The Impact of Innovation and Research and Development on the Transportation Performance: Moderating Role of Supply Chain Management

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***Abstract*-The aim attached to the study is to analyze the impact of innovation, innovation strategies and research and development on the transportation performance of Surabaya airport. The aim also includes the moderating impact of supply chain management among the links of innovation, innovation strategies, research and development and transportation performance. The data has been collected from the innovation department of Surabaya airport by using questionnaires and Smart-PLS has been employed for data analysis. The results exposed that positive nexus among the innovation, innovation strategies and research and development on the transportation performance of Surabaya airport. The results also revealed that supply chain management positively moderated among the links of innovation, innovation strategies and research and development and transportation performance of Surabaya airport. These findings are helpful for the management along with policymaking authorities that they should increase their emphasis on the innovation and research that enhance the performance of the transportation sector.**

Keywords; *Innovation, Research and development, Transportation performance, Supply chain management*

1. Background

The global world has strengthened various countries through variant aspects, and some systems prevail in states, whether inherited or developed. The prevailing systems familiar with the environment of every country while the elements of adaptation and consistency have somehow enumerated vast areas which need focus [22]. When any country strives for the betterment of structures, the paths could clear with the clarity of ideas and techniques used for consideration of such structure. When old things need up-gradation, certain commencements would require accuracy of work with no deficiencies, whereas replenishing the prevailing system is more difficult rather than forming a new one [21]. Any task aimed to bring particular change to the society or project named as innovation, while some formalities that signify such name could assert procedures for accomplishment. The creation of an idea inserted through the innovative scheme of a particular project could bring beneficial outcomes to various countries [26]. Many countries strive for variation of creative ideas that can bring possible changes to their states which need the development of multiple projects that can help their people in different opportunities. Innovation is the term which nor adopted in a single country but considered as a global objective for every country which is striving for the better enumeration of current projects and upcoming projects [8]. The idea of innovation neither prevalent in emerging countries nor developed countries but developing countries keeping a concerned focus on the adoption of the change in their countries. Various sort of strategies prevailing in emerging countries is limelight to the developing nations which are striving hard for the accomplishment of tasks assigned for the rehabilitation of multiple projects [25]. Nowadays, transport is an emerging topic which is limelight to every country, and the full focus has not yet disrupted so far by other countries.

In contrast, the adaptation of specific systems has provided broader views in the attainment of procedural controls prevailing in the project [7]. Innovation where has cleared the strategies of developments, the issues that could insert barrier to change could eliminate by numerous strategies formed with innovation measures. The ascertainment of the new transport system is limelight for the current world, where every country is striving for better establishment of the transport system in their countries [20]. Although, the transport system is considered a dominant project globally not only to facilitate people but also for trade. Some states have established multiple strategies for the accomplishment of the new transport system, while primary strategically contexts actively enhance with a specific timeframe. Business over the countries have risen so far, but the way of trade still prevail as a highlighted issue, where transport not only facilitate the trade but also will provide a standard mode of movements. According to the strategies adopted for a new transport system, generation of ideas, techniques, and process are dominant to be followed according to its creative impact. From the past few decades, the transport system was getting old one and also effecting on the oil prices where consumption grew up due to old pieces of machinery.

Moreover, a new transport system was facilitating the trade and people, will also result in an inconclusive measure of providing jobs for people [18]. After the divine era of innovative, creative ideas, particular strategies adopted to get the work done while accomplishing the concept of innovation, the steps of research and development also prevails. Innovative measures significantly claimed as an influencing factor towards a new transport system. In contrast, the strategies that established with work on innovative measures do affect a modern transport system of the world—research and development placed in the era of a new transport system influencing to a particular extent [27]. The establishment of research and development is a contributing factor for better ascertainment of a new transport system. Every system prevails on research and development because there is no chance of accomplishment until the projects pass by research and development. Various measurements needed by project management to analyze the strengths and weakness of the transport system but an essential part of this study involves linkages amid innovative support, innovative strategies and research and development. Supply chain management factor prevails in this study enumerating itself as a moderating role amid the elected variables, while supply chain management positively counted as a contributing factor for project management [1]. For the actual enumerations from innovation, innovation strategies, research and development; supply chain management elected as moderating element endorsing effect on a new transport system and all the elected variables in this study. The crucial part of sharing information and providing variant supplies, supply chain management, is founded as a significant factor in inserting some role between them [5]. Strategies of innovative measures enumerating variant influences on the new transport system, while if some other projects are elected can have an impact from moderating role of supply chain management. Therefore, many circumstances prevailing in the environment of innovation strategies can have elaboration via supply chain management [11]. Numerous times there is positive relationship reported in between the supply chain management (SCM) and performance of the Firm. The transportation industry is the backbone sector of any country economy. Supply chain management (SCM) plays a vital role in the performance of this industry. Supply chain management (SCM) affect the entire process of this industry.

2. Hypotheses development

The vast area of literature has contributed to the significant role of innovation amongst projects that are prevailing in the global world. In contrast, various innovative strategies have performed better as compared to the other ones. Studies have analyzed a variety of approaches and ideas of innovation that have a due impact on projects, whether having a lasting effect on futures or established to fulfil current laps. Plenty of factors prevailing in the literature influencing beneficial projects over the world, while the creativity of work has somehow overcome such issue, whereas several benefits seen in studies could benefit a new transport system [19]. The factor of research and development provided tools for analyzing the complexity of the project with forecasting measures, while the projects ascertained in literature cannot pursue further without approvals. Goals set in organizations in past replenished by the idea of innovation; therefore, a variety of strategies are considered viable for implementation of the strengthened project. The supply chain management significantly contributes to the eminent procedure of accomplished controls, whereas particular sharing determined to know the effectiveness of the supply chain management amid elected variables of this study [12]. The innovation and research are the key factors along with the supply chain that enhance the organization performance around the globe. In addition, the high performance goals of the organization cannot be achieved without the involvement of innovation, research and development and finally the supply chain management.

The evolution of technology has strongly affected human life. The effect of technology can easily be seen from all the aspects of life. The era in which we are living can be quoted as the technological era. In this technological era, the one who is not familiar with the technology faces day to day numerous obstacles in order to survive in the world. This technological advancement reached to this era vid numerous inventions. Innovation is the key factor behind this change. In this modern world, the one who failed to follow or complete the word can’t survive. This innovation phenomenon becomes the need of the world. Competitive advantage is the key player in the organizational competition. The organization which failed to gain competitive advantage resultantly thrown out of the competition by the competitors. This competitive advantage is having its base on innovation. It’s the innovation which differentiates the organization from its competitors and secures a valuable position in the competition. There is a complete process behind any innovation. All around the globe, there is more preference for online learning as compared to regular learning method like schooling etc. Online learning, the overall concept of online learning and teaching has become novel with the passage of time all around the globe. In broader views, variant patterns and experiences shaped in the environment of a teaching system which was considered a dominance element for debate and attention that encompassed with all necessary factors providing dilemma in unintended preventions for youth teaching. This process stands at research and development. The

research and development allow the organization to act in accordance with the requirement of the customers and the market trends.

The more any organization invest in the research and development (R&D), the more it secures its chances to secure the competitive edge as the innovation having a basis on research and development (R&D) [9]. The organization which discourage the research and development (R&D) culture usually failed to gain the competitive edge as they don't have any specific product or service which differentiate them and also fulfil the customers demand. The establishment of research and development is a contributing factor for better ascertainment of a new transport system. Every system prevails on research and development because there is no chance of accomplishment until the projects pass by research and development. Various measurements needed by project management to analyze the strengths and weakness of the transport system but an essential part of this study involves linkages amid innovative support, innovative strategies and research and development. Supply chain management factor prevails in this study enumerating itself as a moderating role amid the elected variables, while supply chain management positively counted as a contributing factor for project management. The research and development (R&D) is the first step of any innovation process. In the research literature, there is a very strong and positive relationship reported in between research and development (R&D) and innovation [4]. The research and development (R&D) make the organization enables to analyze the customer mind, attitude and behavior along with the market trends and competitor mind in order to develop a product which fulfils all the above-discussed requirement in order to secure the competitive edge in the competition, which is the key to success. In addition, the research and development department, along with innovation strategies, have a greater impact on the performance of the organization.

Martinez-Conesa, Soto-Acosta [14] conducted an investigation the relationship between innovation, CSR and organization performance and proposed that innovation positively mediates the relationship as it's having an impact on CSR and also at the performance. In the mediation effect of innovation, there is betterment in organizational performance. There is positive relationship reported on the nexus between innovation and firm performance [24]. The concept of supply chain management (SCM) is securing a valuable position in the research literature. Supply chain management (SCM) is the key element for the organization entire process [2, 28]. Whether the organization is product or services-oriented the supply chain management (SCM) plays a vital role. In this present investigation, the supply chain management (SCM) is taken as the moderating variable [6, 17]. Many of the past literature viewed that no performance goals have been achieved if the innovation, research and supply chain management ignored in the organization. In addition, innovation, research and supply chain are the foremost function of the high performance and cannot be ignored at any stage of the life cycle of the organization. Literature witnessed that numerous times the supply chain management (SCM) act as a moderator on the multiple organizational variables like innovation, competitive advantage etc. In the present competitive world, supply chain management (SCM) is playing a critical role in order to enhance organization performance [15]. The existing dynamic environment is requiring high-quality goods and services, respond quickly to the customer demand and finally be able to adapt to the rapid changes in the market environment. The supply chain management (SCM) is changing and absorbing the rapidly changing trends of the market in order to contribute in the better performance of the organization by rapidly responding to the customers demand and environment changes [10]. The performance of the organization depends upon the effective supply chain management along with supportive research and development department that encourages innovation in the organization. One of the significant change faced by the supply chain management (SCM) is the risk of supply and demand inequity, the organization liabilities in relation to firm market position, available resources guarantee, technologies and finally the optimizing costs [16].

H1: There is a positive association between innovation and industry performance.

H2: There is a positive association between innovation strategies and industry performance.

H3: There is a positive association between research & development and industry performance

H4: Supply chain management has positive moderation among the links of innovation and industry performance.

H5: Supply chain management has positive moderation among the links of innovation strategy and industry performance.

H6: Supply chain management has positive moderation among the links of research & development and industry performance.

3. Methodology

The aim attached with the study is to analyze the impact of innovation, innovation strategies and research and development on the transportation performance of Surabaya airport. The aim also includes the moderating impact of supply chain management among the links of innovation, innovation strategies, research and development and transportation performance. The data has been collected from the innovation department of Surabaya airport by using questionnaires. A personal visit has been conducted for the purpose of data collection and distributed around 210 questionnaires

among the innovation staff of the airport. After three weeks, another personal visit has been conducted to collect the feedback, but only 170 questionnaires were returned and used for the analysis and represented around 80.95 per cent response rate while Smart-PLS has been employed for data analysis because in case of complex model PLS-SEM is the best option for analysis. The variables that are used include three predictors such as innovation (INN) that has five items, innovation strategies (INNS) that has seven items, research and development (RD) that has four items. In addition, the variables that are used include one moderator, such as supply chain management (SCM) that has eight items and one dependent variable such as transportation performance (TP) that has four items. These variables are mentioned in Figure 1.

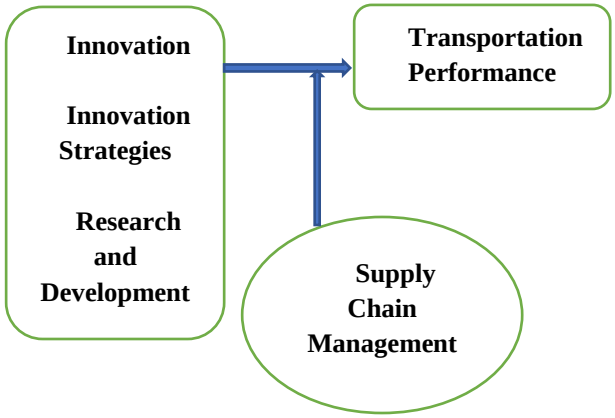

Figure 1: Theoretical framework

4. Results

The output of the present study includes the validity of the data along with the hypotheses testing. The validity includes the convergent along with the discriminant validity, while path analysis includes for the hypotheses testing. Firstly, this study checked the convergent validity related to the items correlation and the statistics show that all the required criteria re fulfilled such as loading and AVE are not smaller than 0.50 while Alpha and CR are not lower than 0.70. These figures proved the convergent validity as valid and exposed high correlation among the items. These figures are highlighted in Table 1.

Table 1. Convergent validity

Items	Loadings	Alpha	CR	AVE
INN1	0.937	0.945	0.958	0.821
INN2	0.855			
INN3	0.941			
INN4	0.854			
INN5	0.939			
INNS1	0.847	0.936	0.948	0.722
INNS2	0.860			
INNS3	0.853			
INNS4	0.866			
INNS5	0.870			
INNS6	0.853			
INNS7	0.795			
RD1	0.914	0.843	0.905	0.761
RD3	0.796			
RD4	0.902			
SCM1	0.566	0.894	0.909	0.600
SCM2	0.567			
SCM3	0.894			
SCM4	0.922			
SCM5	0.566			
SCM6	0.861			
SCM8	0.921			
TP2	0.862	0.814	0.890	0.730
TP3	0.897			
TP4	0.802			

Secondly, this study checked the discriminant validity related to the correlation of the variables and used the oldest method, such as Fornell Larcker. The statistics show that all the required criteria re fulfilled such as the values of the variable itself are not smaller than the other variables. These figures proved the discriminant validity as valid and exposed no high correlation among the variables. These figures are highlighted in Table 2.

Table 2. Fornell Larcker

	INN	INNS	RD	SCM	TP
INN	0.906				
INNS	0.398	0.850			
RD	0.405	0.368	0.872		
SCM	0.489	0.558	0.416	0.775	
TP	0.510	0.418	0.712	0.449	0.855

Thirdly, this study checked the discriminant validity related to the variables correlation and used the oldest methods such as cross-loadings, and the statistics show that all the required criteria re fulfilled such as the values of the variable itself are not smaller than the other variables. These figures proved the discriminant validity as valid and exposed no high correlation among the variables. These figures are highlighted in Table 3.

Table 3. Cross-loadings

	INN	INNS	RD	SCM	TP
INN1	0.937	0.343	0.361	0.446	0.472
INN2	0.855	0.386	0.388	0.440	0.453
INN3	0.941	0.346	0.355	0.446	0.462
INN4	0.854	0.387	0.383	0.442	0.450
INN5	0.939	0.342	0.349	0.440	0.470
INNS1	0.296	0.847	0.308	0.457	0.327
INNS2	0.348	0.860	0.287	0.485	0.358
INNS3	0.310	0.853	0.283	0.449	0.319
INNS4	0.345	0.866	0.258	0.496	0.323
INNS5	0.363	0.870	0.342	0.491	0.395
INNS6	0.377	0.853	0.383	0.479	0.410
INNS7	0.312	0.795	0.306	0.454	0.334
RD1	0.407	0.364	0.914	0.350	0.700
RD3	0.243	0.246	0.796	0.331	0.498
RD4	0.387	0.338	0.902	0.408	0.641
SCM1	0.193	0.670	0.161	0.566	0.183
SCM2	0.192	0.658	0.153	0.567	0.177
SCM3	0.464	0.413	0.389	0.894	0.428
SCM4	0.470	0.371	0.424	0.922	0.432
SCM5	0.192	0.669	0.166	0.566	0.199
SCM6	0.471	0.395	0.358	0.861	0.416
SCM8	0.467	0.369	0.424	0.921	0.428
TP2	0.491	0.340	0.623	0.383	0.862
TP3	0.446	0.369	0.625	0.429	0.897
TP4	0.363	0.366	0.576	0.335	0.802

Fourthly, this study checked the discriminant validity by using the latest method such as Heterotrait Monotrait (HTMT) ratio and the statistics show that all the required criteria re fulfilled such as the values of HTMT ratio are not larger than 0.90. These figures proved the discriminant validity as valid and exposed no high correlation among the variables. These figures are highlighted in Table 4.

Table 4. Heterotrait Monotrait ratio

	INN	INNS	RD	SCM	TP
INN					
INNS	**0.421**				
RD	**0.445**	**0.404**			
SCM	**0.488**	**0.709**	**0.436**		
TP	**0.579**	**0.476**	**0.848**	**0.484**	

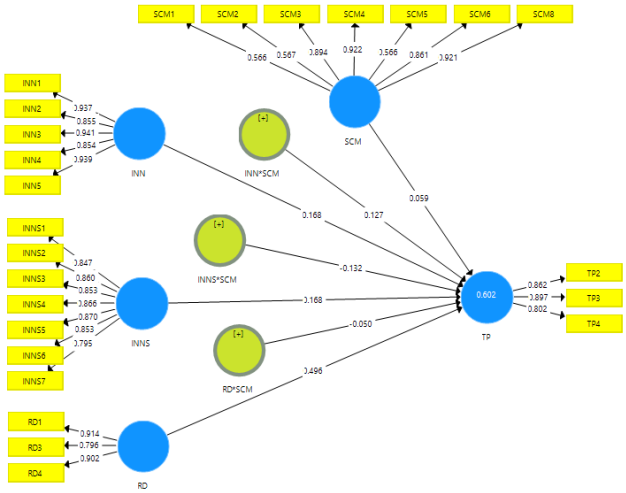

Figure 2. Measurement model assessment

The path analysis for hypotheses testing exposed that innovation along with innovation strategies and research and development have positive along with significant nexus with transportation performance of the airport and accept H1, H2, and H3. Moreover, supply chain management has positively moderated among the links of innovation and transportation performance, innovation strategies and transportation performance, research and development and transportation performance and accept H4, H5 and H6. These figures are highlighted in Table 5.

Table 5. Path analysis

Relationships	Beta	S.D.	t-statistics	p-values
INN -> TP	**0.168**	**0.050**	**3.356**	**0.001**
INN*SCM -> TP	**0.127**	**0.045**	**2.858**	**0.004**
INNS -> TP	**0.168**	**0.057**	**2.951**	**0.003**
INNS*SCM -> TP	**0.132**	**0.045**	**2.895**	**0.004**
RD -> TP	**0.496**	**0.050**	**9.951**	**0.000**
RD*SCM -> TP	**0.150**	**0.044**	**3.409**	**0.015**

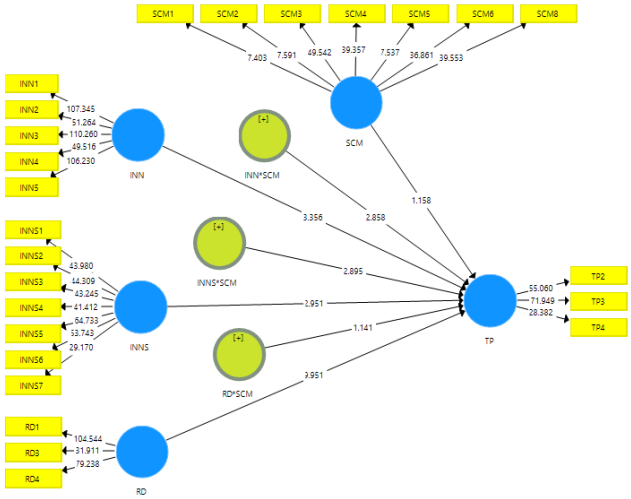

Figure 3. Structural model assessment

5. Discussion and conclusion

The results exposed that positive nexus among the innovation, innovation strategies and research and development on the transportation performance of Surabaya airport. These findings are similar to the output of the Liang, Shu [13] who also found positive links among the innovation and performance of the organization. In addition, these findings are the same as the output of the Bianchi, Croce [3] who also determined that the research and development along with the innovation, can improve the performance of the organization. The results also revealed that supply chain management positively moderated among the links of innovation, innovation strategies and research and development and transportation performance of Surabaya airport. These findings also matched with the results of Seman, Govindan [23] who also examined that supply chain management together with innovation and research and development, have a positive influence on the performance of the institutions. Thus, this study concluded that the research and development department of Surabaya airport has effectively managed the innovation and innovation strategies in the institution that is the reason for high performance in the country. In addition, Surabaya airport also managed the supply chain that is another reason for high performance because the supply chain, along with innovation and research and development have a greater impact on the performance of the organization. These findings are helpful for the management along with policymaking authorities that they should increase their emphasis on the innovation and research that enhance the performance of the transportation sector. This study has some limitation such as this study took only three predictors such as innovation, innovation strategies and research and development and suggested that future studies should add other predictors in their studies. In addition, this study ignored the mediating impact on the model and recommended that further studies should include moderating impact in the model. Finally, this

study has a narrow scope because it examined only one airport and suggested that future studies should expand its scope by adding more industries in the analysis.

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