

EMPOWERING THE MUSLIM UMMAH THROUGH TECHNOLOGICAL INNOVATION

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ABSTRACT

Technological innovation is one of the most important key ingredients for the prosperity of most companies in this world. These companies in turn will generate profits that will contribute towards the prosperity of their nations. Nations with companies that are able to conform to this model are most likely to be strong economically and have a dominant voice in the international platform. Solidarity of these nations within the international platform will be most likely resulted in an unchallenged voice. The other important reason to embrace technological innovation, aside from becoming relevant in the world economic scene, is that it will enable us to be "product owner". This paper discusses the issues related to technological innovation in the context of the Islamic countries. Islamic perspective on technological innovation, the influencing factors and challenges on technological innovation are elaborated. The case of Malaysia being a Muslim nation aspiring to become an industrialized country is discussed with respect to the technological innovation efforts. Data from studies carried out by the authors on technological innovation is used as evidence to show that the challenges facing the Muslim Ummah to be more innovative are both internally and externally driven.

Key words: *Technological Innovation, Muslim Ummah, Islamic Countries, Industrialized Country*

INTRODUCTION

This paper is to discuss the importance, current status, prospects and challenges of technological innovation among the Muslim Ummah. The technological innovation discussed in this paper is not the kind of innovation mentioned in the hadith: "Indeed the best speech is the Book of Allah and the best guidance is the guidance brought by Muhammad ﷺ". The most evil of matters is the innovated one. Every innovation is bid'ah. Every bid'ah is misguidance, and every misguidance is in the Fire." Perhaps the issues of technological innovation will be discussed in the light of a few verses of the Quran and the spirit of another hadith, "Rasullah s.a.w prohibited a sahabah who was trying to perform manual pollination between date trees. The sahabah then said that he has been performing that procedure before and resulted in better harvest. Hearing this explanation, Rasullalah s.a.w told the sahabah to continue with what he was doing and that he knows better with respect to his worldly vocation." This hadith indicates that "technological innovation" on the worldly activity is allowed for the betterment of one's life. Indeed it is within the context of fulfilling the responsibility as the vicegerent of God on this earth that technological innovation will be elaborated. It is the duty of the Muslim engineers and scientists to play a more coherent role in inculcating the creative and innovative capability of the ummah. Once creativity and technological innovativeness become part and parcel of our culture, then only we can garner the potential strength of human and natural resources into a more purposeful effort to sustain the survival of the ummah.

The state of economy of the Islamic countries is not very encouraging. As generally can be observed, the degree of influence and presence of a nation in today's world is largely based on its economic strength. Islamic countries neither possess the influence nor establishing the significant presence in the eyes of international community. This is not surprising if, for example, we look at the data published by the World Bank that indicates that in 2002 none of the Islamic countries qualified to be one of the twenty richest countries in the world. Most of the countries listed were the industrialized countries, and industrialization is having to do with the "the organized action of making of goods and services for sale" [1]. This definition is aligned with "innovation", inferring that one of the ingredients to be one of the world economic powers is to embrace technological innovation.

TECHNOLOGICAL INNOVATION

By definition technology is the assembly of hardware and software means and tools used by human beings to achieve socio-economic goals. Technology refers to ways in which people use discoveries to satisfy needs and desires and to alter the environment to improve their lives.

Innovation is derived from Latin word “novus”, which means new. The Oxford dictionary definition of innovation is to “bring in novelties, make changes”. Researchers and academicians in this field associated two characteristics that must exist in innovation, novelty and adoption. Novelty does not mean “new”. Newness with respect to lapse of time since its discovery, is not important in innovation. Novelty here means the perceived newness of the idea by the individual [2]. Even the implementation of invention that were made elsewhere can be considered as innovation [3]. The second component of innovation is adoption. Adoption is the difference between invention and innovation. An invention is a solution to a problem; an innovation is the commercially successful use of the solution [4].

Technological innovation may take the form of product changes, process changes or improvements of manufacturing process. Technological innovations are concerned with the use of scientific knowledge for the creation and implementation of new technologies. These can be translated in the form of radical introduction of new product to the market, improvement of product features or improvement of the manufacturing processes.

Further classification of product innovation can be identified as the following:

1. Radical innovation- a product or a service providing entirely new features and benefits to customers- e.g., the first pocket radio, the first audio CD player.
2. Platform innovation- a product or service providing a large number of customer improvement and significant changes on either manufacturing process dimension or product dimension or both- e.g., Pentium microprocessor chip.
3. Incremental innovation- product or service that provide only a few customer improvements and involve relatively minor changes in the product offering. This type of innovation ranges from cost reduction version of existing product to add-ons or enhancement to an existing production process.

TECHNOLOGICAL INNOVATION FROM ISLAMIC PERSPECTIVE

Islam condones and encourages technological innovation. Many verses in Al-Quran support this statement. In Surah Ar-Ra'd, Chapter 13 verse 11 “... Allah does not change the condition of a people until they change their own condition ...” Clearly Allah asks us to put an effort to change our life. Many prominent Islamic scholars use this as the basis of their pursuit towards new ideas and new findings. Effort must be made for a change to happen. New discoveries will not likely to happen by chance. Example of the verse that suggested technological innovation is possible and encouraged is in Surah Al-Rahman Chapter 55 verse 33 “O assembly of the jinn and the men! If you are able to pass through the regions of the heavens and the earth, then pass through; you cannot pass through but with authority”. This verse challenges us about the possibility of people traveling in space and to do that, Allah said we need authority. One of the meanings of the word ‘authority’ mentioned here had been explained by some Islamic scholars as knowledge or technology. Another example, in Chapter 34 (Surah As-Saba) verses 10 and 11: “...and We have melted the iron for Daud. Make armoury out of it”; and in Chapter 57 (Surah Al-Hadid) verse 25: “...And We have made available iron, to gain great strength and other benefits for mankind”. In the last verse, Allah has put challenges to mankind in the development of methods and techniques of extracting iron from its ores, and further refinement and modification of the metal for other useful purposes.

Islam does not regard creativity and hard work as alien to its teachings. On the contrary, as ‘a way of life’ economic activity is part and parcel of the spectrum of activities of an individual Muslim and the Ummah. In this regard, economic prosperity holds the key towards success in this world and opens up opportunities for Muslims to reap the bounties in the Hereafter. Allah has reminded mankind not to neglect our well-being in this world while at the same time working for the Hereafter, as mentioned in Chapter 28 (Surah Al-Qasas) verse 77: “And seek, by means of that which God has given you, to attain the abode of the Hereafter and do not forget your share in this world.” This is further reiterated in verse 10 of Chapter 62 (Surah Al-Jumu'ah) when Allah says: “Then when the prayers have ended, disperse and go your ways in quest of God’s bounty. Remember God always, so that you may prosper.” These verses indicate that Islam places great importance on both this world and the Hereafter. Muslims are encouraged to pursue economic activities so that they may prosper. With

economic strength, the cause of Islam can be better facilitated and achieved. History has shown that many of the sahabah had been great entrepreneurs and businessmen.

THE CURRENT STATE OF TECHNOLOGICAL INNOVATION OF THE MUSLIM UMMAH – THE CASE OF MALAYSIA

Although there are prominent Muslim scientists and technologists scattered around the globe, it is generally accepted that the level of achievements of the Muslim nations in science and technology is still low. In the case of Malaysia for example, where the economic and industrial achievements are well ahead of other Muslim countries, the country is still far behind the more industrialized economies in terms of innovativeness, as shown in Table 1[5]. The effects of this phenomenon are currently being felt, where as a result of a relatively low level of indigenous product ownership, the country is feeling the impact of the multinational companies involved in the manufacturing of components moving their operations to the more economical cheaper regions such as China. Efforts are now being taken to move the country's industry from being a component supplier towards a knowledge intensive industry where more local products are generated.

Table 1. Level of Basic Competencies [5]

	Commodity supplier	Component supplier	Systems supplier	Product innovation
UK	2	4	3	3
Germany	0	2	5	4
USA	2	4	4	4
Japan	0	2	5	5
Malaysia	4	5	3	1

Note: 5 = most important; 1 = least important

Further evidence of the huge technological gap between the Muslim nations and the rest of the world can be seen in Tables 2 and 3 [6]. The tables compare Malaysia with a few selected countries in terms of the ratio of Gross Expenditure on R&D to the Gross National Product and the number of R&D personnel per 10,000 work force.

Table 2. Ratio of Gross Expenditure on R&D to the Gross National Product [6]

Country	GERD/GNP ratio
Indonesia (1995)	0.20
Philippines (1997)	0.22
Malaysia (2000)	0.50
India (1996)	0.66
China (2000)	1.00
Australia (1996)	1.68
UK (1998)	1.83
Singapore (2000)	1.89
Taiwan (1999)	2.05
Germany (1999)	2.38
South Korea (1998)	2.55
US (1999)	2.65
Japan (1999)	2.80
Finland (1998)	2.92

Table 3. Number of R&D personnel per 10,000 work force [6]

Country	No. of researchers per 10,000 work force
Indonesia (1991)	3.0
Philippines (1991)	3.0
Thailand (1991)	5.0
Malaysia (2000)	15.6
South Korea (1998)	60.0
US (1999)	74.0
Singapore (2000)	83.5
UK (1995)	95.0
Australia (1998)	99.0
Germany (1998)	116.0
Japan (1999)	136.0

Since technological innovations are driven by achievements in research and development, the challenges for Muslim countries like Malaysia are to enhance the R&D activities and promote innovativeness and creativity in the society.

In the context of the Malaysian economy, technological innovation is seen as a means of providing technology deepening in the form of higher local value-added content of production. Studies in innovation and new product development activities are recent phenomena. This is not surprising considering the nature of economic activity that was strongly based on agriculture commodities prior to the 1980's. In an effort to improve the situation, various policies and strategies have been formulated. The Industrial Master Plan I outlined a strategy for sustained and viable industrialisation of the country. The plan represents a watershed in the structural shift of the country's economy from one dependent upon agriculture and primary products to one in which the manufacturing sector plays a much greater role. The Industrial Master Plan was later followed by the National Plan of Action for Industrial Technology Development. The five strategic thrusts proposed by the Plan that will enhance technological innovations are [7]:

1. Providing leadership that strengthens the institutional and support infrastructure for Industrial Technology Development.
2. Ensuring widespread diffusion and application of technology, leading to an enhanced market-driven R&D to adapt and to improve technologies.
3. Building competence for specialisation in key emerging technologies.
4. Strengthening institutions and mechanisms for continual development and elevation of the technical proficiency of the human resource base.
5. Elevating awareness and appreciation for science and technology, hence providing the most favourable climate possible for invention, innovation, and technological advancement.

Thus the last twenty years have seen tremendous achievement in the adoption, adaptation and improvement of the imported technology. At the same time innovative efforts have been channeled towards promoting the development of indigenous technology. However, sustained and competitive industrial technology development cannot be ensured solely on process improvement. More resources need to be allocated in developing new products, especial among the local companies. Further emphasis on technological innovation was evident with the publication of the Industrial Master Plan II (IMP2) that emphasized strategic linkages between the production activity with the upstream and downstream activities. Coined as Manufacturing Plus Plus strategy, it calls for a shift from assembly-intensive manufacturing to integrated industry clusters embracing product development, design and distribution [8].

TECHNOLOGICAL INNOVATION STUDIES

The following account of the studies carried out by the authors is intended to provide useful insights into the nature and characteristics of technological innovation.

Study #1

The first study looked at new product development (NPD) which is a form of technological innovation. The study involved a sample of forty-three companies involved in the manufacturing of plastic (27 companies) and telecommunication (16 companies) products [9]. Telecommunication industry had been selected as it is an industry that is fast expanding in Malaysia. In fact telecommunication has been chosen as one of the clusters in the Second Industrial Master Plan. The plastics industry on the other hand provides a significant support in terms of the production of molded parts for telecommunication products. Data for the study was solicited by the use of questionnaire survey. A firm is considered as having carried out a new product development project if it has performed any one or more of the types of product developments mentioned earlier in the paper in the last five years. The research questions addressed in the study were: (1) the motivations for companies to undertake new product development projects, (2) the type of new product development undertaken, (3) the factors that influence the performance of the NPD project, and (4) the problems associated with NPD.

Some of the more pertinent results in the form of descriptive statistics are presented. The results are aggregated, without distinguishing the two types of industry as the objective of this paper is only to show trends in NPD activities.

Types of product developed

Table 4 shows the distribution of the type of products developed by the respondents. Some of the companies may have developed more than one type of product at any one time.

Table 4: Types of product development

Types of products	Percentage of Respondents
Improved product	56 %
New to firm	53 %
New to market	35 %
New to the world	19 %

Reasons for NPD initiatives

Table 5 shows some of the reasons why the sample companies undertook NPD activities with some companies citing more than one reasons. The reasons have been ranked according to the degree of importance indicated.

Table 5: Reasons for involvement in NPD projects, ranked

Reasons For NPD	Degree of importance
Fulfill customer's orders	1
Use existing technology	2
Try new market	3
Compete in the present market	4
R&D outcomes	5

Allocation of Funds

The respondents were asked to indicate the extent of their NPD efforts, in terms of the funds allocated as percentages of the annual budget. This is shown in Table 6.

Table 6: Allocation of Fund.

Products:	Percentage of Respondents
None	9 %
0 – 10 %	56 %
11 – 20 %	21 %
21 – 30 %	12 %
> 30 %	2 %

Factors influencing the success of NPD:

Table 7 provides the ranking of the factors, from 1 being the most cited by the respondents as important and 13 the least factor that influences new product development.

Table 7: Factors for successful NPD projects

Factors	Ranking
Clear product strategy	1
Technical capability of the company	2
Technical capability of the staff	3
Product fulfill customer's need	4
Good planning and control system	5
Allocation of funds	6
Leadership style	7
In-depth market study	8
Understanding of competitor's product	9
Supplier's comment	10
Inter-departmental cooperation	11
Supportive government policy	12
Top management support	13

Problems Associated With NPD

Typical problems faced by the local companies during NPD process are shown in Table 8. Again the respondents were asked to rank the degree of importance of each factor.

Table 8: Problems faced During NPD

Problems of NPD	Degree of Importance
Inadequate support from consultants	1
Government regulations	1
National economic downturn	2
Competitor's dominance	3
Insufficient fund	4
Lack of support from top management	5
Inexperience project leader	5
Lack of market information	6
Lack of skilled staff	7

Study #2

This study investigated the front-end of New Product Development Methodology, namely the strategic planning and the idea generation process [10]. Part of the study is to identify the characteristic of the companies that become successful through technological innovation and the product innovation classification pursued by these successful companies. Secondary data from Thackara [11] was used in the initial phase of this study. Thirty companies that had been successful through product innovation were selected. These companies grew by an

average of 21 percent per annum and the employment levels increased by almost 160 percent during a recession period (early 1990s) when the number of jobs in the economy fell. When compared to companies that suffered during the recession, the difference was on the strategy that they had adopted. The successful companies were emphasizing on the product differentiation. This is in contrast to the strategies pursued by most companies that suffered during the recession where the emphasis was the cost leadership. Success through product differentiation can only be achieved through innovation.

Background of the Companies

Fifteen of these companies are classified as Small and Medium Enterprise (SME) and the other 15 companies are classified as large companies per European Union (EU) definition. EU definition of SME companies are those that have less than 250 workers and revenue of less than 40 million EUC or maximum balance sheet total of less than 27 million EUC. Revenue range of these companies is between 180 millions EUC to 0.8 millions and the product manufactured by them ranges from as simple as baby bottles to as complex as robotics.

Type of product innovation pursued

Figure 1 shows the classification of the products owned by the 30 companies. Six of the products are classified as radical innovation, fourteen products falls under platform innovation category, and the other ten products fall within incremental innovation categories.

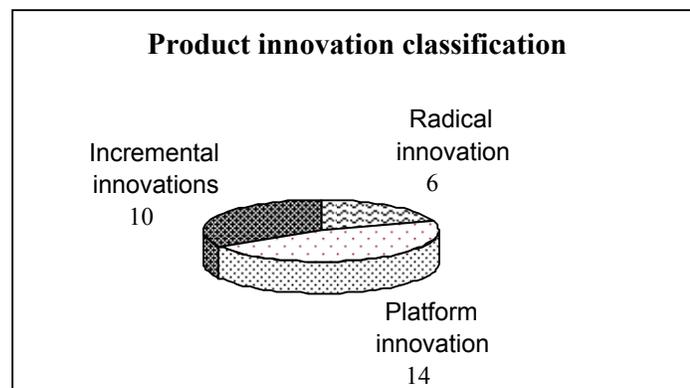


Figure 1: Product classification of the benchmarked companies

Innovative companies - SMEs and Large Companies

Further categorization of these data with respect to the size of the companies is reflected in Figure 2. The data indicates that there is no significant influence of company size to the type of product innovation category being pursued by the companies.

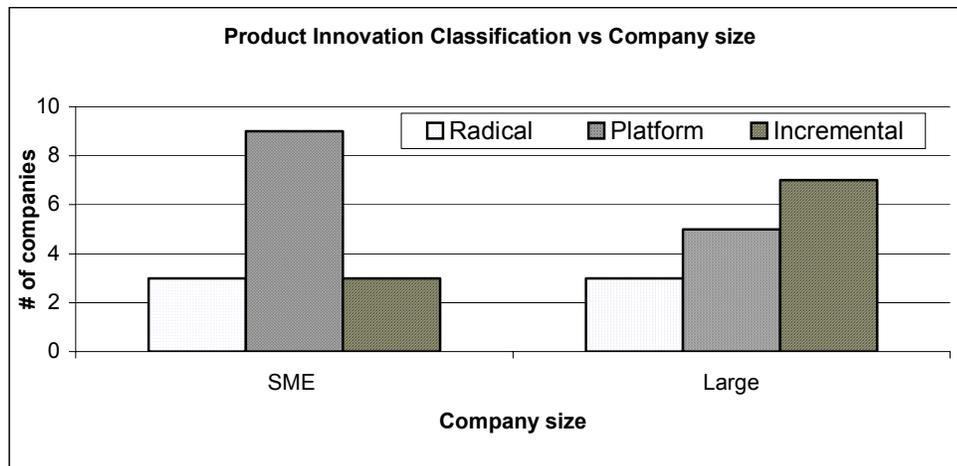


Figure 2: Size of company and type of innovation

The internal technological capabilities

In coming up with innovative product, it is pertinent for the companies to identify internal technological capabilities that will give themselves technological competitive advantage against their competitors. These technological capabilities can be in any operational areas within the company such as technical, marketing, distribution, and financial [12]. Figure 3 shows the internal technological capabilities embraced by the successful companies under this study. Some of the companies utilized more than one internal technological capabilities as their focus, but this study identifies the main one as the companies focus area.

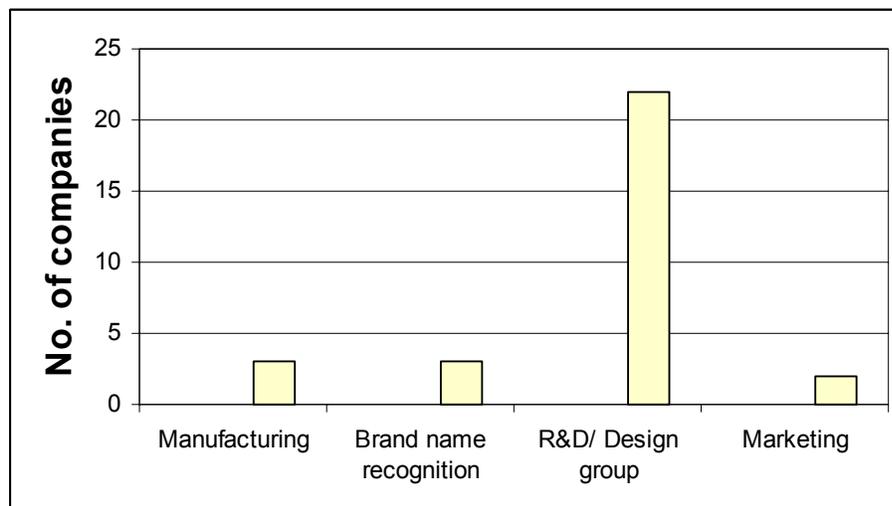


Figure 3. Internal Technological Capabilities Adopted

The three technological capabilities adopted by the companies are manufacturing, brand name recognition, R&D/ Design Group, and marketing. As reflected by the data, most of the companies adopted internal technical capabilities in the form of R&D and/or the establishment of a design group.

DISCUSSION

Study #1

Technological innovation in terms of new product development involves high risks as evident from Table 4 where the majority of the respondents shied away from being involved in a truly innovative product that is new to the market. Product improvements and introducing product that is familiar to the market appeared to be much easier to the local companies. Furthermore improved or similar products will increase the utilization of the available capacity. This is supported by the data in Table 5, where fulfilling the customer's requirements and trying out new market will not need additional investment in terms of equipment and machinery. Perhaps the rapid pace of technological change within the industrial countries has made it difficult for other less developed countries to keep up thus, making the technological gap even larger. This study has shown that the respondents' scope of technological innovation activities was limited by the available technology. It is very encouraging to note from Table 5 that the respondents are reasonably competitive by involving in the R&D work, and in trying to push their innovative efforts into the market. The type of product innovation is also very much dictated by the availability of funds, as indicated by Table 6. Table 7 provides indication that technological factors seem to play a more significant influence in the success of product innovation, as compared to the managerial factors such as leadership and the facilitation of interdepartmental cooperation. The ability to develop and market a genuinely innovative product or to continue to launch new generation of products is central to most successful and fast growing corporations. The firm must possess the technological capability to develop a superior product. The product may be better because it uses newer technology or is better designed and engineered than competing product. The new product process must marry the technical side of product design and engineering to the needs of market place to ensure that the product does indeed deliver unique features to the customer. The results also indicate that having sophisticated technologies in design and manufacturing appear to be more significant motivator for companies to develop new products.

In terms of problems in technological innovation, the external factors seem to be the major concern among the respondents, as shown in Table 8. Unfortunately these are the factors that the companies will have the least control. Hence the technological management of the companies must also consider ways of minimizing the effects of external factors on the innovation process. This is followed by parameters associated with the management of the organization. External factors such as the competitor, suppliers and government appear to be less significant in ensuring NPD success. The need for innovation normally arises from changes in the pattern of customer demand or from the activities of competitors in the market. The externally driven factors that influence decisions on innovation efforts can be divided into two groups, namely demand led innovation and competitive led innovation. The external factors include (i) desire to overcome labor shortage, (ii) desire to overcome materials shortage, and (iii) desire to meet excess demand. The internal factors include (i) demand by customers for new product types, (ii) direct pressure of competition and (iii) force from firms in other market sectors. To a certain extent firms have control over the causes of success and failures of new products. Table 8 also indicates that there is a need for continuous investment in human resource development to ensure sustainable innovations. For the technological innovation to be effective, there should be some sort of R&D function within the firm led by an experience technical personnel who understands the risk involved and also have the capacity of making decisions. A team of technically skilled personnel including those with business/marketing background must support him or her. A great amount of teamwork supplemented with communication and co-ordination skills will foster a path for successful technological innovation. This will facilitate interdepartmental coordination, open communications and high mobility of personnel across departmental boundaries.

Study #2

One of the preconceived ideas among some of the SMEs is that only large corporations can be successful in technological innovation. However the data indicated even SMEs can be successful in this field; in fact, being technologically innovated is one of the key elements for them to be more successful than their competitors that are focusing on cost competitiveness only. By focusing on product differentiation that attracts end users has resulted in the customer's willingness to pay premium price for their products [11]. Despite the greater availability of resources in larger corporations, corporate size has been found to be inversely correlate to growth through innovation due to genetic conservatism and learning deficiency [12].

Another preconceived idea is that successful product innovation must be a radical product innovation, product with totally new features and benefits. Data from the study indicated that out of the thirty companies, only six were focusing on radical innovation. The rest of the companies were either focusing on incremental or platform innovations. All these companies identified and capitalized their internal technological strength that gives them

the edge over their competitor. These technological advantages encompassed not only “lab work”. Marketing, production, brand name recognition had also been found to contribute towards technological advantages [13]. Successful product innovation is not only about invention, but also commercialization.

With regards to the SME’s ability to get involve and be successful in radical product innovation activities, the data indicated that equal number of successful companies, SMEs and large companies pursued radical product innovation. This data indicated that the notion, that only large company companies are able to have a research and development group, is not true. Further investigation on these companies also indicated that all the companies involved in radical product innovation do have a strong technical group doing research and development (R&D). Inference that can be made is that for radical innovation, the company needs internal technological strength in the area of technical R&D group. To prove a point that even with incremental product innovation, a company can be successful; the data indicated ten out of the thirty companies pursued incremental innovation. And surprisingly, seven large companies pursue incremental innovation compare to only three SMEs.

This study has indicated that to be technologically innovated company, the company does not have to be a major corporation. In fact SME can be more successful in doing it and even in the area of radical product innovation. These findings are significant in that they should provide some useful pointers to the small and medium size manufacturing firms in the emerging economies of the Islamic countries to emulate.

WHAT ARE THE ISSUES/CHALLENGES?

What are the options for the Ummah? Or is there any option? Deliberations on what need to be done by the Ummah have been done on other platforms, and their detailed discussion is not covered under the scope of this paper. It sufficient to list what other authors have said about the subject. Kunio [14] for example, under a Chapter on “What do Asian countries need to do?” outlines these issues: economic development as a necessity, making democracy work, educating the masses for economic empowerment, educating the masses to create a national community, and nurturing a national economic base. Although the argument put forward by Kunio is biased towards promoting the Japanese model in facing globalization, yet they are relevant for consideration by the Muslim countries. In facing the global challenges, the importance of education and training of Muslim engineers and scientists have been deliberated, for example in Abdul Aziz et. Al [15]. Tasmini [16] outlined the following factors to solve Muslim World’s Technological Problem: referring to the Holy Quran, referring to the Hadith and Sunnah, referring to the historical background, high priority of wealthy Islamic culture over national culture, compatibility between national and Islamic aims, self-reliant, providing conducive atmosphere to scientific and technological talents, proper management of resources of science and technology for sustainable development, ensuring proper balance between Islamic culture and technology, ensuring independency of Muslim countries, scientists and scholars must be treated with respect and consideration and scientific international relation among the Muslim countries. There should be efforts by the Muslim scholars, scientists, engineers and technologists to increase cooperation and collaboration in research and development. The current platforms can be used to initiate these efforts. An example in this case is the formation of the Standing Committee on Invention and Development under the auspices of the Federation of Engineering Institutions of Islamic Countries.

CONCLUSIONS

Technological innovation is the necessary step to ensure the emerging economies of the Islamic countries from being over-dependent on other advanced nations. The internal organizational factors will determine the nature of technological innovation that will be more suitable to be undertaken. There must be serious and concerted efforts by the Muslim engineers and scientists to enhance the culture of entrepreneurial activity for successful technological innovation. Institutions within the Muslim nation such as the government agencies, government research institutes and the universities play an important role in developing programs on innovativeness and entrepreneurship especially in the manufacturing sectors.

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