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Nourishing Organizational Performance through Engineering Education: Mediating Role of Open Innovation and Intellectual Property Rights Protection

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Article Info
Volume 82
Page Number: 3440 - 3451
Publication Issue:
January-February 2020

Article History
Article Received: *18 May 2019*
Revised: *14 July 2019*
Accepted: *22 December 2019*
Publication: *20 January 2020*

Abstract:
The purpose of the current research was to examine the role of engineering education (EE) in nourishing organizational performance (OP) and to analyze the mediating role of open innovation (OI) and intellectual property rights protection (IPRP) between EE and OP. The impact of EE on OP and the mediating effect of OI and IPRP between EE and OP have been analyzed by collecting data from technology sector of Malaysia. The data was collected through structured questionnaire because the questionnaires were distributed among 350 employees and owners of technology sector of Malaysia. The quantitative data analytical tools (SPSS and AMOS) were used for analysis of the data through which the confirmatory factor analysis and structural equation modeling were performed on the data. Results of the study revealed that there is a significant positive role of EE in nourishing the OP because increase in EE enhances the OP. Findings of the study further suggested that there are significant mediating roles of OI and IPRP between EE and OP. The current study and findings are of great importance for researchers and practitioners because the current study will enhance the understanding of the phenomenon through which EE, OI and IPRP can enhance the OP.

Key words: *Organizational performance, engineering education, open innovation, intellectual property rights protection*

I. INTRODUCTION

Organizational performance is the measure of how well an organization has performed in a specific time span. To measure this performance, there are many ways such as the financial statements of that organizations and other facts and numbers of that particular organization (Chienwattanasook&Jermsittiparsert, 2019). Any organization takes many steps in order to improve its performance and increase its worth (Alberto & Braga, 2017; Panichayakorn & Jermsittiparsert, 2019). Engineering education is extremely important for civic, economic and intellectual activities of any country. Engineers all over the world learn to produce various products and device certain processes in several fields of life such as industry, businesses, healthcare, govt. institutions etc. These products and services are very beneficial for the country as they make the economy of the country grow more and more effectively. That is why engineers in most of the regions of the world are paid well and are in demand (Anderson & Gallini, 2019). Some of the engineers conduct different researches about aspects in different fields of life in order to bring innovations in the products, services and processes in those particular sectors(Wu, Straub, & Liang, 2015). Other engineers utilize these researches and practically produce and devise different products, services and processes in innovative ways that is eventually beneficial for the economy of the country. This means that engineers are not only competent in the fields of technology and science, but they also play important role in other sectors as well such as healthcare, business, industry etc. Technology oriented countries all over the world take crucial steps to promote engineering education in their country (Bettig, 2018). The old practices of engineering are now effectively replaced with

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new and innovative ones. All these points clearly depict the importance of engineering education in any country.

Open innovation refers to the use of innovative ideas not only from inside the organization or firm but also from the people and organizations outside of that organization. This enables the organizations to bring and utilize the knowledge, ideas and experiences from people outside their organization in order to bring innovation in their products, services and processes (Bhat, 2017). These organizations basically make mixture of their own ideas and ideas from external sources and then use that mixture in an optimum way in different processes of that organization. There are different models of open innovation in use these days. In bound open innovation means that an organization uses the information or knowledge from external sources and develop a product as a result. Out bound open innovation involves that the organization handover its product or process to an external source and let them make innovations in these products and services (Bogers et al., 2017). Coupled innovation process means that the organization and external source act together on a specific project and share their ideas and knowledge with each other and in this way, they mutually bring innovation in some product or process. The actors outside that organization from where the ideas and knowledge can be taken may include different competitors, research agencies, customers, suppliers, distributors etc. As we know that more minds result in more ideas and that is eventually beneficial for the organization using open innovation technique (Brunhaver et al., 2018).

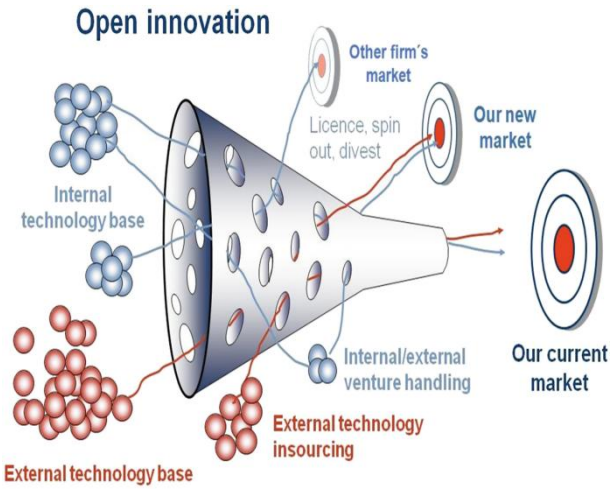

Figure 1. Open Innovation (Source: link.springer.com)

Figure 1 shows the whole process of open innovation. Intellectual property rights are those that enable a person to protect his ideas, plans, technologies, products or processes so that they may not get stolen or copied by someone else. The protection of these rights is a legal process and can be done by a professional lawyer or an intellectual property rights protection official. These rights have four types i.e. patent, trademark, trade secret and copy right (Brunswicker & Vanhaverbeke, 2015). Patent is actually the protection of an invention made by a person or an organization so that other people and organizations do no steal or misuse that invention in any way. Trademarks involve the legal protection of the products or services of any organization or business so that other businesses may not use or copy them. Trademark usually involves a specific and distinct name for that particular product or product line. Trade secrets provide protection to specific formulas or processes used in different organizations for various purposes. The last type of such rights is copyright that is specifically associated with artistic work. The singers, poets, painters etc. can protect their songs, poetry and drawings respectively, through copyright (Bucciarelli & Kuhn, 2018).

Engineering education is very much necessary for open innovation process and these innovations can be protected by using intellectual property rights protection IPRP. An effective system of these things ultimately increases the organizational performance of any company. But unfortunately, in the technology-based firms in Malaysia engineering education is not that reformed and refined, which hinders the way of open innovation and IPRP (Cameron, 2015). This ultimately decreases the organizational performance in these firms. Other than Malaysia, other developing and underdeveloped countries are facing the same issue and thus having low organizational performance (Tzabbar, Tzafrir, & Baruch, 2017). If this problem is not solved as soon as possible, it will not be in the better interest of organizations of that particular country. Therefore, it is very important to improve engineering education conditions in Malaysia and all over the world (Cassiman & Valentini, 2016). There are some papers that have studied the impact of engineering education on organizational performance, but no study has been conducted in order to see the mediating impact or role of open innovation and IPRP between engineering education and organizational performance. So, a research paper has recommended conducting a research to see the mediating role of the above variables (Davoudi et al., 2018). The important objectives of this research are as follows:

- To analyze the significant impact of engineering education on organizational performance of technology-based firms in Malaysia
- To analyze the significant mediating role of open innovation between engineering education and organizational performance of technology-based firms in Malaysia
- To analyze the significant mediating role of intellectual property rights protection between engineering education and organizational

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performance of technology-based firms in Malaysia

Malaysia has been transformed its image as an agricultural country to resource based country gradually. Now it is ready to be transformed into a technology-based country with all the innovations. It has been observed that Malaysia instead of producing new and latest technology, imports it from other countries. This is because of the lack of the concept of open innovation in Malaysia. The scope of this study revolves around the idea of how to increase organizational performance through open innovation, IPRP and engineering education. This study provides the complete information about engineering education, open innovation and IPRP and how these aspects can affect the organizational performance of any company (Corvellec, 2018). In addition, it assists the technology base organizations of Malaysia to move towards the trend of open innovation and IPRP, which is the need of the hour. Moreover, it also assists the government of Malaysia to devise policies favorable for open innovation and IPRP and increase the standards and opportunities of engineering education in Malaysia.

II. Literature Review

Theory of Economic Development

Theory of economic development, introduced by John Schumpeter, starts with the concept of circular flow. Circular flow refers to the repeating activities taking place in organizations on regular basis resulting into same products and services. There is a state of equilibrium in an organization according to the concept of circular flow, which depicts the equilibrium of demand and supply in that organization (Devadiga, 2017; Drahos, 2016). The revenues and profits remain constant in this situation of equilibrium. This equilibrium is the core of circular flow just like the blood that circulates in the human body. This circular flow is disturbed by some spontaneous and continuous change that occurs in that organization. This disturbance is actually occurred because of innovations and technological advancements in the processes of that particular organization.

In other words, innovations and technological advancements disturb the state of equilibrium and the process of development starts. We can define innovation as the change in traditional production processes, which is introduced by an entrepreneur so that the profits can be increased and to costs of production can be minimized (Dutfield, 2017). Schumpeter's definition of development can be related with the concept of innovation because changes and development obviously come through innovations in practices used in certain organizations and industries. Innovation can be in any form; the basic forms of innovations may include a whole new supply of raw materials from a new and better supplier, production of a new product by using those raw materials, new and innovative method of production of that product, sending that product to a new and better market (Eckhardt, Ciuchta, & Carpenter, 2018). The core of Schumpeter's theory of economic development revolves around the introduction of new products by using innovative and technological processes so that ultimately leads towards the economic development of that country.

According to Schumpeter, innovation is brought about by an entrepreneur, which is an important figure in the process of economic development. An entrepreneur is different from the managers and employees of any organization because he brings something new while the managers maintain the old and regular processes. An entrepreneur performs many roles in the process of innovation (Fang, Lerner, & Wu, 2017). He introduces all the aspects that are crucial for innovation, overcomes all the difficulties and barriers that come in his way of bringing innovation, directs the whole process of innovation, manages the credit and financial needs required for bringing innovation, encourages his fellows and subordinates to take risk with him, possesses excellent leadership qualities and finally takes the huge risk of innovation for the development of economy of his country. An entrepreneur plays all the above-mentioned roles and requires two basic things for this purpose (Gunasekaran et al., 2017). The first thing in this regard is his knowledge about technical aspects of different things in regard of innovation. There is a lot of knowledge and lots of inventions that can be used for the purpose of innovation. The second thing is the need of factors of production, for which an entrepreneur must be having the purchasing power in the form of capital or credit, which is provided usually by banks and other financial institutions, and thus they also play a crucial role in the economic development of a country (Gunasekaran et al., 2017). We can study the relationships of our concerned variables i.e. engineering education, open innovation, IPRP and organizational performance effectively by using this theory of economic development.

Impact of Engineering Education on Organizational Performance

Engineering education has huge importance in the modern age because for the development of economy of any country and keeping technological pace with other countries, engineering concepts are required. There are different fields of engineering that might be equally important for economic development. As in the Schumpeter's theory of economic development, it was clear that when there is a circular flow, all the activities take place in a regular and repetitive manner, and there is an established equilibrium there (Jung, Kim, Suh, & Kim, 2016).

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In this condition there is no development or growth of that organization. But when some act of development takes place, this equilibrium is vanished, and circular flow is stopped. This development is increasing the performance of any organization and makes it grow. Engineering education plays significant role in this scenario (Tejedor, Segalàs, & Rosas-Casals, 2018).

Engineering educational institutes provide knowledge about different fields related to engineering and these fields are used in different respective sectors in that country. Mechanical and electrical engineering may be useful in manufacturing sectors; civil engineering is useful in construction sector etc. In the same fashion, other fields of engineering are also beneficial in certain fields or sectors of a country (Karabulut- Ilgu, Jaramillo Cherrez, & Jahren, 2018). Engineering education basically provides the technical and innovative skills to individuals when when utilized in different sectors of industry, improve the performance of that particular organization. This is because of the fact that this is the era of technology and innovation. The old, traditional and conventional methods of production of different products and services are not enough today for growth and development of economic conditions of a country. Absence of engineers in an organization is a major setback for that organization because in this way, that organization is lacking technical and innovative minds and ideas and is stick to the traditional ones. This creates the Schumpeter's circular flow in that organization where there is no opportunity of moving forward (Lopez-Vega, Tell, & Vanhaverbeke, 2016; Martin-Rojas, Garcia-Morales, & Gonzalez-Alvarez, 2019). To break that circular flow, it is very much necessary to fine and hire the individuals having appropriate engineering education that can be employed in the organization for better productivity and more profits. From all above discussion, we can conclude that engineering education has a very significant role for the betterment of organizational performance in the technology-based firms of Malaysia. So, we develop the following hypothesis:

H 1: Engineering education has significant impact on organizational performance in technology-based firms in Malaysia.

Mediating Role of Open Innovation between Engineering Education and Organizational Performance

Open innovation refers to the use of external sources of knowledge, ideas and plans by an organization in their internal processes and practices for the improvement of organizational performance. The basic purpose behind the transfer of ideas, knowledge and suggestions from external sources is to bring innovations in different products or services provided by that particular organization. These organizations not only use the external sources, but they also use the internal sources and then by mixing them together, use that mixture in optimum values in their organizational practices (Mauricio, Veado, Moreira, Figueiredo, & Costa, 2018).

The people from which an organization can take ideas and knowledge may include its suppliers, distributors, costumers and other research sources. Studies have shown that engineering education is all about innovation and technology, which can be about either field or sector of that country. Engineering education provides appropriate amount of knowledge and skills to an organization in the form of its employees having engineering education. These employees use these skills and knowledge in order to bring innovation in different products or services provided by that particular organization(May, 2015). In order to bring innovation, their knowledge about technical aspects of those products and services is used effectively. Other than that, if an organization is providing some service or producing a product for which they do not have enough expertise or they want more expert opinion or idea for that product or service, they go for the external sources of ideas, knowledge and skills. Pharmaceutical companies sometimes import chemical formulas of medicines from external sources and then by using their equipment and human capital, produce that medicine themselves (Newstetter & Svinicki, 2015). This is one example of open innovation; there are many more areas or sectors where open innovation has great importance. Different types or models of open innovation are in use such as in-bound open innovation, out-bound innovation and coupled innovation process. All these models are distinct from each other on the basis of their properties (Sweet & Maggio, 2015; Täks, Tynjälä, & Kukemelk, 2016).

In-bound open innovation refers to the import of ideas and skills from external sources, out-bound open innovation refers to the exporting a product to some external source to bring some innovation in that product, coupled innovation process is the mutual working of both internal and external sources on some innovation project (Petrenko, Aime, Ridge, & Hill, 2016). The basic purpose of all these models is to increase the performance of an organization. As this is the era of innovation and technology, organizational performance is bound with these two important aspects. To put it in a nutshell, engineering education promotes open innovation in organizations which in return increases the performance of that particular organization. We can say that open innovation has significant mediating role between engineering education and organizational performance of technology-based firms in Malaysia. We can generate the following hypothesis in this regard:

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H 2: Open innovation has significant mediating role between engineering education and organizational performance in technology-based firms in Malaysia.

Mediating Role of Intellectual Property Rights Protection between Engineering Education and Organizational Performance

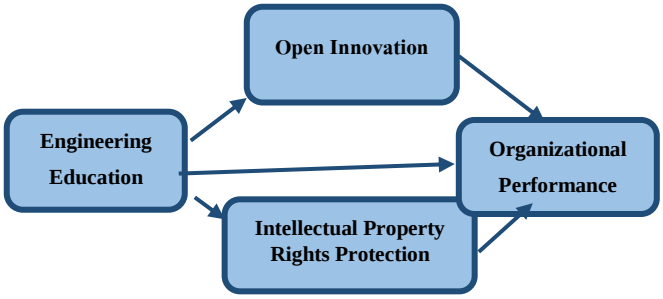
Intellectual property rights have recently gained a huge popularity because of the increased competitive environment. As we know that the competition among different organizations producing similar products or providing similar services has been increasing, it has become very important for all of them to protect their innovative and technical ideas, knowledge and skills for the better interest of their organizations (Ramírez-Montoya & García-Peñalvo, 2018). There are different types of IPRP in use these days such as patents, trademarks, trade secrets and copyright. Patents are basically used to protect any kind of innovation of a particular organization. This is important because innovation is an exceptional thing related to any organization or person and it is supposed be associated with that particular person or organization. Other than that, we have trademarks, which actually protect the products or services of a particular company or organization and differentiate them from the products and services of other companies and organizations (Randhawa, Wilden, & Hohberger, 2016; Saebi & Foss, 2015).

This is necessary because a product or service of a company must be recognized with the name of that particular company or organization. Trademarks give this protection to them. In addition, trade secrets are used to protect the formulas of a specific product or the procedure to produce a product or to provide a service. All such signature formulas, information and procedures are kept safe by using trade secrets. In the last, we have copyrights, which are associated with the artistic services or skills such as singers copyright their songs, poets may copyright their pieces of poetry and so on (Schuster, Groß, Vossen, Richert, & Jeschke, 2016). By using all these models or types, intellectual property rights can be effectively protected. As we know that engineering education provides technical skills about bringing innovations in different products, services or procedures, so these skills must be protected by using IPRP. In addition, by using these skills, when an innovative product is produced, it must also be protected by using IPRP. This is necessary because it ensures the improvement in organizational performance of any company. To put it in a nutshell, we can say that IPRP must be used in order to protect an individual's skills and the product or services designed by using those skills in order to increase organizational performance (Shanker, Bhanugopan, Van der Heijden, & Farrell, 2017; Shin & Konrad, 2017).

From the above discussion, we can conclude that intellectual property rights protection has significant mediating role between engineering education and organizational performance. We can generate the following hypothesis in this regard:

H 3: Intellectual property rights protection has significant mediating role between engineering education and organizational performance in technology-based firms in Malaysia.

Research Model:



III. Research Methodology

Population and Sample

This proposed study is about the impact of engineering education on organizational performance, in mediating role of open innovation and intellectual property rights protection. It is mandatory to collect the responses about this specific study because in previous literature no one observed the impact of engineering education on organizational performance. Researcher has been selected the learnitude technology Pvt. Ltd., Osiris solutions and VADS berhad company from technology sector of Malaysia. Out of this population, researcher selects the senior managers, business owners as the respondents of the study because they can entail that how the organizational performance nourished if the engineering education provided to the employees and managers. This sample has been selected by using purposive sampling techniques because objective of the study described that data has to be collected only from those who have knowledge about the technology involvement in organizational performance. Moreover, sample size selection is based on Klein (2015) idea which states that number of questions*10 provides more accurate and acceptable sample size. According to that, 350 questionnaires have been distributed among the respondents, out of which only 325 filled responses have been collected. After the deletion of invalid and incomplete responses, researcher collected only 303 responses.

Data Collection Procedure

In this research, researcher has been used questionnaire as data collection method. Survey questionnaire is more suitable

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for the quantitative study and for collecting the numeric data. Researcher has been asked two types of questions from respondents such as demographic questions and variable scaled questions. Questionnaire has been piloted for several times in order to verify the format, wording and ordering of the questions. In pilot study, researcher investigates the perspectives of the involved parties regarding the understanding of the scale items. Questionnaire has been rephrased according to the collected feedback. The finalized questionnaire with cover letter mailed to the respondents in order to collect the data from them. Online questionnaire administering technique has been used because respondents can conveniently solve it.

RELIABILITY AND VALIDITY OF MEASURES

Reliability of measurement model has been evaluated by using Cronbach's α and composite reliability criteria. Cronbach's α and composite reliability has to be greater than threshold value 0.70 because it ensured the satisfactory level of internal consistency and desirable level of items reliability respectively. For the evaluation of validity, researcher has been used AMOS and criteria used for the assessment of convergent validity are (1) items loading λ which has to be greater than 0.70 because its values get stronger at above 0.70 and (2) average variance extracted (AVE), its threshold range is greater than 0.50 because at this point convergent validity of constructs have been ensured. For the evaluation of discriminant validity, the criterion used states that square root of average variance extracted must be exceed when it compared with inter-correlated coefficients of the other constructs.

Common method bias has been originated when independent and dependent variables have been measured by using same measures which have been recommended by common raters (Donaldson & Grant-Vallone, 2002; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) for explanatory variables. It is critical to examine the common method bias because outcomes of the study get contaminate with the indication of corruption of measures in the same direction (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). As every study is different from other study that's why researcher has to use different measures for the measurement of specific set of variables. In this research study, set of variables are engineering education, open innovation, intellectual property rights and organizational performance. To identify the common bias method in the proposed study, researcher has been used Harman's single factor test. In this test, researcher checked whether all the constructs accounted for by single factor or by multiple factor. Results of test report that, about 91% of variance accounted for by multiple factors and only 14% of variance accounted for by single factor. Therefore, inexistence of common bias method has been confirmed because not 50% of variance interpreted by single factor.

MEASURES

For the evaluation of the variables of the study, researcher used adapted the measures from the work of other authors in previous literature. These measures are stated below.

A. Engineering Education

Engineering education (independent variable) has been evaluated on the basis of 12 questions, which have been developed from (Jarrar & Anis, 2016). Researcher asked respondents about 12 dimensions of engineering education, out of these survey items one is, "lifelong learning of engineering education help me to improve the quality of work". These items have been evaluated on the bases of 5-point Likert scale which states that responses were collected in the form of range from 1 strongly disagree to 5 strongly agree.

B. Open Innovation

To measure the status of the open innovation, 7 questions have been developed. This measurement scale has been suggested by (Dries, Pascucci, Török, & Tóth, 2013). The scale is 5-point Likert scale, in which responses ranges from 1 (strongly disagree) to 5(strongly agree). One of survey item is "The firm has intensive info exchanges with buyers".

C. Intellectual Property Rights

Intellectual property rights as mediating variable has been measured with 5 questions. The 5-item scale has been developed on the bases of suggestion of (Luoma, Paasi, & Valkokari, 2010) and (Enkel, Bell, & Hogenkamp, 2011). One of the survey items is, "Firms want to keep everything for themselves". The scale has been used for the measurement is 5-point Likert scale, in which 1 stands for strongly disagree and 5 stands for strongly agree.

D. Organizational performance

For the evaluation of dependent variable such as organizational performance, 6-items scale has been used, which is originally developed by (Yang, Chen, & Wang, 2012). The scale is 5-point Likert scale, in which responses have been categorized in range from 1 to 5, 1 refers as strongly disagree and 5 refers as strongly agree. Out of the 6 survey items, one is "The quality objectives of firm were achieved for each project.

HYPOTHESIS TESTING

Researcher test whether the hypotheses were positively related and negative related, by using the structure equation modeling. It has been run on AMOS and AMOS used covariance-based approach for running the diagnostics of structure equation modeling. Researcher test the various

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hypotheses under the covariance-based approach, which are impact of engineering education on organizational performance, in mediating role of intellectual property right protection and open innovation. Researcher verified the acceptance or rejection status of hypotheses by checking the direct, indirect and total effect. Moreover, researcher has been checked the relative significance and t-statistics values of hypotheses, for reporting that which hypothesis accepted, or which get rejected.

IV. Findings

The current paper has investigated the influence of engineering education (EE) on organizational performance (OP) along with the mediating role of open innovation (OI) and intellectual property rights protection (IPRP). For this purpose, 303 considerable responses were received back from respondents of this study that were in the position to be used for analysis. Among 303 responses, 125 responses had been filled by male respondents while 178 responses had been filled by female respondents. It means that there were more females in the sample as compared to male respondents. The demographic factor of education revealed that most of the respondents were post-graduated (48.8 %) and master's degree holders (40.3 %). There were only 7.6 percent respondents who were graduated while only 3.3 percent respondents were having other educational qualifications. The age of the most of respondents was between 21 and 30 years (82.5%) while there were 13.9% respondents in the sample who were of age between 31 and 40 years. Out of 303 respondents, 3 percent respondents were of age between 41 and 50 years while only 0.7% respondents were of age greater than 50 years. It means that most of respondents were young. The data collected from respondents was analyzed in terms of its descriptive statistics, suitability, convergent validity, discriminant validity, model fitness and SEM.

Descriptive Statistics

The descriptive statistics of studied variables have been shown in table 1 in which their "mean value, skewness, and standard deviation" are presented to show the normality and acceptability of the data.

Table 1
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
EE	303	1.00	5.00	3.4491	1.10238	-.617	.140
OI	303	1.00	5.00	3.5917	1.07450	-.883	.140
IPRP	303	1.00	5.00	3.5439	1.13120	-.745	.140
OP	303	1.00	5.00	3.5814	1.08766	-.812	.140

Findings of descriptive analysis are revealing that all studied variables have shown statistics within acceptable ranges because mean values of all of them are within the range of 1-5 which was the scale of measurement for all these variables. The skewness for all of them is more than -1 and less than +1. The variation as indicated by standard deviation is also acceptable because there is not too much variation in the data. Hence, the current data is normal and there is no extreme value in it.

Table 2
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.943
Bartlett's Test of Sphericity	Approx. Chi-Square	11309.852
	df	435
	Sig.	.000

The suitability of the data has been confirmed by "KMO and Bartlett's Test" because KMO for the current data is >0.6 and p-value is <0.001.

Convergent validity and Discriminant validity

The convergent validity and discriminant validity of the data have been proved to check the internal consistency and multicollinearity of the data. Findings of table 3 are showing convergent and discriminant validity.

Table 3
Convergent Validity and Discriminant Validity

	CR	AVE	MSV	Max R (H)	IPRP	EE	OI	OP
IPRP	0.949	0.788	0.370	0.950	**0.888**			
EE	0.906	0.773	0.250	0.984	0.395	**0.879**		
OI	0.922	0.740	0.370	0.988	0.608	0.500	**0.860**	
OP	0.948	0.754	0.370	0.992	0.608	0.419	0.445	**0.868**

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Results are suggesting that reliability of all variables has been confirmed because CR for IPRP, EE, OI and organizational performance is more than 0.7. The AVE for all of them is >0.5 which means that more than 50% variation is explained by them. All values of MSV are smaller than their respective AVE so, the convergent validity of the data is confirmed. The discriminant validity of IPRP, EE, OI and OP has also been proved because all these variables have shown highest correlations with themselves as compared to their correlations with any other variables

Model Fitness (CFA)

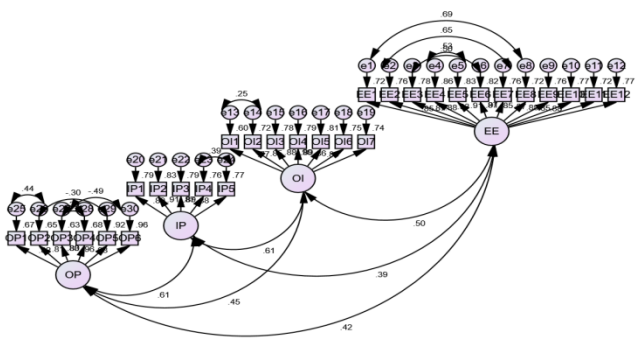
The model fitness has been tested through CFA which provided results presented in table 4 in which the threshold ranges along with the observed values of each indicator have been shown.

Table 4
CFA

Indicators	Threshold range	Current values
CMIN/DF	Less than or equal to 3	2.224
GFI	Equal or greater than .80	.848
CFI	Equal or greater than .90	.958
IFI	Equal or greater than .90	.958
RMSEA	Less than or equal to .08	.064

Results are proving that the current model has the good fit because CMIN/DF, GFI, CFI, IFI and RMSEA are all within acceptable ranges of these indicators so, the model fitness has been proved through CFA.

Figure 1
CFA



Structural Equation Modeling

The hypotheses of the current study have been tested through SEM in which total, direct and indirect effects of independent and mediating variables have been estimated. Table 5 shows SEM results.

Table 5
SEM Results

Total effect	EE	IPRP	OI
IPRP	.376***	.000	.000
OI	.485***	.000	.000
OP	.444***	.452***	.140**
Direct effect	**EE**	**IPRP**	**OI**
IPRP	.376***	.000	.000
OI	.485***	.000	.000
OP	.206**	.452***	.140**
Indirect effect	**EE**	**IPRP**	**OI**
IPRP	.000	.000	.000
OI	.000	.000	.000
OP	.238***	.000	.000

Note: *** indicates p-value <0.001, ** indicates p-value<0.01, * indicates p-value <0.05.

Results of SEM are suggesting that there is a significant and positive impact of engineering education on OP because one unit increase in EE caused 44.4% total increase in organizational performance. However, the total impact of EE on OP is not equal to the direct impact of EE on OP which means that there is some indirect effect of EE on OP which is caused by some mediating variables. This indirect effect of EE on OP has been caused due to the open innovation and IPRP. Results of SEM are showing that one unit increase in EE causes 37.6% increase in IPRP which ultimately increases the OP significantly with an effect of 45.2%. Similarly, one unit increase in EE causes 48.5% increase in OI which ultimately increases the OP significantly with an effect of 14 percent. Hence, it has been found that engineering education is a significant predictor of OP while the open innovation and IPRP are significant mediators between engineering education and organizational performance.

Figure 2
SEM

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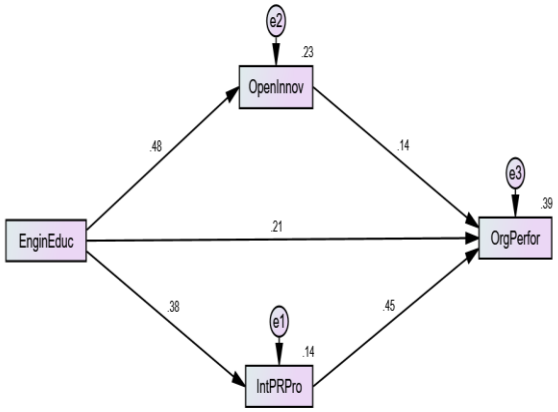

V. Discussion

The aim of this study was to know about the relationship that exists between entering education and organizational performance (Abele et al., 2015). This study took open innovation and intellectual property rights protection as a mediator between engineering education and organizational performance. As, engineering education involves teaching all the principles and knowledge regarding the professional practice of engineering. Its impact on organizational performance was an important case to study between the role of such variable (Bucciarelli & Kuhn, 2018). Open innovation cannot be left unattended. As open innovation accelerates the rate of internal innovation in the organization and in this way, it expands the market of that organization for the purpose of external use of that innovation. Moreover, where the things like engineering education and open innovation are discussed the protection of individual intellectual property rights was an important mediator to insert in (Chao, Chen, & Chuang, 2015). As they are regarded with the protection of an individual invention's literacy and once innovative piece of work. After the conduction of proper data collection and after the review of past literature. This research study proposed three brief hypothesis which wee then analyzed for their validity and then results were concluded. Each of the result will be discussed one by one in the section of discussion (Devadiga, 2017). The first hypothesis proposed ion the relationship of engineering education and organizational performance was, "engineering education has a positive and significant impact of organizational performance." According to the study of (Horváth, 2016), it was clarified that the organizations which implement continuous innovation in their systems and work hand to hand with the need of the time are always one step ahead of their competitors (Newstetter & Svinicki, 2015). Engineering education and its implementation through the employees of the organization are considered as a very vital part of the success and the growth of an organization in the era of modern technology so, as per the data from the past study and the results of the analysis of the current study it can be concluded that engineering education and organizational performance has a significant and positive relation between them (Karabulut- Ilgu et al., 2018). The second hypothesis suggested was about the mediating role of open innovation between engineering education and organizational performance, "The mediating role of open innovation and organizational performance is significant and positive." As open innovation is the factor which opens the gate of innovation in an organization and it allow the inflows and outflows of innovative knowledge and enhance the innovative capabilities of the organization. According to study of (Lima, Andersson, & Saalman, 2017) it is clearly proofed that open innovation enhances the impact of engineering education which enhances the organizational performance respectively. The third relationship studied in the research was of the mediating role of intellectual property rights protection between the engineering education and the organizational performance, "there exists a positive a significant mediating role of intellectual property rights protection between the engineering education and the organizational performance." According to the study of (Martin, 2015) wherever, engineering education or any kind of innovation involved the protection of the intellectual property rights of individuals is the key of the enhancement of organizational performance and for providing the competitive advantage to the organization. It is the most important factor to protect the intellectual property rights of that organization. Because, the stealer of those rights can easily snatch away the competitive advantage of that organization (Martínez-Núñez, Fidalgo-Blanco, & Borrás-Gené, 2015).

VI. Conclusion

The aim of this study was to have a deep insight about the relationship between engineering education on organizational performance and to know about the mediating impact of open innovation and intellectual property rights protection between the engineering education and organizational performance. This study was conducted in SEMNAN science a technology park and this study included thirty companies from those companies one forty questionnaires were distributed to the managers and business owners and out of which one twenty-six were received with proper filling and answers. The study used descriptive co-relation and after that the analysis was done using structural equation modeling technique. The results of the study showed that there exists a positive and significant relation between the engineering education and organizational performance, and the positive and significant impact of the mediators between the engineering education and the organizational performance.

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VII. Implications of the Study

The study has played a very vital role in increasing the knowledge about the intellectual property rights protection, a factor which is mostly neglected and taken on a lighter note by the organizations and they usually lose their important and precious intellectual property rights. The study has also enhanced the significance of engineering education of enhancing the organization performance. By the practical implication of the process of the protection of intellectual property rights organizations can not only enhance their performance but can also gain competitive advantages over their competitors. In the policy making section of the organization the owners can add engineering education as mandatory thing to enhance the performance of their organization and take it to the next level in short this study has enhanced the theoretical, practical and policy making importance of engineering education, open innovation, intellectual property rights protection for the enhancement of organizational performance.

VIII. Limitations and Future Research Recommendations of the Study

This study has filled different previous gaps present in the literature yet in the case of practical application it lacks significance amount of data collected about the problem. The study targeted the only thirty organizations and considered upper level faculty only. Whereas, according to the factors lower level employees should have been considered too. In order to expand and refined the model of the study the future researchers are recommended to considered other sectors like manufacturing sector or any other service sector and future researchers are recommended to study any association other than cause and effect relationship and also there are various other variables that impacts the organizational performance. These should be considered in the future as well. All the limitation of the current study is clearly mentioned the future researchers are recommended to fill these gaps.

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