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THE INDUSTRY 4.0 REVOLUTION: SCRUTINISING THE ENABLERS FOR YOUNG TECHNOPRENEURIAL FIRMS' COMPETITIVENESS

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Abstract

It has been anticipated that the Forth Industrial Revolution to transform our living style, working pattern and communication system. We can also anticipate that there is a possibility of change in our value systems, what and how we value certain items, today and tomorrow. At present, the changing is taking place in business models and employment trends. However, IR 4.0 rate in Malaysia is still quite unimpressive than other nations. In addition, the IR 4.0 in Malaysia is at the beginning stage especially among young technopreneurial firms. Therefore, this study aims at examining the impact of enablers on young technopreneurial ventures' agility and competitiveness in the industry revolution 4.0. The study contributes to the literature by presenting interview findings of the study. Altogether eighteen entrepreneurs who operated young technopreneurial firms had participated in a series of semi-structured interviews. The findings offer an understanding on the relationship between enablers and the agility and competitiveness of young technopreneurial firms in the era of IR 4.0.

Keywords: Agility and competitiveness, individual, Industrial Revolution 4.0, Malaysia, organizational and institutional factors.

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1. Introduction

The industrial revolution has brought some benefits and challenges to the socioeconomic status of every country. For instance, the first industrial revolution 1.0 was led by the Great Britain with the introduction of commercial engines that use steam; communication and transportation. The second industrial revolution 2.0 first occurred in the United States where telephone revolutionizes our communication method. The third industrial revolution 3.0, is the Internet, in which it is the main driver where its usage has been a success due to its function as the public infrastructure technology. The fourth industrial 4.0, is based on digital revolution, where it involves the bridging of digital technology, the people and other tangible applications (Iqbal & Nawaz, 2019; Md Ali, 2018; Morrar et al., 2017). Disruptive technologies of industry 4.0 are giving birth to information pollution (Iqbal et al., 2020). Yet, the revolutions have facilitated the growth of economies, better well-being and enhanced productivity (Morrar et al., 2017). Malaysia is one of the nations that embraces IR 4.0.

1.1. Literature review

A review of literature suggests that there are many factors affecting the competitiveness of new start-ups including technopreneurs. These factors were then classified into Enablers which could be dissected into 3 components, those are Individual, Organizational, and Institutional.

1.1.1. Individual factor

Factors that facilitate the development and growth of young technopreneurial firms are termed as enablers. This study aimed at finding out the individual factors responsible for impacting young technopreneurial ventures' agility and competitiveness in Malaysia. The individual factors that influence young technopreneurial agility and competitiveness are Entrepreneurial Orientation, Entrepreneurial Strategy, and Entrepreneurial Bricolage.

Entrepreneurial Orientation is a construct that has three elements, namely innovative, pro-active and taking risk (Rauch et al., 2009). The innovativeness initiates new services/products as well as strategies; thinking out of the box in exploration and exploitation of new products/services (Hamel & Ruben, 2000). Pro-activeness is about to generate ideas, to strategize in ensuring continuous demand stream from the market and to meet customers' needs and demands. Taking risk taking is about taking strong action where unfamiliar areas are explored despite the lack/limited experience in business. The vital element to firms' success is entrepreneurial orientation. Various literature shows that there is a positive correlation between better performing firms and entrepreneurial orientation (Arshad et al., 2014; Rauch et al., 2009; Zainol & Ayadurai, 2011). According to Hart (1992), in organizations, strategy making is a an extensive endeavor that encompasses analyzing, planning and making decisions. There is also an integration of various organizational aspects such as culture, organizational goals and values. Further, it represents the entrepreneurs' actions and decisions in relation to the organizations' policies and activities. Meanwhile, Entrepreneurial strategy might be seen as the process of formulating strategies, achieving the firm's goals and visions and creating competitive advantage (Rauch et al., 2009). Stinchfield et al. (2013), define entrepreneurial bricolage as 'mechanism to observe the weaknesses. Bricolage is something that is available at a certain time which can be appointed into as needed to have diverse abilities and resources to generate

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what could not be can be possible in a resource constrained environment (Hotho & Champion, 2011). In this context of study, entrepreneurial bricolage can be used as an approach to boost innovation performance. This is because the outcomes of bricolage may play an important role in shaping firm innovativeness (Andersen, 2008).

1.1.2. Organizational factor

This study aimed at the organizational factors responsible for impacting young technopreneurial ventures' agility and competitiveness in Malaysia. The organizational factors that influence the young technopreneurial agility and competitiveness are structural capital, human capital, social capital, technological capability and business agility.

Today, businesses are consistently being challenged with external and internal factors that require them to transform as the market has become more aggressive. External factor like a new industry and rapidly changing information technology are factors that influence the way businesses are done (Gunasekaran et al., 2005). Meanwhile, the study by Isaac et al. (2010) stated that structural capital is the process and practices crafted and stored in the firm's system that improves organizational knowledge. Structural capital, as argued by Ramezan (2011) involves a firm's structure and system. It is highly vital for businesses in creating value-added goods and services and achieving competitive advantage. Therefore, we can conclude that structural capital encompasses of system guidelines, infrastructure and procedure.

Another organizational factor, human capital, is related to combined knowledge, skills, abilities, and experience; which collectively are a firm's innovation source and strategic revitalization (Shaari et al., 2011). Human resources are the main factor to a firm's value added. This capital revolves around the workforce's capability, knowledge and proficiency, competence, behavior, and intellectually agile. Businesses that have abundance of social capital may be able to attain greater competitive advantage (Nahapiet & Ghoshal, 1998). Moreover, Youndt et al. (2004) mentioned that relationships extend beyond the workers, where it also involves the clients, partners, suppliers and others. Social capital has a vital function in the intellectual capital growth in all businesses (Bueno et al., 2004; Hamzah & Isa, 2009).

The role played by technological capital is widely recognized in knowledge-centric economies A firm is able to generate business values by employing its technology resources and know-how (Chae et al., 2018) including technology driven production systems and techniques. In organizations, technological capabilities are particularly vital to firms that use knowledge extensively; which is the fundamental to the firms' competitiveness (Khalique et al., 2011; Wang et al., 2004; Zott, 2003). Capability of a firm to achieve agile operations is by improving competitive advantage that is time dependent, i.e. receptiveness and adjustment to clients' demand and conditions (Shin et al., 2015). Previous studies show that these organizational factors have a vital function in the improvement of organizational performance and attainment of competitive advantage (Chae et al., 2018; Hamzah & Isa, 2009; Khalique et al., 2011; Shin et al., 2015).

1.1.3. Institutional factor

The institutional factors are responsible for impacting young technopreneurial ventures' agility and competitiveness in Malaysia. This study aimed at several institutional factors such as financial, technology

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support, machines and equipment, training and coaching, market accessibility and promotional support, and R&D support.

The growth of new venture formation is directly influenced by the institutional environment (Hwang & Powell, 2005). In organizations, institutional factors signify that all forms of assistance and support mechanism should be made available to firms to improve their performance. These institutional factors play a powerful role in creating and even destroying entrepreneurship in a country (Zimmer, 1986). Studies have highlighted on the relationship between institutional environment and entrepreneurship development (Arasti et al., 2012; Baumol, 2005). Previous research provides important information on the role of institutional factor of institutions in promoting entrepreneurship at country level (Acs et al., 2008; Bowen & De Clercq, 2008; Hessels et al., 2008). Institutional factors influence the levels and types of entrepreneurship in a country or region through the behavior of entrepreneurs; which, again is influenced by how these entrepreneurs perceive their environment. The environment of the institutions will limit, create and define the vision, purpose and opportunity of the entrepreneurs. Therefore, influencing the pace and range of the level of entrepreneurial entry (Shane, 2004).

1.1.4. Agility and competitiveness of technopreneurs

The word agile had first made its appearance in the business literature concerning flexible production method, whereby the words ‘flexible’ and ‘agile’ are always being interchanged (Li et al., 2008). The link between flexible and agile is similar to the association of competent and capable. Agile is an ability that is concentrated externally. Meanwhile, flexible is a capability that is concentrated internally, the opposite of being agile (Swafford et al., 2006). From this perspective, being agile is a one-of-the-kind element, an ability involving market sensing used in exploring and exploiting opportunity for hedging (Roberts & Grover, 2012). This is similar to the notion that being agile is a dynamic ability (Roberts & Grover, 2012). There is another notion that being agile does not only mean capability, it is also a characteristic of agile companies that might need a set of meta abilities (Doz & Kosonen, 2008). Companies that are agile-centric have to be familiar to being effective in acquiring resources and harmonizing abilities (Chen & Chiang, 2011; Shin et al., 2015).

1.2. Theoretical framework

In accordance to the above, a framework that could explain the relationship between the enablers (facilitating factors) and technopreneurial ventures’ agility and competitiveness is proposed. The factors that increase young technopreneurs’ agility and competitiveness are individual factors, organizational factors and institutional factors. Figure 01 below presents this study’s framework.

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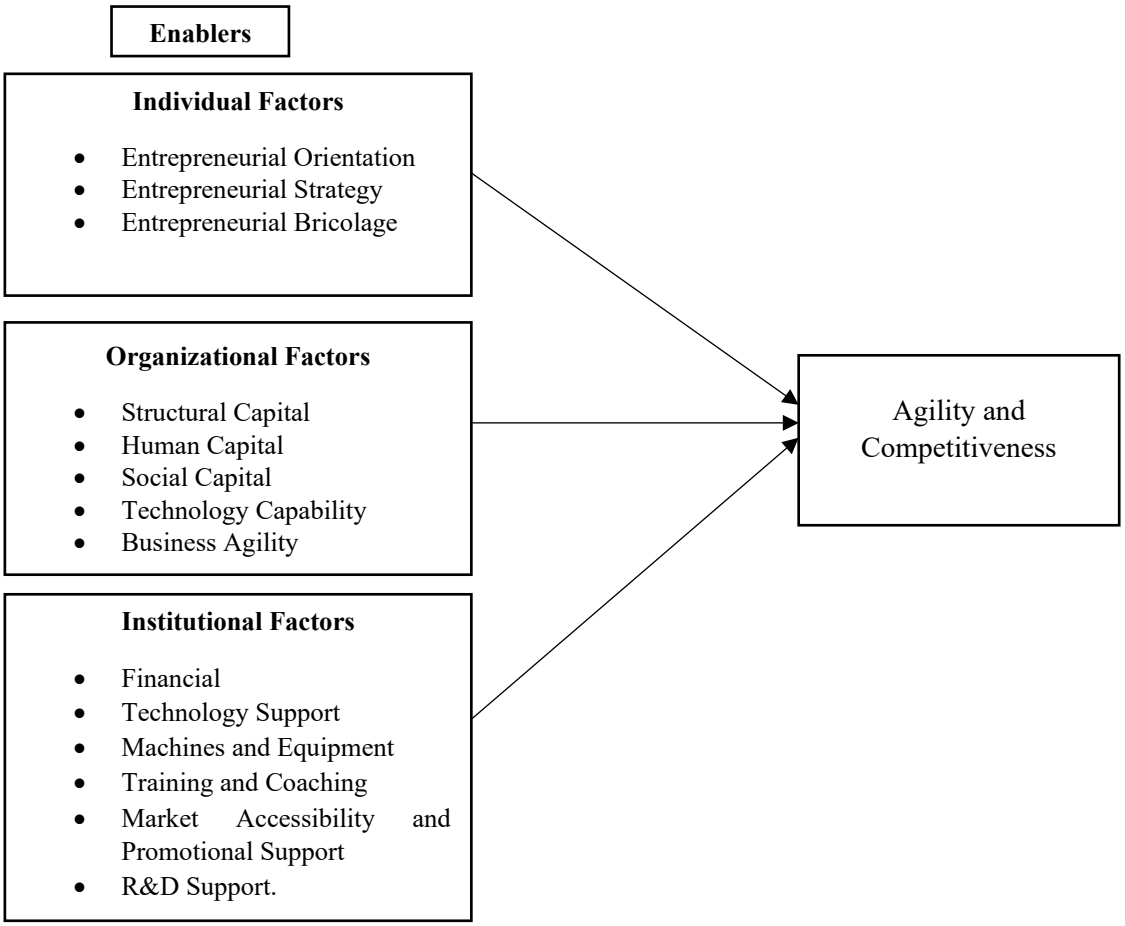

Figure 01. Conceptual framework

2. Problem Statement

All industrial revolutions have changed the operations of manufacturing industries. Industry 4.0 requires manufacturers to produce high quality product at low cost efficiently and effectively along with high customization (Iqbal et al., 2019). The revolutions have facilitated the growth of economies, better well-being and enhanced productivity (Morrar et al., 2017). Malaysia is one of the nations that embraces IR 4.0. In the context of Malaysia, the speed, density and scale of technological changes posed challenges to these firms especially in the face of Industry Revolution 4.0. This study tries to analyze the factors impacting the agility and competitiveness of young technopreneurial ventures from the lens of individual, organizational, and institutional level factors. By understanding the enablers at these three different levels, a more holistic and comprehensive understanding of the "what" and "how" issues that build or deter the competitiveness of young technopreneurial ventures could be generated.

3. Research Questions

This research is expected to offer an explanatory framework that demonstrates the systemic impact of individual-organizational-institutional nexus on the agility and competitiveness of young technopreneurial ventures; which could assist the formulation of the right strategies for Malaysian technopreneurial ventures. The originality of this research lies within its attempt to open the 'black box' of

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young technology-based entrepreneurial firms given the inherent dynamic and turbulent nature of the context and the multiple interactions between individual, organizational and institutional levels. The following research questions are considered to explore in the present study;

1. How do enablers and inhibitors contribute to the agility and competitiveness of the manufacturing firms in industry 4.0?
2. What are the internal and external factors that contribute to enablers and inhibitors in the context of industry 4.0?

4. Purpose of the Study

The prime motivation of current study is to investigate the impact of enablers on young technopreneurial ventures' agility and competitiveness in the industry revolution 4.0. A scrutiny of the relevant literature suggests that debate surrounding the origin of technology-based competitiveness is overwhelming; surprisingly however little is known until today (Tornikoski et al., 2017). Similarly, according to (Beckman et al., 2012) the importance of the integrative relationships among individual, organizational, and institutional factors in explaining entrepreneurial firms' performance has been highlighted. Nevertheless, many themes remain relatively unexplored especially in understanding the competitive level of young technopreneurial firms.

5. Research Methods

To choose the most suitable approach for a study, the type of questions posed by the study has to be given a thought (Morse & Richards, 2002; Shaw, 1999). As this study's questions are exploratory in nature, data collection has to be of qualitative method. It was argued by Morse and Richards (2002) that qualitative method is suitable should "the purpose is to learn from the participants in a setting or process the way they experience it, the meaning they put on it, and how they interpret what they experience " (p. 28). In addition, Snell and Lau (1994) stated that "the practical advantage of such research (qualitative) is that it can avoid the dangers of imposing inappropriate 'solutions' borrowed from larger organizations in the West" (p. 4).

The sample of study was selected based on purposive sampling based on the following inclusionary criteria:

a) Firms must be operating within 5 years or less

b) Firms that are involved in hard sciences or with technological products/processes but not applications or websites.

Altogether eighteen entrepreneurs who operated young technopreneurial firms had participated in a series of semi-structured interviews from May to August 2018. An interview protocol had been established before the interviews were conducted. This will guide and ensure uniformity during the interview sessions (Appendix A). The profile of the respondents is depicted in Table 1 below.

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Table 01. Respondents' profile

Respondent	Gender	Age	Education level	Business Type/Sector	Years of the Company	No of employees
#1	Female	31	Master's in biology	Research and Development Service (Botanical products - Pharmaceutical and Cosmetics)	5 years	4
#2	Female	31	Degree in Biology	Food based powder (Green Banana Flour-Gluten free)	5 years	5
#3	Female	30	Degree in Biotechnology	Manufacturing & Services (Tissue Culture)	5 years	4
#4	Female	31	Degree in Engineering	Foods and Beverages (Halal-based Diet Chocolate)	2 years	5
#5	Male	36	BSc. Biotechnology	Waste Water Treatment Technology	3 years	2
#6	Female	31	Bachelor's degree	Engro-based technology (liquid-based mushroom)	4 years	2
#7	Male	30	Bachelor's degree	Technology-based Leather Design an Production	4 years	2
#8	Male	41	Diploma	Manufacturing & Services (Go Green stationery and printing)	3 years	3
#9	Male	37	Bachelor of Engineering	Engineering-based technology	2 years	6
#10	Male	35	Degree	High-tech 3D Printing	4 years	3
#11	Female	37	Master's in technology management	Technology Design	4 years	7
#12	Male	35	Degree in Business and Commerce	Food Technology	3 years	3
#13	Male	30	Diploma	Palm Oil Biomass	5 years	1
#14	Male	21	Diploma	Organic Mushroom	< 1 year	2
#15	Male	37	MBA	Plastic Industry	5 years	10
#16	Male	25	Degree in Business	Water technology	3 years	4
#17	Male	41	Bachelor's degree	Technology based-wood craving	5 years	8
#18	Female	34	Degree	Agri-technology (chilies and leave vegetables)	5 years	23

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6. Findings

Based on the thematic analysis conducted on the transcribed interviews, several domains of Enablers and Inhibitors were extracted. They were then clustered into 3 different segments, (1) Individual Factors (2) Organizational Factors and (3) Institutional Factors. The themes were clustered based on the following domains:

Enablers: factors that facilitate the development and growth of young technopreneurial firms (Table 02).

Table 02. Domains of enablers, descriptions and selected excerpts

No	Enabler Domains	Description	Illustrations (Selected Excerpt)
	Individual Factor		
1.	**Entrepreneurial Orientation** Definition: A construct encompassing three aspects, i.e. innovative, pro-active and taking risk (Rauch et al., 2009).	• Proactive – to generate ideas, to strategize in ensuring continuous demand stream from the market and to meet customers' needs and demands • Innovativeness - initiates new services/products as well as strategies; thinking out of the box in exploration and exploitation of new products/services • Take risk- takes strong actions where unfamiliar areas are explored despite the lack/limited experience in business	*"As our products are still new in Malaysia, we have to be proactive in looking for ways to maintain the product quality and to serve our customers" (#2)* *"Owning a business, you have to be proactive all the time, plan forward, explore new ideas. I am active in social media to get ideas for my product" (#7)* *"In this industry I must be efficient, I always look forward and grab the opportunity without thinking too much of the risks. (#15)*
2	**Entrepreneurial Strategy** Definition: Actions taken that change and shape the business operations, which include the exploration of innovative and creative strategies in anticipation of current and future demand (Hakala, 2015)	• Adopts pioneering strategy – the first company to set a standard for botanical products. • Exploration of new services - starts new business with R & D lab for pharmaceutical and cosmetic because not all companies have research lab. • Competes with competitors in terms of offering various range of products unavailable in	*"This product is available in the Philippines and some other countries such as the US. However, in Malaysia, this is the first of its kind" (#2)* *"Right now, I'm the first to introduce healthy chocolate and 3D museum. Customers can learn the process of making chocolate, have a visit to our avatar theme garden and purchase healthy chocolate at a cheaper price" (#4)*

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		the market and speeds up the process of product • Competitive pricing strategy- price based on market trends • Making a difference in terms of product quality and service – value proposition. • Price and service strategy-cheaper price and good service • Promotion strategy- promote in social media, schools and universities • On the lookout of current market trend- always be on track • Pursue Global Strategy – penetrates global market	*"I do a lot of sampling as well as testing of our patties by the customers and improve our recipe from their comments. I have my own technology to test the quality of the ingredients for my products" (#12)* *"In Malaysia this industry is very aggressive and intensely competitive. My strategy is increase production and go global. I am not focusing only on Malaysian market but also global market" (#17)*
3	**Entrepreneurial Bricolage** Definition: The capability of entrepreneurs of innovating, adapting, and recombining current or accessible resources like human resources and raw input for the creation or capturing of opportunity or resolving issues (Baker & Nelson, 2005).	• ability in finding workable solution by using technology given the various constraints • responds to a new problem or opportunity by using previous experience	*Despite the many constraints, I managed to do well. No more traditional ways of doing things. I can increase production and sell to the market more frequently" (#6)* *"In business we will face various problems, but you need to look at them from the positive side. Based on my experience I can deal with the problems and turn them into opportunities faster than competitors" (#9)*
	Organisational Factor		
4	**Structural Capital** Definition: Processes and procedures that are created and stored in an organization's system that enhances the knowledge through the organization (Isaac et al., 2010).	• Develops new procedure and process to test products • Develops new standards to be adopted by the industry. • Has the procedures to develop its unique capabilities • Availability of company's information system that helps employees to perform their jobs.	*"In this industry, I am amongst the first to introduce the new standards for botanical products. That's one of my strengths." (#1)* *"My employees and I often share ideas on product management and how to improve product quality and reduce cost. We translate the ideas into procedures that can be shared by everyone in the company" (#2)*

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			I provide training to staff on certain procedures. However, the staff in R&D is more knowledgeable regarding the green ingredients. We always share the knowledge in terms of improving the business" (#12)
5	**Human Resources** Definition: The combination of capability, knowledge, ability as well as experience that are strategic renewal and innovation source of a firm (Bontis, 1998)	• Technically competent and skillful employees • Experienced employees	*"My employees are innovative and skillful. I hire those with some working experience" (#17)*
6	**Social Capital/ Networking** Definition: Relationships that are not only limited to internal knowledge among employees, but also extend to linkages with customers, suppliers, alliance partners and the like (Youndt et al., 2004).	• Good relationships with customers • Establishes trusting relationship with suppliers • Maintains stream of loyal customers • Good relationship with local authorities • Builds networking with other entrepreneurs • Networking- attends and participates in seminars and workshops	*"I always attend exhibition and business programmed. Apart from enhancing my business knowledge, I am able to build my networking" (#5)* *"I have a very good relationship with my suppliers, which makes it easy when it comes to negotiating the terms and cost of the supply. We trust each other" (#17)*
7	**Technology capability** Definition: The ability of a firm to generate business values by employing its technology resources and know-how (Chae et al., 2018) including technology driven production systems and techniques.	• Leverages on up-to-date technology to develop more efficient work processes. • owns the technology and as well as expertise in utilizing the technology	*People around me think that ago business will not go far. But I prove them wrong. With the technology that I am using, I can produce in large quantities and I earn more than expected. What I can say, don't be scared to try, you will never know what will happen next!" (#18)*
8	**Business agility** Definition: The capability of achieving agility in operation through the improvement in competitive	• Responsive to customer needs by monitoring market trends • able to renew, adapt and change quickly in a	*"In technology-based industry, you must move fast, you have to adapt and change quickly because the environment is very dynamic. That is why we need to*

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	advantage that is time sensitive such as being responsive and adapting to customers' demand (Shin et al., 2015)	rapidly changing environment • offer	*upgrade our technology" (#3)* *"My nature of business is unique…I transformed waste to wealth through biotechnology. I update my knowledge to keep abreast with the new development and to stay ahead in business competition" (#13)* *"Evolution is normal, you can't avoid it. I am always on the lookout for the market trends. I always stay ahead to ensure that I sustain in the long run" (#13)* *"I have my own target. I will do changes and redesign my products even though it's very tough, otherwise I can't sustain" (#17)*
	Institutional Factor		
9	**Institutional/Government Agencies Support** Definition: All forms of assistance and support mechanism made available to the firms.	• Technology support • Machines and Equipment • Financial support • Training and Coaching • Market accessibility and promotional support – awareness about products • Research and Development support • Technical Advices	*"We are thankful to Agency A and B for the technology and financial support"* *"Initial training provided by Agency C and A gives us many early exposures regarding this technology"* *"Trainings provided by Agency D, Agency E, and Agency F really help new technopreneurs to gain knowledge in running a business"* *"Agency A assists us by organizing events to introduce our products to the market. This is really helpful"* *"Agency G provides coaching and training assistance to us; and that really helps given that we are lacking in terms of business skills."*

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			"Agency H opens up a lot of opportunities for us to get access to the market." *"Agency, I organized trainings for technopreneurs development programme for young entrepreneurs like me. We learn how to run business and how to deal with challenges"* *"I attended various trainings organized by the local universities on the use of technology and how to improve productivity with technology as well as R&D support".* *"there are other institutions and government support to my business by showcasing my products in business events and exhibitions. It really helps my company. It enables the company to grow further"*

6.1. Discussion

The present study that involves a series of interviews conducted among technopreneurs has managed to extract several important insights into the enabling factors that facilitate the development and growth of young technopreneurial firms. The Enablers include several domains that relate to the Individual Factors, Organizational Factors and Institutional Factors.

In the quest to obtain information related to the experience of young technopreneurial firms in dealing with day-to-day challenges as well as the challenges to grow their businesses, majority of them highlighted on the importance of the followings:

a) possessing entrepreneurial skills and competencies (individual factor),

b) enhancing organizational capabilities and competitiveness (organizational factor),

c) obtaining support and assistance from relevant agencies and networks (institutional factor), and

d) the effect of environmental factors (i.e., the rapid growth in technology especially in the era of Industry 4.0)

It can therefore be surmised that, the interactions among all these actors (Individual, organizational and institutional factors) as well as the systemic integration among Individual-Organizational-Institutional nexus are important to ensure that technopreneurship agenda in Malaysia achieved its intended objectives.

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7. Conclusion

In conclusion, the present study has unearthed important insights into the factors that could facilitate as well as hinder the development and growth of young technopreneurial firms. Notably, the findings demonstrate the importance of systemic integration among actors within the entrepreneurial ecosystems which include the (1) entrepreneurs themselves, (2) the resources and capabilities of the firms, (3) the intervention and support mechanism from relevant agencies and institutions as well as (4) the business environment. The identification of issues and challenges within this technopreneurial ecosystem in the context of Malaysia is hoped to serve as a basis for better formulation of policies and strategies to spur the development and success of technopreneurship agenda in Malaysia. The study will investigate the prevalence of these factors in the context of larger population of technopreneurs in Malaysia to enable generalization to be made in the context of Malaysian technopreneurship.

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