Antecedents and Consequences of Indigenous Innovation: Evidence from Mobile Phone Producers in Turkey

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Abstract

Knowledge intensive processes are being deployed as the conditions of the market evolve according to the needs of the customers. Firms need to adopt their production systems to catch up the latest technology and this challenge involves intensive use of innovation. However, innovation is accepted to be a risky and costly process as it includes the use of venture capital not for being more profitable in the short term. Thus, the economic outcomes of innovation is more important for firms as the position of the firm mostly depends on it.

In mobile device production, the situation discussed above is more prominent as everyone can remember the case of Nokia. Once a company can be the leader of the market, but it can lose its position in a short time. Therefore, continuous effort is vital for the firms in this sector. Moving fromhere, we conducted the present research on the Turkish mobile device producers. We investigated the antecedents and consequences of indigenous innovation as these firms are deploying many efforts in this context. A sample of 272 practitioners are asked to fill in questionnaire forms the items of which are adopted from a previous study.

Succinctly, we have found that business performance is being affected by indigenous innovation. In addition, we found empirical evidence that supports the idea that intellectual capital and university knowledge are the antecedents of indigenous innovation. Lastly, we found that environmental uncertainty and dysfunctional competition is affective on the antecedents of indigenous innovation. In conclusion, we provide some research implications and policy directions for the practitioners.

Keywords: Indigenous innovation, Antecedents, Consequences.

Introduction

In today's economy, globally competing firms need to adopt themselves to the ever-changing conditions of the market. Initially they are expected to fulfill the customer needs while providing the highest profitability. Secondly, they are supposed to use natural resources in a steady way. The literature is rich in studies explaining the innovation strategy and its outcomes of China(Chen et al., 2006), whereas there seems to no study dealing with Turkey. Chow(2013) states that the improvement in China is a result of Multi-National Companies' (MNCs) investments on their production flows. However, the economic development of Turkey is rather different.

The ability to produce things can boost economic growth while emerging environmental solicitude. Thus, enterprises are expected to adopt or develop more responsible production flows, which means there is need for indigenous innovation(Appelbaum et al., 2016). Within this respect, countries are listed according to their attempts to be innovative and the position of Turkey is under the line as having lower Gross Domestic Product (GDP) outcomes compared per capita (Bichler & Schmidkonz, 2012). This depicts that the added value of products is comparably low. The country is not rich in natural resources and unfortunately, it is not an oil-exploiting country like Norway, Qatar and United Arab Emirates (Bichler & Schmidkonz, 2012). Thus, technology development becomes the key element of industrialization. Especially in developing countries, industrial growth is being widely being accepted as an essential criterion for economy of the nation (Guan et al., 2006). Moreover, Howell(2020) claims that innovation is essential for firms to maintain competitive advantage in the markets while achieving long-term success. Like all other emerging markets, Turkey faces technology transfer because of the desire of development via imports due to the addiction of the industry to foreign technology. Then there comes a tradeoff between developing the technology by bearing the costs and time spent on it, or easily transferring and giving the right to gain more to other nations and generally firms are not performing well in finance and they select the second choice(Long & Laestadius, 2016). However, the government deploys some programs in order to substitute imports and provides subventions and tax discounts to indigenous innovation(Fu & Gong, 2011). Just as China, some precautions are being utilized in order to maintain economic sustainability(Grimes & Du, 2013). Hence, the desire to import technology creates vulnerable economy and indigenous innovation is told to be used in minimizing its effects(Matthews, 2017).

The rivalry in mobile device production is outrageous and as it can be observed in the example of Nokia, the leader of the market can lose its place in a short time. Therefore, dysfunctional competition is another issue that firms face. In this respect, Intellectual Property Rights (IPRs) are being protected in terms of copyright, geographical indications, patents, trademarks and so on(Drahos, 2011). However, with the help of reverse engineering technology, the products can be imitated in short times.

Moving from here, the present study aims to define the antecedents and consequences of indigenous innovation

via the model of Zhang et al.(2019). To do so, mobile device producers in Turkey are observed in The Union of Chambers and Commodity Exchanges of Turkey (TOBB)'s database and only five firms are detected. Three of them are not operating and the ones in Istanbul and Manisa are covered in this research. 272 responses from online surveys are obtained and data is analyzed via SPSS and AMOS.

The results of the survey revealed that dysfunctional competition and environmental changes effect intellectual capital and university knowledge. Besides these, these two factors effect indigenous innovation capability of the firm and finally indigenous innovation effects business performance positively. Implications for future research besides policy proposals are also included.

Literature Review

The literature is rich in studies focusing on the development of China in indigenous innovation. Thus, the bulk of former work deals with this issue. Unfortunately, there is no piece of literature including indigenous innovation in Turkey. The present work is unique as it covers the antecedents and consequences of indigenous innovation in Turkish mobile device production context. The former literature is reviewed in terms of topic, methodology, conceptual framework and findings. The results are depicted as follows.

Initially, Appelbaum et al.(2016) deal with the nanotechnology and investigate whether indigenous innovation succeeded in China. They emphasize the role of Research and Development (R&D) infrastructure in the production flows. Likewise, Luo et al.(2017)conducted a research on the photovoltaic industry of China. They emphasize the role of intellectual returnees in indigenous innovation. Similarly, Bichler and Schmidkonz(2012) focused on the indigenous innovation system of China and investigated its effects on Foreign Direct Investments (FDIs). They conclude that innovation is vital for economic growth of China as well as other emerging markets. Baark (2019)also conducted a research on the indigenous innovation policies of China and he concludes that innovation is vital for Chinese economy and the precautions and policies adopted by the government are doing well.

More specifically, Chen et al.(2006) investigated the case of Haier Group in terms of indigenous innovation. They found that the system is working on a strategically designed plan and this expedites indigenous innovation firm-wise. Besides these, Chow (2013) interrogates the role of World Trade Organization (WTO) in China's indigenous innovation policies. The study concludes that China's IP right protection system is not working well, so dysfunctional competition is common. Another work done by Fu and Gong (2011) dealing with the indigenous innovation context of China seeks the drivers of technological upgrades. They conclude that intensive support on R&D can boost indigenous innovation systems.

Similarly, Grimes and Du(2013) also made a study on indigenous innovation policies of China and they make emphasis on the need for multinational R&D activities. Identically, Guan et al. (2006) cover the Chinese application policies on indigenous innovation. With a huge sample of 2334 firms in Chinese industry, they analyzed the emerging need for technology transfer. Moreover, Herrerias et al. (2016) dealt with comparison of the energy intensity of indigenous innovation versus foreign ones in Chinese context. They concluded that foreign innovation is much costly in long term. Besides these, Howell (2015) investigated the Chinese transformation in industry in terms of sustainability of new comers. He claims that the environmental uncertainty is rather high, thus firms need a strategic alliance in order to be consistent in the markets while making indigenous innovation. On the other hand, Wang et al.(2014) provide information on the late comers. They claim that international support can be utilized in developing an indigenous innovation strategy. Thus, they hope the IP rights can be standardized and China can get on well with the West. Howell(2020) also made another research on liberalization process of China and its effects on indigenous innovation. He introduces a structural innovation model that combines the FDI and multinational R&D. In addition, Jiang et al.(2016) draw a model that focuses on indigenous innovation for Chinese firms. They claim that instead of "zizhu chuangxin" (indigenous innovation policy of China based on doing the innovation by local resources) can be supported by internationalization.

Furthermore, Liu and Cheng (2014) argue a model that can be adopted as a national indigenous innovation strategy. Their argument is mostly based on deploying more effective policies that increase the innovators swing by more intensive subventions. In this respect, Li-Ying and Wang (2015) also made a contribution to the literature by revising the innovation policies of China and its effects on indigenous innovation. They conclude that although there is a vulnerable bulk of population in China, the number of skilled people is scarce. Therefore, there is need for international support in making innovation domestically. Moreover, Xie et al. (2015) emphasize the role of social ties and claim that indigenous innovation can be boosted by an integrative strategy. Vinig and Bossink (2015)also investigated the indigenous innovation policies of China and they came up to a conclusion that the agenda of China is

approaching very fast and this annoys the West in a great extent. Lastly,Zhang and Wu(2012) focused on the high tech parks on developing indigenous innovation in China based on biotechnology context. To some extend their claim on meeting the need of innovation is mostly on investments on infrastructure and human resources is true, however the severe epidemic that devastate the whole world economy is a result of unsteady type of manner in these facilities.

On the other side there are studies dealing with other paradigms of indigenous innovation. First, Zhang et al.(2019). searched for the antecedents and consequences of indigenous innovation in India. The design of this research is adopted to the present one and their scale is used in measurement. Moreover, Matthews (2017) focused on the rural development of West Africa and they searched evidence for indigenous innovation. His research revealed that even the poorest parts of the world could deploy indigenous innovation as they challenge the harsh living conditions. Similarly, Miltner and Coomes(2015) dealt with the Amazonian Peru and they report same results. Identically the results of Ukwuoma et al.(2018) on Nigeria are the same. They also complain that the bulk of literature is on mainly on China and India in this respect.

There are some research on the conceptual framework of indigenous innovation. Phelps(2018) claims a model that can be used in emerging economies. He also provides information on the historical aspects of innovation. In addition, Taubman (2012) draws a path to indigenous innovation and gives specific strategies to adopt it. Carlson and Dreher (2018) focused on the role of indigenous innovation in social media. They found that the perception of the customer is being affected by the means of media and as social media is becoming the most dominant one, firms should pay attention to such marketing assets. Besides this, Conway (2011)draws a policy direction to promote the indigenous innovation firm-wise. He claims that building an organizational climate based on entrepreneurship can boost indigenous innovation. On the other hand, Drahos(2011) deals with IP and its effects on indigenous innovation. He puts forth a voluntary system that protects the IP rights can work well. Similarly, Lazonick (2007) points out the need for FDIs in order to sustain indigenous innovation and preventing migration. He argues that insufficient local resources directs the qualified labor to migrate and then indigenous innovation becomes a more challenging topic. On the contrary, there are some research on benchmarking the indigenous innovation competences of different nations. Namely, Liu and Jayakar (2016) compared India and China's standards for indigenous innovation in terms of wireless practices.

They conclude that China cannot compete in this respect as India has a more qualified labor. In this respect, Long and Laestadius (2016) also made a research on practices of indigenous innovation in the context of mobile communication. They conclude that indigenous innovation is costly and time consuming but in the long term, it decreases the dependency on foreign resources.

Succinctly, the literature is mostly based on the indigenous innovation in China and India. Although there are some attempts to discover the other parts of the world, the bulk of literature mainly consists of these two countries. Thus, the present work will fulfill the gap for empirical data (partly) in Turkish context.

Theory and Hypotheses

For regional and national economic development, it is reported to have sufficient sources of competitiveness and one of these is majorly technological innovation(Li-Ying & Wang, 2015). According to Phelps(2018), invention is not just a satisfactory result of innovation and learning is also as important as the new products. Thus, the firm can create its bunch of experience to be adopted in the future needs. Innovation is a costly and risky process, as it requires coherence between resources and processes while being in an ever-changing market conditions(Fu & Gong, 2011). Therefore, firms should adopt the technology or processes in their production systems or indigenously develop their own processes or equipment. However, developing technology directly is a hard challenge for the developing countries because of the limitations in time and finance. Then, mostly new comers in emerging market initially try to transfer the required technology that costs nearly all of their budgets. Thus, the need of finance in marketing and supply chain besides the labor costs can oppress enterprise managers in allocation of resources.

The paradigm of indigenous innovation is drawn by Howell(2015) as he claims that the firms of developing countries needs to compete in a global scale which requires lots of venture capital. He also reports that the unlawful abrogation and lack of IP right protection can cause dysfunctional competition. Thus, firms are about to make a decision or imitating the innovation with lower costs or producing a better way by indigenous innovation. Within this respect, Jiang et al.(2016) argue that firms need internal and external knowledge at the same time. Moving from here, the intellectual capital in the firms besides the university knowledge and collaboration gains importance.

In traditional Schumpeterian models of innovation, allocation of inner resources were crucial whereas the market conditions of today requires being a part of an innovation circle and that makes the outer resources as substantial as the inner ones(Matthews, 2017). Also Ukwuoma et al.(2018) claim that the need for indigenous innovation is vital for the sustainability of the society as they will be able to survive in all conditions. Thereby, they will need to control the key technologies for R&D in a more indigenous way while bringing more business performance (Xie et al., 2015).

By using the information above, the hypotheses are derived as follows;

H1a: The ability to cope with environmental uncertainty positively effects intellectual capital.

H1b: The ability to cope with environmental uncertainty positively effects university knowledge.

H2a: The ability to cope with dysfunctional competition positively effects intellectual capital.

H2b: The ability to cope with dysfunctional competition positively effects university knowledge.

H3a: Intellectual capital positively effects the indigenous innovation.

H3b: University knowledge positively effects the indigenous innovation.

H4: Indigenous innovation capability of the firm positively effects the business performance.

This research basically aims to test the hypotheses related to the antecedents and consequences of indigenous innovation as shown in Figure 1.

Figure 1. Research Model



Business performance is going to be tested as the consequence of indigenous innovation while intellectual capital and university knowledge are going to be tested as antecedents. Moreover, the business environment is going to be represented by dysfunctional competition and environmental uncertainty. Herewith, the conceptual framework is going to be depicted in separate titles while discussing the hypotheses in the model.

Indigenous Innovation

Nowadays, the risk of shipment is rather high because of the severe epidemic. Countries are trying to protect themselves by deploying many restrictions on circulation of people and goods. However there is need to fulfill the changing demand and this requires innovation. Thus we come up to Appelbaum et al. (2016)'s proposition that indigenous innovation is vital more than ever before. According toHowell (2020), innovation is a risky process but its long-term consequences evoke the development of native technology. Thus, firms can adopt an old technology by adding new features or increasing its efficiency while increasing capacity with indigenous innovation (Long & Laestadius, 2016).

The concept of indigenous innovation originated from Chinese term "zizhu chuangxin" which means native or homegrown innovation (Bichler & Schmidkonz, 2012). Similarly Xie et al. (2015) and Baark (2019) argue that this term comes from Chinese and implies innovations that are under sovereign control of China. Also Chen et al. (2006) claim that the term is uttered by Professor Jin Chen in 1994 in order to define the capability of firms in adopting new technologies.

According to Phelps (2018), by the 19th Century, the global economy was being leaded by Britain, United States, Germany and France. These countries were able to make innovation because of qualified labor and university knowledge. Then, they were to propagate technological developments to others. Within this respect, Conway(2011) approaches the term from its historical origins. He argues that the colonization of other nations has made significant impacts on indigenous innovation. By this way, nations got together and started to create solutions to their problems. Especially the colonizing countries brought their technological competence to be used in the colonized ones. In this way, many improvements are told to be observed from weapons to agriculture. With the same scope, Drahos (2011) explains the effects of British colonization on Australia. He claims that the technology made the lives of natives easier while having the colonizing countries to have cheaper supply chains. On the other hand, Guan et al.(2006) disagree with this idea and according to

their argument, the process of colonization retarded the development of indigenous innovation. Thus, by 1990s, China started to make innovation in homeland and began to resolve its technological needs by itself. By 2006, according toLiu and Cheng(2014), it became the unique country to react in the global financial crisis as a result of homegrown solutions in the long run.

By using the knowledge above, it is obvious that countries are going to be developing their own innovation systems and indigenous innovation will be vital than ever. If a firm is performing well in indigenous innovation, it will be benefiting from huge cost savings in terms of technology transfer. Moreover, they will be able to transfer this novel technology to others and addicts the industry to itself. By this means, their business performance should be higher with outrageous indigenous innovation performance.

Environmental Uncertainty

As a result of globalization, trade liberty and acting in a knowledge based economy, the business environment is evolving and this change has obligatory consequences for firms(Ukwuoma et al., 2018). In emerging markets, enterprises are expected to compete globally in terms of products and processes(Jiang et al., 2016). The capital could be transmitted from one country to another in a short time and every country needs foreign direct investments to grow the economy (Wang et al., 2014). Global flow of items and goods are changing every day and this brings out a very inconstant climate for business environment(Lazonick, 2007). Market conditions can change in very short times and adaptation to such a mutable rivalry needs more skills and competences (Long & Laestadius, 2016). Therefore, in this research environmental uncertainty will be conceptualized as the perception of the employee on overall unpredictability of market conditions and technology (Zhang et al., 2019).

Product innovation is mostly based on adding new specifications on the product as a result of science and technology (Appelbaum et al., 2016). Therefore, there are many changes in the world of production and the easiness of availability for nanotechnology and technological development besides the ICTs are making markets very unsteady(Bichler & Schmidkonz, 2012). Moreover, the rivalry on being the producer of the world between China and US is being named as trade wars (Baark, 2019). These challenges are making the rivalry harder than ever and it is apparent with the use of social media (Carlson & Dreher, 2018).

In this respect, Chen et al. (2006) argued that innovation should be market oriented. They also point out the need of indigenous innovation in order to obtain unique products and processes. Similarly, Grimes and Du(2013) emphasize the need for market oriented innovation, as it results more economic solutions. So, whether indigenous or exogenous, new products are expected to meet the global needs. Also,Guan et al.(2006) advice firms to adopt technology from abroad in order to catch up technology. However, Howell(2015) discusses this process in a Schumpeterian approach and implies indigenous innovation. In this case, they will be able to produce their own technology, but they will fail in competition, as their innovations' maturity will have lower aspects.

So far, we have observed that the uncertainty in the business environment is an ongoing process and firms can only compete globally by innovation. If they make indigenous innovations, they will be more aware of the production systems and spend less in acquisition of technology. This brings out unique products that are hard to imitate and intellectual capital because of innovative learning environment. Then they will make use of their university knowledge and cooperate with the academy.

Intellectual Capital

Production is an exuberant process that enables the enterprise to collect knowledge from experience. Mostly nations deploy education programs to dispose the society to the challenges of the future, however learning based on memorization does not culminate innovative solutions (Appelbaum et al., 2016). Thereby, there is need for qualified labor who are ready to accumulate intellectual capital especially for the developing countries (Fu & Gong, 2011). However, building intellectual capital in developing countries is a hard challenge and the lack of knowledge and human resources can act like a key inducement (Long & Laestadius, 2016).

In this point, Chen et al.(2006) claim that the indigenous innovation based on intellectual capital must have six aspects to be more useful. Namely, these are the technological strategy and center, innovation resources and centers besides the environment and motivation of the entrepreneur. This also includes the dominant role of enterprises in business. Then we can come up to a decision that if the innovative climate for labor is constituted, the intellectual capital can be obtained. So, as Conway (2011) states, indigenous innovation and entrepreneurship are results of collective and pervasive policies.

On the other hand, firms can reach intellectual capital by Multinational Companies (MNCs) operating in the homeland (Bichler & Schmidkonz, 2012). They bring the latest technology with the intellectual capital. Then it is reported that the innovation in China is mainly foreign owned (Grimes & Du, 2013).Furthermore, the scholarship based on the host country can result beneficial innovation (Jiang et al., 2016).In addition, the host country can get better employment ratios. Gradually, from imitation to indigenous innovation the local firms start to develop their needs by interacting the MNCs (Baark, 2019). By this way, it is reported to have higher GDPs in India and China (Chow, 2013). Also,Li-Ying and Wang (2015) offers a path to firms to make use of the external knowledge. Luo et al. (2017) also suggests the use of intellectual returnees to increase the innovation capabilities. In this respect, Turkey has been sending students to abroad for education by the use of Law No: 1416. They make significant contribution to the scholarship and transfer the knowledge acquired abroad.

Another aspect of intellectual capital is the IP rights protection. World Intellectual Property Organization (WIPO) tries to protect these rights;however, the infrastructure and juristically limitations evoke the violation of them (Drahos, 2011). In this respect, dysfunctional competition is severe. Matthews(2017) suggests constituting some indigenous communities for fulfilling the gap of WIPO.

University Knowledge

Education is vital for the regeneration of nations. It can make the individual more aware of the things going around. In some countries, the right to access education is just for the privileged ones. Therefore, they can reach anything that desire while the disadvantageous ones suffer from hunger. As a result of democratization, many countries started to give the right to be educated to everyone and as they all realized the force of having qualified society, most of them makes education compulsory(Lazonick, 2007).

The intellectual capital that the firm collected from experience is highly important but the university knowledge that eases the labor to adopt this practice is rather notable. If the individual knows how to learn, then s/he can be more aware of his/her own competences. In this point, Phelps (2018) argued that the practice is more important in Schumpeterian innovation theory. According to him, endogenous sources of knowledge can make better results than the nation's scientists. It is obvious that globally the transfer of academic knowledge is not as fast as the adoption of firms to meet the customer needs. Then, countries started to integrate the universities to industry. The dilemma here is twofold. Initially the businessperson can make a bulk of wrong production via the use of improper production methods just to gain more. Secondly, the academic can make a better way of production but it takes long time. In this point, Appelbaum et al. (2016) claims to bring out a high tech nation that can operate in

both sides. However, the industry can easily imitate another which means plagiarism for academy. In addition, Bichler and Schmidkonz(2012) suggest a public model that accumulate international knowledge. Similarly, Grimes and Du(2013) offers international R&D processes to be deployed globally. On the contrary, while emphasizing the rivalry, Fu and Gong (2011) point out that the need for labor is going to diminish, so the firms can make investment on the skilled labor to be more effectual. Besides this, Jiang et al.(2016) argue that the in-house knowledge development can accumulate innovation. Zhang and Wu(2012) argue the geographical proximity of universities. Clustering same kind of research institutions in a narrow place is being criticized. Lastly, Zhang et al. (2019) offers to create knowledge based view that both accumulate university knowledge and experience.

Dysfunctional Competition

Dysfunctional competition is the term used to define the perception and practice of firm managers on not paying attention to IP rights of others in the industry and behave opportunistically via unlawful competition (Zhang et al., 2019). Lack of protection in IP rights caused dysfunctional competition. Extensive corruption, lack of ethics and bribery encourage some firms to imitate the innovation that is made costly (Appelbaum et al., 2016). The presence of weak legal protection and gaps in legislation among countries cause this kind of competition and it blocks the path to innovation. The shift to market based economy coerced firms to make necessary changes in their products but the lack of control weakens the governance and in fact, governments are not more willing to cope with this challenge as whether the product is an imitation or not, it brings foreign currency (Bichler & Schmidkonz, 2012). On the other hand, Taubman (2012) argues the copyrights of traditional works and knowledge also be protected. Then, as Wang et al. (2014) state, IP rights and indigenous innovation can clash. In this respect, many countries are grumbling on the practice of China as its firms are copying the IP rights easily because of low legislation standards (Baark, 2019).In addition, Chow (2013) reports some precautions that are being deployed in the US for Chinese products. Besides these, Conway (2011) emphasizes the United Nations declaration on protection of IP rights. Moreover, the Chinese are complaining about their IP protection system, as the outcomers are not paying attention to these aspects when they make investments in China (Grimes & Du, 2013). Li-Ying and Wang (2015) states that indigenous innovation will help China to get rid of the addiction to Western technology.

To sum all up, the lack of legislation and practice of laws cause dysfunctional competition. Thus, the intellectual

Business Performance

Today's economy is mostly based on knowledge management due to the improvements in IT (Carlson & Dreher, 2018). On a glance with the most valuable firms, the IT practitioners are on top of the list. Enterprises are about to provide highest profitability as there is a wide range of investment options for funders. Achieving this goal is bound to performing their best in business processes. According to Appelbaum et al. (2016) innovation is the key element to achieve the highest standards in businesses. If the firm is not sufficient in terms of technological competence, the innovation will be limited (Bichler & Schmidkonz, 2012).

The sustainability of these new comers mostly depends on the origin country. In middle or lower income countries, the lack of finance and scarcity of the intellectual capital generally diminish the abilities of the firms. As a result of this fact, brain drain is one of the most severe problems of these countries (Fu & Gong, 2011). However, the markets in these countries are plenteous as the market shares are nor rigid as the developed countries. So, as Liu and Cheng (2014) suggest that indigenous innovation might bring more effective solutions on business performance. They might also make use of cheaper labor costs and they can provide the lowest costs while having the advantage of more sales(Long & Laestadius, 2016). Thus, the investment on human resources can boost business performance in this context(Xie et al., 2015).

So far, from the information above, we have witnesses that the knowledge-based economy of today requires the minimum costs with maximum profitability. In order to do that, indigenous innovation might perform well as it has many advantages in the long term. Up to now, the theory and hypotheses are inferenced from former research. The following part of the research will be on reporting the empirical evidence on antecedents and consequences of indigenous innovation.

Research Method

Mobile device producers are listed in Industry Database of TOBB in five different cities (İstanbul, Manisa, Malatya, Bursa and Samsun). The ones in Bursa, Malatya and Samsun are micro enterprises and they did not report capacity in the database. Therefore, we were to narrow the scope on the producers in İstanbul (1615 total number of employees) and Manisa (6678 total number of employees). The universe thus included a total of 8293 employees. Random sampling is done and with 90% level of reliability it is observed to have 263 responses are going to be adequate. Similar sampling methods can be observed in Appelbaum et al. (2016),Liu and Jayakar (2016). The scale developed by Zhang et al. (2019) is translated into Turkish and re-translated whether there is semantic shift. After consulting experts, the questionnaire was ready to be applied. By mailing and intensive phone calls, 272 online responses are obtained. Data is transformed to a data set and analyzed via the use of SPSS and AMOS.

Factor	Variable	f	%	Factor	Variable	f	%
Gender	Male	174	64,0	City	İstanbul	60	22,1
	Female	98	36,0	City	Manisa	212	77,9
Education	Associate	38	14,0		22 to 28	72	26,5
	Bachelor	198	72,8		29 to 35	67	24,6
	Postgraduate	36	13,2	Age	36 to 44	76	27,9
Marriage	Married	151	55,5		45 to high out	57	21.0
	Single	121	44,5		45 to nignest	57	21,0

Table 1. Demographic features of the sample

The analysis firstly included basic descriptive methods(Appelbaum et al., 2016; Guan et al., 2006; Xie et al., 2015; Zhang et al., 2019). The demographic features are presented above in a Table 1. The sample mostly consists of males. In Turkish context, the participation of women in economy is still a hard challenge. They are mostly engineers, mechanics and their education level is high. More than half of the sample is married and most of them are from the facility in Manisa. The ages of the sample differs from 22 to 73 and in order to manage the data in ease it is divided into nearly equal quarters in variance.

T-tests and ANOVA are applied in order to see whether these demographic features cause statistically significant differences. The age groups and gender of the sample did not report any significant difference. Marriage differs in dysfunctional competition. The perception of the married ones are higher than the singles. The city causes statistically significant difference in all aspects. The ones in Manisa have higher perceptions than the ones in İstanbul in every dimension. In addition, level of education causes statistically significant difference in all dimensions. The higher the education, the higher the perceptions are. Thus, we can say that the firms should pay attention to university knowledge and intellectual capital in order to obtain better indigenous innovation results. The firm in Manisa is the leader of the sector in production and their human resources policy is mainly on providing best opportunities to the labor.

Factor	Number of Items	Cronbach's Alpha	Mean	Std. Deviation		
IntCap	10	0.919	4.0985	.72218		
UniKn	8	0.950	4.1809	.81501		
IndInn	4	0.838	4.0156	.88080		
BusPer	5	0.817	4.3449	.64383		
DysfCom	4	0.845	4.2463	.69691		
EnUnc	4	0.902	4.0561	1.00911		
IntCap= Intellectual capital; UniKn= University knowledge; IndInn= Indigenous innovation; BusPer= Business performance;						
	DysfCom= Dysfunctiona	al competition: EnUnc= Environme	ental uncertainty			

 Table 2. Reliability Measures and Descriptive Statistics

After detecting the demography, the descriptive statistics and reliability measures are calculated and shown in Table 2. Cronbach's Alpha scores are higher than the acceptable thresholds in social sciences (Cronbach, 1971). The Likert type scale starts from "completely disagree" to "completely agree". The means obtained show that the sample mostly agrees on the items. Standard deviations are low and this depicts that they share similar ideas on the items.

Factor	UniKn	IndInn	BusPer	DysfCom	EnUnc
IntCap	.337**				
UniKn	.274**	.341**			
IndInn	.549**	.404**	.289**		
BusPer	.592**	.336**	.242**	.464**	
DysfCom	.242**	.231**	.193**	.362**	.237**
		**=	=p<0.01		

 Table 3. Correlations

The tests to reveal the relationships between factors are done. In this respect, Pearson correlation is used. According to Table 3, the highest correlation is reported to be between university knowledge and business performance (r=.549; p<0.01**) and the lowest one was between business performance and dysfunctional competition (r=.193; p<0.01**). All of the factors are correlated to each other positively. Such correlations can also be observed in other studies(Guan et al., 2006; Herrerias et al., 2016; Jiang et al., 2016; Li-Ying & Wang, 2015; Xie et al., 2015; M. Zhang et al., 2019).

Afterwards, Exploratory Factor Analysis (EFA) is done in order to test the validity of the scale. KMO and Bartlett's test score is .859 and Total Variance Explained (TVE) is 69.95%. These two results indicate that the size of the sample is sufficient and the construct validity is ensured. Principle component analysis with varimax rotation is used in EFA and the results are shown in Table 4.

	1	2	3	4	5	6
IntCap1		.715				
IntCap2		.737				
IntCap3		.759				
IntCap4		.825				
IntCap5		.723				
IntCap6		.701				
IntCap7		.662				
IntCap8		.699				
IntCap9		.640				
IntCap10		.568				
UniKn1	.920					
UniKn2	.918					
UniKn3	.682					
UniKn4	.923					
UniKn5	.804					
UniKn6	.925					
UniKn7	.818					
UniKn8	.738					
IndInn1					.883	
IndInn2					.672	
IndInn3					.684	
IndInn4					.880	
BusPer1				.612		
BusPer2				.768		
BusPer3				.643		
BusPer4				.701		
BusPer5				.541		
DysfCom1						.759
DysfCom2						.799
DysfCom3						.693
DysfCom4						.688
EnUnc1			.840			
EnUnc2			.839			
EnUnc3			.886			
EnUnc4			.852			

Table 4 Rotated Component Matrix

All of the items are listed under the other items of the scale. However, the factor loadings of these are high and this suggests the tests of collinearity. In order to so, Confirmatory Factor Analysis (CFA) is conducted. Initially the model is formed just as the EFA results indicate. The factors are listed with their indicators and error terms are added to the measurement model. By the use of AMOS, the results of CFA are illustrated as Figure 2.





The initial tests did not report satisfactory results, so the modification indices are revised covariance reporting items are tied together. By this way, a satisfactory measurement model is obtained (CMIN/df= 2.617;

GFI=0.783; AGFI=0.742; NFI=0.856; RFI=0.838; IFI=0.906; TLI=0.893; CFI=0.905; RMSEA=0.077). The results indicate that there is positive relationship between items.

	CR	AVE	MSV	MaxR(H)	DysfCom	IntCap	UniKn	IndIn n	BusPer	EnUn c
DysfCo m	0.848	0.584	0.442	0.856	0.764					
IntCap	0.920	0.536	0.454	0.947	0.665	0.732				
UniKn	0.951	0.712	0.169	0.990	0.355	0.370	0.844			
IndInn	0.831	0.583	0.052	0.993	0.188	0.180	0.219	0.763		
BusPer	0.803	0.553	0.452	0.993	0.622	0.674	0.411	0.228	0.773	
EnUnc	0.878	0.651	0.097	1.075	0.224	0.237	0.228	0.160	0.311	0.807
CR= Composite Reliability; AVE= Average Variance Extracted; MSV= Maximum Shared Variance; MaxR(H)= Maximum Reliability										

Table 5.	Reliability	v and Validity	/ Measures
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Next, the reliability and validity measures are calculated and the CR is higher than 0.70 for all dimensions. Also, the MSV for all factors are lower than the AVE. These results indicate that the discriminant and convergent validity issues are fulfilled and there is no problem of covariance. Later on, hypotheses are tested via Structural Equation Model (SEM) (Hair et al., 2016). AMOS is also practical for SEM and the means of the items for measuring the dimensions are illustrated in Figure 3 below.

Figure 3. SEM Measurement Model



The tested model reported satisfactory results in fit of data with the model (CMIN/df= 3.756; GFI=0.986; AGFI=0.905; NFI=0.970; RFI=0.849; IFI=0.978; TLI=0.885; CFI=0.977; RMSEA=0.101). These results depict that business performance is being affected by indigenous innovation by 40%. In addition, indigenous innovation is being affected by intellectual capital at least but more from university knowledge. Besides these

dysfunctional competition is being affected by intellectual capital in a great extend (57%) while the affection is comparably low from university knowledge (29%). Lastly, environmental uncertainty is being affected by university knowledge and intellectual capital. However, the affection in dysfunctional competition is higher than the one in environmental uncertainty.

Table 6. Hypotheses Testing Results

Hypothesis	Result
H1 _a : The ability to cope with environmental uncertainty positively effects intellectual capital.	Supported
H1 _b : The ability to cope with environmental uncertainty positivel y effects university knowledge.	Supported
H2 _a : The ability to cope with dysfunctional competition positively effects intellectual capital.	Supported
$H2_b$: The ability to cope with dysfunctional competition positivel y effects university knowledge.	Supported
H3 _a : Intellectual capital positively effects the indigenous innovation.	Supported
H3 _b : University knowledge positively effects the indigenous innovation.	Supported
H4: Indigenous innovation capability of the firm positively effects the business performance.	Supported

The hypotheses are tested via SEM and the results indicate that all of them are accepted as shown in Table 6. The model depicts that indigenous innovation can make contribution on the business performance. Meanwhile it is being affected by intellectual capital and university knowledge. In addition, dysfunctional competition and environmental uncertainty are crucial factors in the innovation processes. Thus, empirical results are depicted and the following part of the research will discuss these results with the findings of the former works.

Conclusion

In this research, we aimed to investigate the antecedents and consequences of indigenous innovation in Turkish mobile device production sector. In this sense, we conducted a literature review and found that the former studies are mostly based on the Chinese and Indian experience. Therefore, the present research is identical as it covers the Turkish context for the first time. We collected data from 272 practitioners in order to test our hypotheses and the analyses revealed that all of them are supported by the data. We came up to some conclusions and initially we found that the indigenous innovation affects the business performance in a great extent. Meanwhile indigenous innovation is affected by intellectual capital and university knowledge. These constructs are being affected by dysfunctional competition and environmental uncertainty. In this part of the study, we will discuss our findings with the outcomes of former research. By doing so, we will induce some research implications besides policy directions.

Business environment of our age requires more intensive use of knowledge and innovation as the needs of the customer and the dynamics of the market continuously change. Firms need to deploy innovation on their production flows, their products and services. In this context, Appelbaum et al.(2016) emphasize the importance of regional strategies on economic zones in order to keep up to the recent dynamism of the market. To do so, they also offer to pay attention to manufacturing research besides having more efficient education systems. The venture capital can access to any market because of liberalism, so it is crucial for firms to protect and improve the market share to be competitive.

All nations desire to have greater economies and make the lives of their citizen more attractive (Bichler & Schmidkonz, 2012). In this sense, they provide support for the growth of a knowledge based society by the use of education and subventions to innovation(Baark, 2019). By the use of social media, people are aware of the latest products with the use of IT (Carlson & Dreher, 2018). Then meeting the requirements of the customer can gradually become global and keeping up with this hard challenge requires more intellectual capital and university knowledge. To do so, it is argued that strategies converting imports to indigenous innovation, developing synergy for the indigenous products and a total strategy to boost innovation country-wise might be beneficial in the long term (Chen et al., 2006). Moreover, Lazonick (2007) claim that the prosperity of the nation depends on the indigenous innovation capabilities of their firms. Thus, we come up to a conclusion that the market conditions of any country depend on its production capabilities. Moving from here, Guan et al. (2006) suggests developing indigenous innovation systems can diminish the need for imports while creating opportunities for exports. Then we come up to another conclusion that every nation has to be productive in order to have a more charming economic status and to do so, indigenous innovation is vital.

While operating in the markets, firms should satisfy the profitability desire of the venture capital and they seek ways for more profitability in order to be sustainable. Then the use of current production flows in a more efficient way can be a good idea, however the maximum potential of a system is limited as the potential of innovation is unlimited. The IP rights of the innovation can be used in order to prevent dysfunctional competition (Conway, 2011). In this sense, Drahos (2011) also suggests that developing a system for IP rights indigenously can protect the firms. However, the protection of these rights in developed countries is highly different from those in the developing and under developed ones (Fu & Gong, 2011). By using the gaps in legislation, some firms are violating the IP rights of others, which means benefiting from a technology by not paying the R&D investments (Grimes & Du, 2013).

On the other hand, the literature is rich in studies that the future of the firms will depend on their integration levels with others. Initially, Herrerias et al. (2016) claim that domestic and foreign innovation can sustain the economy of the day. Furthermore, Howell (2015) claims that innovation is a risky process and these risks can be eliminated by the use of the international intellectual capital. In his another piece of literature, Howell (2020) also suggests the R&D intensity of the innovation will increase the risk of it as the venture capital spent on these processes will ascend. Liu and Cheng (2014) also offer to utilize open innovation, as the energy to be spent on protection of the IP rights is comparably higher than doing novel innovation. Then as Liu and Jayakar (2016) define, there is need for strategies that ease the coordination with other firms. Besides these, Luo et al. (2017), Li-Ying and Wang (2015) and Jiang et al.(2016) claim that the theory and practice of indigenous innovation differs in a great extend as the success of innovation is mostly based on its

economic outcomes. Thus, we come up to another conclusion that domestically or internationally the success of innovation will mostly be on the economical outcomes of it. Then firm managers should integrate their firms in innovation circles. By this way, they will be eliminating the risks of failure while benefiting from the latest innovation. In this respect, Wang et al. (2014) and Ukwuoma et al.(2018) argue that by integrating the innovation system globally, the standardization of innovation can be obtained as protecting IP rights of it will be easier.

When we come up to research implications, it is suggested to conduct longitudinal research on the problem of indigeneity (Zhang et al., 2019). Similarly, Matthews (2017) emphasizes to investigate the social interaction in indigenous innovation aspects. Identically, Taubman (2012) offers some research on the success of indigenous innovation from resistance, revision and economic dimensions.

Lastly, we offer some policy directions to boost indigenous innovation. Xie et al. (2015) claim that catching up other counties in production is vital for the growth and sustainability of the economy. Likewise, we offer to increase subventions on developing indigenous innovation systems domestically. We also claim that integration of this system to global innovation systems will make contribution in terms of university knowledge and intellectual capital. Furthermore, Zhang and Wu (2012) suggest to develop indigenous innovation by the use of high-tech development zones. Similarly, we also suggest to restructure higher education based on institutions for specific objectives. Then we believe that regional innovation systems can bring out a significant difference in science and research base. By this way we can develop a more qualified human resource, protect and improve the market potential. To do so, strong government and top management support is vital.

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