction, ultimately enhance the Supply Chain Performance of the organization either it is automotive or any other. It considers notice that robot have intelligence just like human during its designing. In this way many robots perform mainly difficult and repetitive task as physically on behalf of humans within a given protocol.

H3: Robotic trustworthiness improve the Supply Chain Performance with mediating role of robotic intelligence

Robotic Trustworthiness Effect the Supply Chain Performance with Mediating Role of Perfect Automation Scheme

According to S. M. Merritt et al. (2015), human robot interaction have trust as coordination that related intimately with the concept of perfect automation schema (PAS). Furthermore, perfect automation schema (PAS) is defined as a schema as cognitive of a human that containing content of trusts about the performance of robot in automation systems along with two main factors that describe the perfect automation schema (PAS). The first one is reliance on aids of automated while second one is reliance on humans, which were proposed by S.

Merritt et al. (2019). Trustworthiness on robot have many factors that effect on it and in this area many attempts were done to highlight the issues. (Schaefer et al., 2014) examined that the initial perceived trustworthiness have impact may be from the robots in physical form toward robots primarily which was perceived through classification and intelligence of the robot. It is proved with research that perfect automation schema (PAS) have aspects that related with trust as robotic worthiness in automation technology (S. M. Merritt et al., 2015). Thus, for the establishment of trust base model in automation system that enhance the Supply Chain Performance pf the firm perfect automation schema (PAS) consider as important concept (Lyons & Guznov, 2019).

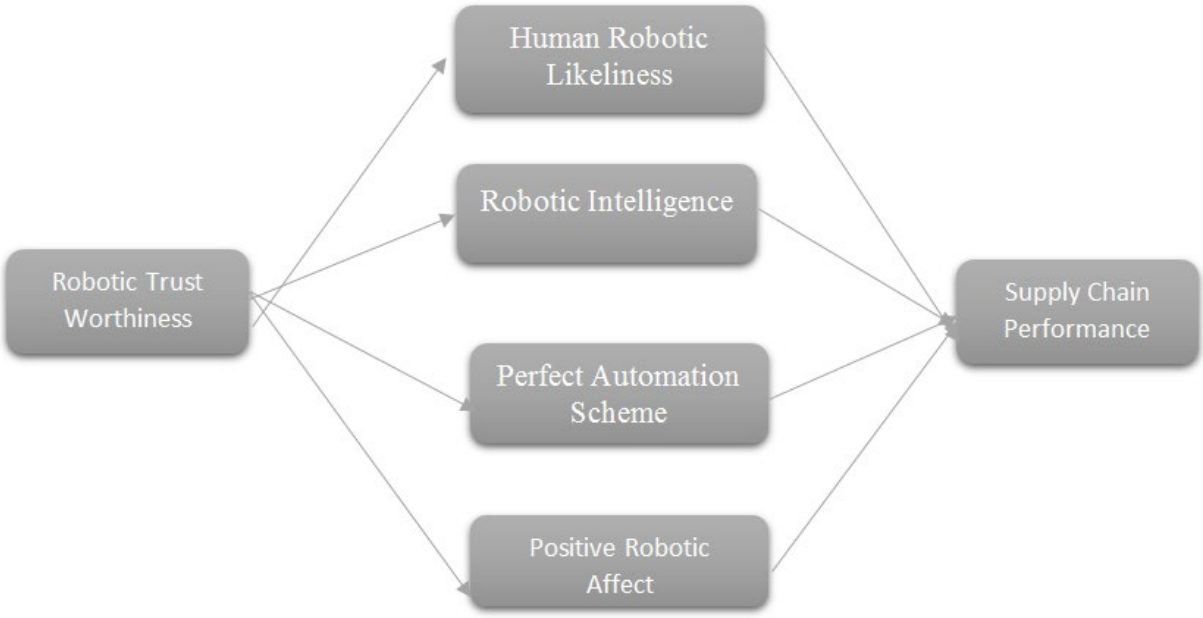
H4: Robotic trustworthiness improve the Supply Chain Performance with mediating role of perfect automation scheme

Robotic Trustworthiness Effect the Supply Chain Performance with Mediating Role of Positive Robotic Affect

The positive robotic affect is important in enhancing the Supply Chain Performance with trustworthiness on robot by human. Such positive affect of robot occur in term of satisfaction that influence by awareness context of robot and also from the predictability. Along with, implicit and mood also have ability to affect the trustworthiness on robot because it highlight positive affect of robot. Thus, a number of studies done to explain the positive affect of robot that ultimately influence the human robot interaction in initial stage. Satisfaction as well as comfort are the factors that regarded as they affect the trust on robot. The characteristics of the robotic along with automation system such as dependability, error control, faith and predictability become the base of Trust. It is also argued by some researcher that through the evaluating the trustworthiness of potential partners the trust is made. So, in such case the Trustworthiness assessed with the help of benevolence, integrity and ability (Calhoun et al., 2019). If these factors remain positive then trustworthiness of robot also improves and resultantly the Supply Chain Performance of the organization improves. While in the same way, comfort level that show the positive affect depend on the control of robot and strategy of task in intelligent transportation systems (ITS). It is also confirmed that the trust occur on robotic system or automation systems when satisfaction in the situation of driving is improved (S. M. Merritt, Heimbaugh, LaChapell, & Lee, 2013).

H5: Robotic trustworthiness improve the Supply Chain Performance with mediating role of positive robotic effect.

Research Model



Methodology

Survey Instrument and Data Collection

The researcher has designed a survey instrument that measure the constructs of this study with the aim of evaluating the conceptual model developed in this research. Before designing the instrument, 10 open ended interviews were conducted; 6 interviews with senior managers in automobile companies that deployed the usage of autonomous robots and 4 interviews were conducted with academics that specialized in robotics and business. The purpose of these interviews was to support the construct representation in the survey. Secondly, after the first draft of the survey was created, pilot tests were conducted with 20 participants, 16 professionals and 4 academics, for ensuring the validity of the survey instrument. The feedbacks from this panel helped the researcher to rephrase of the questions and rearrange the item sequences for improving the clarity and readability. Moreover, the panel made sure that the survey was relevant to the context of the study i.e. the automobile industry in Thailand. The target population comprised of executives in Supply chain management roles, manufacture ring managers, IT and other working in the automobile industry of Thailand. Moreover, the researcher made sure that the participants had accurate knowledge regarding robot usage in industry. 40 automobile firms were selected for participation based on the selection criteria that they had been using robotic technologies in their factories for more than 3 years. Senior executives were selected as representatives in each firm and Email invitations were sent out to these representatives. The invitation email included detail about the purpose and scope of the study along with the ethical considerations that were adopted in the process of data collection

and analysis. The invitation emails were followed by reminder phone calls to make sure that the understandability of the questionnaire is achieved and maximum response rate is achieved (Singh & El-Kassar, 2019). After this step 27 representatives agreed for participation and were sent 50 questionnaires each. A total of 489 questionnaires were received back after the waiting period of 4 months. After removal of redundant, incomplete and irrelevant responses, 448 responses were finalized to be included in the research. The response rate was low and there was need of checking for nonresponse bias. 20 non respondents were contacted through phone calls after completion of wait period (Sheikh & Mattingly, 1981) and they were inquired about the reason for opting to not participate. Lack of information about the various constructs and the issue of over burdening came forward as the most highlighted reason. Chi-Square testing (McHugh, 2013) on demographics of early and late respondents showed that there was no significant difference among the two groups.

Measures

The survey statements for each of the study variables are presented in the appendix of this research paper. The five point likert-type scale has been used in this research for the purpose of measuring responses against the six variables. *Supply Chain Performance has* measured using 4 items. *OP has been* assessed using the pre-established measures that were adapted from previous studies of Kotabe, Martin, and Domoto (2003) and Croom, Vidal, Spetic, Marshall, and McCarthy (2018). Trustworthiness is the independent variable that has been measured using 10 items that are based on the previous studies (Calhoun et al., 2019; Colquitt, Scott, & LePine, 2007; W. Kim et al., 2020). These items tend to measure how much trust the respondent feels in the fact that the robots can perform their tasks effectively. Positive robotic affect is measured using 5 items (S. M. Merritt, 2011), human likeness using 7 items(Wang, Lilienfeld, & Rochat, 2015) , PAS using 4 items (S. M. Merritt et al., 2015) and intelligence using 5 items (Bartneck, Kulić, Croft, & Zoghbi, 2009).

Findings

Demographics

The sample consists of 448 employees belonging to the automotive industry of Thailand. The sample consists of 55.8 percent are male and 44.2 female respondents. The disparity in male and female employees is due to the reason that more men are involved in the manufacturing sector and especially the automotive industry. 78.3 percent of the sample has an educational background equivalent to masters. 60.1 percent of the sample is aged up to 35. The managers, supervisors and assistant managers were the constituents of the sample therefore such a variability in age and education is present.

Descriptive Statistics

The descriptive analysis of the data is presented in table 1. The minimum and maximum, means and skewness coefficients are analyzed to check the data for the presence of outliers, data normality and the inclination of responses. The minimum and maximum are according to the limits of the Likert scale (1-5), therefore no outliers were detected in the data. Skewness measures represent the normality of the data. As the skewness coefficients of all scale items are within the -1+1 range, therefore the data follows a normal distribution. The mean values of all scale items are approaching 4, demonstrating that majority of the respondents were in agreement with the statements of the scale items.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
RobotTra	448	1.00	5.00	3.4078	1.17244	-.595	.115
HumRobLike	448	1.00	5.00	3.5153	1.14654	-.688	.115
RoboInte	448	1.00	5.00	3.4723	1.17549	-.702	.115
PerfAfSc	448	1.00	5.00	3.5407	1.19803	-.672	.115
PosRobAf	448	1.00	5.00	3.6146	1.13845	-.540	.115
OperPerf	448	1.00	5.00	3.5831	1.12349	-.666	.115
Valid N (listwise)	448						

KMO

KMO is a measure of the adequacy of the sample. The KMO test checks for the sample adequacy and also analyzes the sample for relevancy among variables. The KMO value is greater than 0.8 and the results of Bartlett's test are also significant. Thus the sample is adequate and unrelated, it is fit for factor analysis

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.983
Bartlett's Test of Sphericity	Approx. Chi-Square	42661.872
	df	1128
	Sig.	.000

Factor Loading

The component loadings of all scale items is presented in table 2. The loadings of each scale item represents its contribution in the overall variance of the construct. A loading greater than 0.7 signifies significant contribution. The loadings of all individual scale items are greater than 0.7 and therefore significant. The factors haven't been observed to cross-load against each other as well.

Table 3: Rotated Component Matrix

	Component					
	1	2	3	4	5	6
RT1	.750					
RT2	.712					
RT3	.798					
RT4	.756					
RT5	.742					
RT6	.877					
RT7	.880					
RT8	.886					
RT9	.877					
RT10	.879					
RT11	.887					
RT12	.884					
RT13	.904					
RT14	.901					
RT15	.890					
RT16	.890					
RT17	.911					
RT18	.918					
RT19	.920					
RT20	.922					
RT21	.919					
RT22	.918					
HR1		.763				
HR2		.785				
HR3		.782				
HR4		.803				
HR5		.789				
HR6		.780				

HR7		.767				
RI1				.719		
RI2				.713		
RI3				.719		
RI4				.694		
RI5				.713		
PA1					.741	
PA2					.759	
PA3					.755	
PA4					.754	
PR1			.773			
PR2			.769			
PR3			.776			
PR4			.738			
PR5			.792			
PR6			.784			
OP1						.741
OP2						.725
OP3						.748
OP4						.742

Convergent and Discriminant Validity

Convergent validity is assessed on the basis of CR and AVE values. CR, composite reliability, is a measure of the internal consistency possessed by all scale items of a construct. A CR value greater than 0.7 verifies the internal consistency. On referring to table 2 it can be seen that all of the CR values are greater than 0.7 and therefore the scales are internally consistent. AVE, average variance extracted is a measure of the variance an item has managed to explain. The AVE values are supposed to be greater than 0.5 to verify convergent validity, and as table 2 demonstrates all AVE values of scale items are above the threshold value, ensuring the convergent validity of scale items. The MSV values are less than the AVE values and self-correlation coefficients are also higher than those of the variable-variable correlation. Thus discriminant validity is also present.

Table 4: Convergent and Discriminant Validity

	CR	AVE	MSV	PR	RT	HR	RI	PA	OP
PR	0.928	0.880	0.561	**0.938**					
RT	0.903	0.869	0.406	0.610	**0.932**				
HR	0.920	0.877	0.615	0.728	0.637	**0.936**			
RI	0.931	0.910	0.615	0.746	0.589	0.784	**0.954**		
PA	0.912	0.932	0.557	0.746	0.575	0.697	0.745	**0.965**	
OP	0.956	0.875	0.561	0.749	0.602	0.688	0.734	0.712	**0.936**

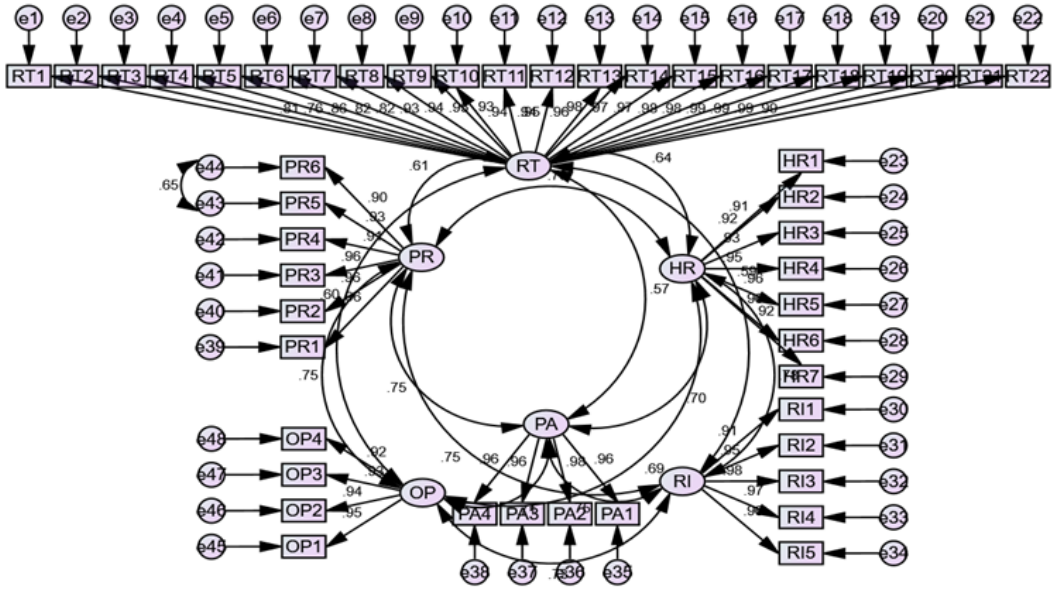
Model Fitness

The model fitness is established on the basis of CFA results CFA i.e. CMIN, RMSEA, CFI, GFI and IFI values. Two columns are evident in table 5. The current values are in accordance with the prescribed limits; CMIN is under 3, GFI is greater than 0.8, IFI and CFI are greater than 0.9 and RMSEA is under 0.08.

Table 5: Confirmatory Factors Analysis

Indicators	Threshold range	Current values
CMIN/DF	Less or equal 3	2.147
GFI	Equal or greater .80	.811
CFI	Equal or greater .90	.972
IFI	Equal or greater .90	.972
RMSEA	Less or equal .08	.051

Figure 1. CFA



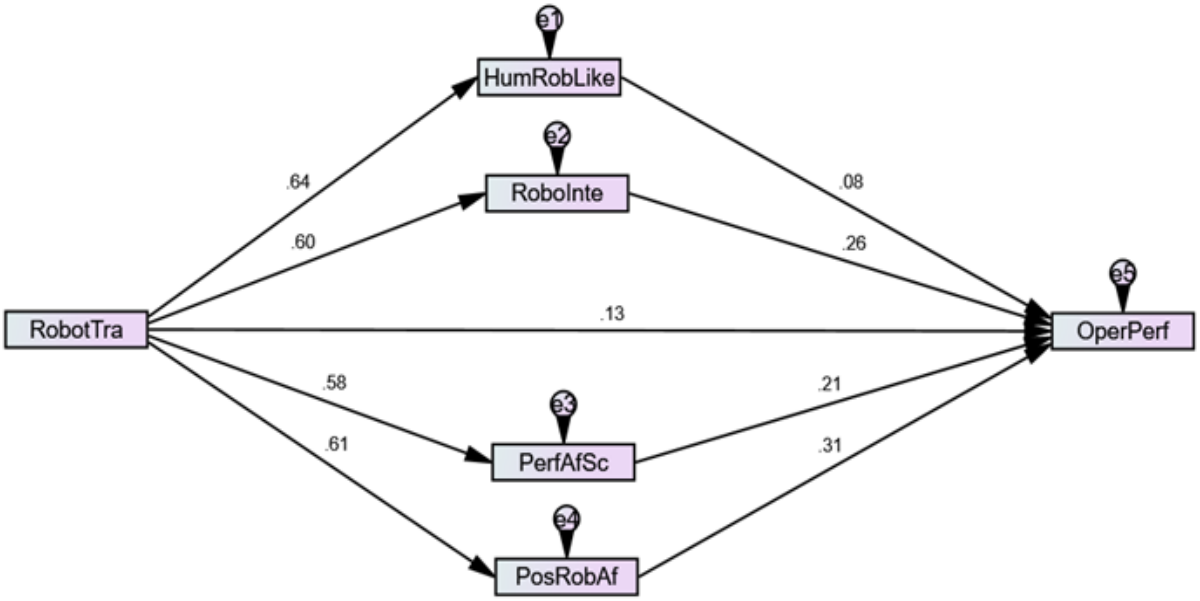
SEM

One unit change in RobotTra produces a change of 13.3 percent in Supply Chain Performance. The hypothesis is accepted as the relationship is significant. The mediation effect of PosRobAf PerfAfSc RoboInte and HumRobLike produces an effect of 31.5, 20.8, 25.7 and 8.2 percent on OperPerf. Hypotheses 2, 3 and 4 is accepted as the relationships are significant, however hypothesis 5 is rejected on the basis of insignificant results.

Table 6: Structural Equation Modeling

Total effect	**RobotTra**	**PosRobAf**	**PerfAfSc**	**RoboInte**	**HumRobLike**
PosRobAf	.612***	.000	.000	.000	.000
PerfAfSc	.580***	.000	.000	.000	.000
RoboInte	.599***	.000	.000	.000	.000
HumRobLike	.643***	.000	.000	.000	.000
OperPerf	.653***	.315***	.208**	.257**	.082
Direct Effect	RobotTra	PosRobAf	PerfAfSc	RoboInte	HumRobLike
PosRobAf	.612***	.000	.000	.000	.000
PerfAfSc	.580***	.000	.000	.000	.000
RoboInte	.599***	.000	.000	.000	.000
HumRobLike	.643***	.000	.000	.000	.000
OperPerf	.133**	.315***	.208**	.257**	.082
Indirect Effect	RobotTra	PosRobAf	PerfAfSc	RoboInte	HumRobLike
PosRobAf	.000	.000	.000	.000	.000
PerfAfSc	.000	.000	.000	.000	.000
RoboInte	.000	.000	.000	.000	.000
HumRobLike	.000	.000	.000	.000	.000
OperPerf	.520***	.000	.000	.000	.000

Figure 2. SEM



Discussion and Conclusion

Discussion

In this research, it has been analyzed for if robotics can be trusted for better Supply Chain Performance of automobile industry of Thailand. Moreover, the mediating roles of human-robotic interaction dimensions have also been evaluated in the given domain. The findings of the analysis have revealed that robotic trustworthiness has a significant impact over human robotic likeness. Therefore, it implies that this hypothesis is true. Moreover, it has been analyzed that robotic trustworthiness also affects the robotic intelligence in a positive way. Based on this, it can be stated that the other hypothesis is also true. The impact of robotic trustworthiness over perfect automation schema has been considered too. This is in congruency with the research of Dal Mas et al. (2019), in which it was identified that perfect automation schema gets positively influenced through the robotic trustworthiness. Moreover, the research has also defined that robotic trustworthiness positively affects the positivistic robotic affect which implies the correctness of another hypothesis. The overall analysis has revealed that robotic trustworthiness affect human-robotic interaction dimensions in a positive way. In addition to this, the researcher has also investigated that how Supply Chain Performance gets affected through the human-robotic interaction dimensions. The results of the research have revealed that human robotic likeness does not influence Supply Chain Performance significantly. Therefore, based on this, it can be stated that this hypothesis got rejected. However, on the other hand, it has been identified that robotic intelligence positively affects the Supply Chain Performance ensuring the acceptance of this hypothesis. Perfect automation schema has been considered as making positive affect over the Supply Chain Performance. It can be stated that the given hypothesis also got accepted. The hypothesis related to the impact of perfect automation schema over Supply Chain Performance have got accepted. This is in

consistency with the research of Song, Guo, Sun, Jiang, and Yang (2018), in which it was analyzed that perfect automation schema results into effective Supply Chain Performance. Moreover, positive robotic effect also influences Supply Chain Performance in a positive way, as per the results of this research. Therefore, it can be stated that this hypothesis is also true. In addition to this, it has also been considered that human-robotic interaction dimensions play a mediating role in between robotic trustworthiness and Supply Chain Performance. Thereby it can be stated that this hypothesis is also true.

Conclusion

In this research, it was analyzed for if robotics can be used for better Supply Chain Performance of automobile industry of Thailand. The mediating role of human-robotic interaction dimensions in relationship between robotic trustworthiness and Supply Chain Performance has been identified. The results of the study have proven that all of the human-robotic interaction dimensions except for human robotic likeness have significant impact over Supply Chain Performance. Moreover, it has been analyzed that robotic trustworthiness tends to make significant influence over all of the human-robotic interaction dimensions. The automobile industry of Thailand can use the given aspects in order to have better Supply Chain Performance.

Implications and Limitations

The scope of this research is limited to the automobile industry. The automobile industry of Thailand can trust on robotics in order to have better Supply Chain Performance as per the results of this research. Moreover, it has also been identified that human-robotic interaction dimensions play a mediating role in relationship between Supply Chain Performance and robotic trustworthiness. However, the basic limitation of this research is that this research has been done in the context of only one industry. This research could have been done for different other industries too. Moreover, the results could support the extension of the supply chain research, as studied by Aunyawong et al. (2020), on robotic issues and Thailand automobile manufacturers' supply chain performance.

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