Towards Assessment of Innovation in SMEs with Decision Analysis Concepts

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Abstract

We propose a Commercialization Model incorporating decision analysis where the value created by the owner/s of the SME is subjected for assessment from different angles. This assessment includes the feasibility study, which considers all the uncertainties surrounding SME sustainability. These uncertainties involve uncertainties at the development phase of the business idea. Many SMEs in Oman face uncertain demand for example and the feasibility study conducted at the early phase of the business does not do simulation or scenario analysis. We suggest the use of the Decision Analysis (DA) science in Engineering to help the SMEs study their market carefully and take calculated risk. The application of the field Decision Analysis fits very well and yet helps them make "good" decision. The current feasibility study for example used by Riyada-Public Authority for SME Development is static and never perform sensitivity analysis for the SME owner. According to the Central Bank of Oman (CBO), one critical challenge faced by SMEs in Oman include high costs of conducting professional feasibility studies which may be the case in other part of the world. In brief, we are going to develop a decision analysis assistive tool that is going to give a decision quality score at each stage of the innovation process.

Keywords
Innovation, SME sustainability, Decision Analysis.

1. Rationale and Motivation

Innovation and entrepreneurship are critical elements in diversification of economy worldwide and the engines for economic growth and job creation. The role of innovation in SMEs creation and sustainability is critical. SMEs depend heavily on new ideas or novel research outcome, which leads to the definition of Innovation as, is the useful exploitation of an idea. The innovation process stats in general with an idea that can be translated into product or services which has a value. The value can take different shapes such as knowledge, economic, social…etc. Innovation is viewed as an engineering process where ideas and research outputs can be seen as input entities to the process. The process output should be the number of ideas that was able to generate values. The effective process is the one that maximize the output by transforming 100% of all input ideas and business models. But in reality this is ideal because the transformation process from idea to value involve enabling factors that help create this

value. Studies show that the idea is only the seed which will never grow to be a fruitful tree if there is no enabling environment, human support, funding, and legislation. These enabling factors may vary in three dimensions: 1) local context, 2) idea category, and 3) time horizon. Local context plays a key element in the innovation process. The uniqueness of every environment makes it impossible to generalize one model for innovation because model at US for example was built. Taking the same model to another country is a challenge due to differences in eco-system, legislations, infrastructure, culture, etc. The second dimension (idea category) illustrates that different ideas need different kind of support. ITC ideas need different infrastructure and resources than material science ideas for example. The last dimension is time horizon means the right idea at the right time. For example, one might be willing to invest years in cancer research while invest few days in mobile apps or other dynamic technology. Therefore, having the right capabilities for the Omani SMEs is essential to compete in today's market and sustain itself. A survey by the Central Bank of Oman (CBO) shows that more than 70% of SME's did not receive training related to SMEs. This is very critical for sustainability of SMEs in Oman. Another important results by the CBO survey indicates that 56% of SMEs firms were under a self-funded system or family support and only 13% borrowed from banks and financial institutions. The lack of financing is considered as one of the main challenges facing SMEs in Oman. This can be due to the duration of loan approval, interest rate and the risk associated with these startup firms. The proposed commercialization model would help both SMEs firm, banks and other lending institutions and funds to measure and explore the risk and opportunities associated with SMEs in Oman. This will help them to sustain their business operation and compete in the market. The research will produce an innovative decision analysis tool for commercialization that is ease to use to assess all uncertainties and help the decision maker to make a" good" decision. This tool will be available to the Omani SMEs to conduct feasibility study of the innovative idea before they burn their resources. The tool will validate the total innovation value as the total expected sum of the values at the development phase, intellectual property phase, and the commercialization phase.

We propose a Commercialization Model where the value created by the owner/s of the SME is subjected for assessment from different angles. This assessment includes the feasibility study which considers all the uncertainties surrounding SME sustainability. These uncertainties involve uncertainties at the development phase of the business idea. Many SMEs in Oman face uncertain demand for example and the feasibility study conducted at the early phase of the business does not do simulation or scenario analysis. We suggest the use of the Decision Analysis (DA) science in Engineering to help the SMEs study their market carefully and take calculated risk. The application of the field Decision Analysis fits very well and yet helps them make "good" decision. The current feasibility study for example used by Riyada-Public Authority for SME Development is static and

never perform sensitivity analysis for the SME owner. According to the CBO, one critical challenge faced by SMEs in Oman include high costs of conducting professional feasibility studies. In addition, many of these SMEs which depend on personal cost never conduct a feasibility study which is supposed to help them make the decision to "go" or "no go" with their business. SME is a great application area for decision analysis (DA) due to the lack of economical evaluation, uncertainties are not addressed properly, and no notion of expected utility when evaluating innovative projects. Many SMEs unfortunately follow the stimulus or having escalating commitment due to sunk cost. The normative approach consists of the three decision bases: (1) alternatives, (2) preferences, and (3) information.

2. Innovation Decisions and Uncertainties

Innovation is the useful exploitation of an idea. The value of an innovation can take different shapes such as knowledge-based, economic-based, social-based or many others. The common theme in all innovation is that it has create a positive shift in usefulness and utility.

The innovation process starts in general with an idea that can be translated into products or services which has value to a user. Innovation may be viewed as an engineering process where ideas and

research outputs can be seen as input entities to the process. The process output should be the number of ideas that was able to generate values. The effective process is the one that maximize the output by transforming 100% of all input ideas and business models. But in reality, the transformation process from idea-to-value must involve enabling factors that help create this value. The figure below show that the idea is only the seed which will never grow to be a fruitful tree if there is no enabling environment, human support, funding, and legislation. These enabling factors may vary along three dimensions: 1) local context, 2) idea category, and 3) time horizon. Local context plays a key element in the innovation process. The uniqueness of every environment makes it impossible to generalize one particular model of innovation because model at US for example was built. Taking the same model to another country is a challenge due to differences in eco-system, legislations, infrastructure, culture, and potentially other factors. The second dimension (idea category) suggests that different ideas need different kind of support. ITC ideas need different infrastructure and resources than material science ideas, for example. The last dimension is time horizon means the right idea at the right time. For example, one might be willing to invest years in cancer research while invest few days in mobile apps or other dynamic technology. However, there may be some transferable principles or methods that work independent of the particular types of technologies or applications.

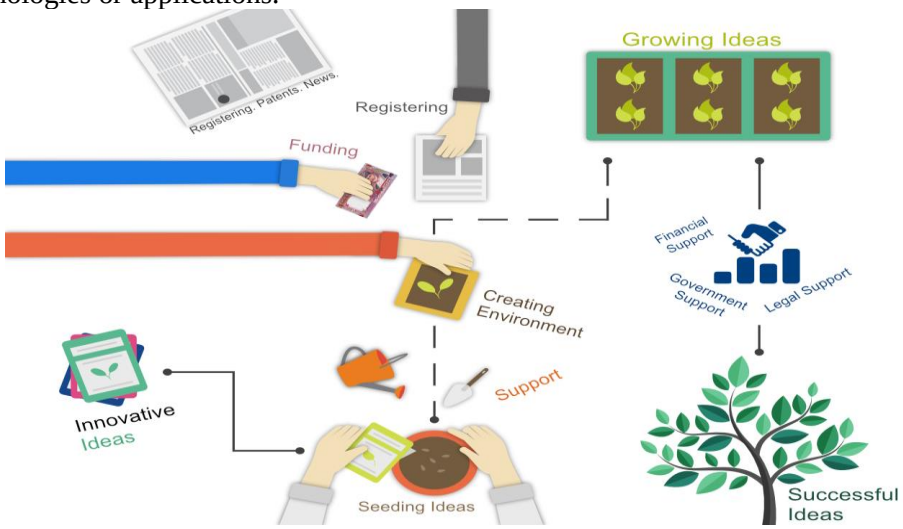

Figure 1: Innovations Enablers

The process-diagram (P-diagram) in the following figure explains the role of each of these enabling factors in the innovation process.

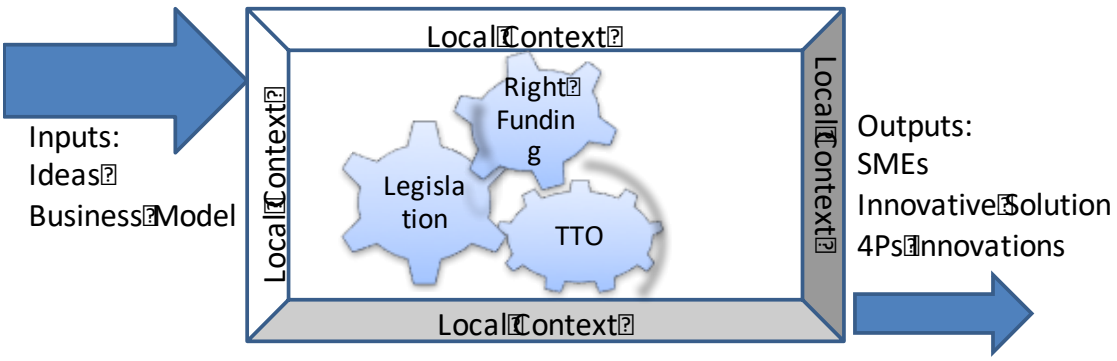

Figure 2: Innovation P-diagram.

Intuitively having more ideas (inputs) into your system will maximize the expected output or the surviving ideas. Therefore, one crucial element in any innovation process is the number of input to the system and that is why they always say "Crazy ideas are all welcomed". These "crazy" ideas may not proceed to the next step and yet they will be filtered out immediately. Moreover, the interrelationships between the numbers of inputs are the process makes it essential to design "best innovation" model for unique environment that takes into considerations the types of inputs, types of outputs, and "process gearing" factors that translate the inputs to valid outputs. Typically, the time taken to translate an idea into product or services is a dependent variable on the idea maturity level, level of market readiness, level of funding, availability of IP legislations, etc. Each of these independent variables have several layers within themselves. Moreover, the self-motivation and creative thinking of individuals, universities, and companies will drive the process for transforming ideas to useful values. However, this motivation decline by time spent in this process and as a result of market's change and the pace of innovation, the idea value may decline as well.

For Planning the process of innovation and developing a successful innovation model, we propose to measure it based on the number and value of outputs. We plan to create a model that can help reduce the amount of the resources that might be spent to create this value. Thus, the innovator (individual, universities, companies) will have a decision tool for the assessment of the innovation process. For example, a faculty member may provide a research proposal where the stated value is to create novel methodology that can be patented and later licensed and requested a fund. The funder may accept the proposal and assign a chance for the risk to fail and no novel methodology is created and the maximum benefit is a publication with acknowledgment to the funder. The decision tool will assist both the faculty and the funder to make "good" decision where all alternatives are listed with the surrounding uncertainties and the preferences for the value created. Individuals may have different preferences than companies or universities. Many times technology development and funding decisions are made without any consideration of IP early in the process. This may result in an innovation with limited protect ability leading to limited opportunity for commercialization. This research will consider these factors very early in the process which will have impact the overall process. There is ample evidence of technology and innovation where IP was an afterthought. Consequently, the inventors and developers are unable to reap the full benefits of their innovations. This research will address these challenges and create a comprehensive analysis and decision-support tool. The tool that we propose to create will be illustrated in the next sections.

3. Decision Analysis (DA) Model in Innovation

The need for decision analysis is crucial in SME sustainability and it leads to apply the decision based design concepts. "Decision-based design (DBD) is an approach to engineering design that recognizes the substantial role that decisions play in design and in other engineering activities, largely characterized by ambiguity, uncertainty, risk, and trade-offs. This research will combine two fields: Engineering Decision Analysis and Economical Assessments. The aggressive nature of competition in today's markets makes innovation in SME a central point of contest. The benefit goes to the companies that are able to efficiently introduce products (price and performance) into the market. SMEs in Oman must guide their development effort toward three main objectives: low price, high quality, and long marketing window. The low cost Feasibility Study available in Oman are guiding them by applying a one single scenario profit i.e. profit is the margin between cost and selling price. The marginal profit must be sufficient in order to sustain SMEs and help them to grow. But we all know that high performance comes with high price and as a result a low demand. Having competitive edge in price and performance makes it a challenge for SMEs. While these objectives are often clashing or conflicting, they must be compromised using a normative approach by applying decision analysis. Balancing these conflicting objectives using a normative approach helps to make SMEs efficient and business strategies effective.

4. Significance of the DA Model

The planned goal of this paper is to provide a DA model that can assess any innovative idea or research in advance for SMEs. The short term will be by analyzing the current innovation strategy decisions in Oman and identify different stakeholders and their interrelations. However, the long term will be a sustainable decision analysis tool that will be available to them. This tool will guide the decision maker who can be the innovator himself . Therefore, this DA model tries to answer the following questions:

- Do we invest on this idea given that there is chance it may lead to no value?
  Our research will develop a decision analysis tool that take into account all the enabling factors or uncertainties that help the decision maker (individuals, universities, companies) "how" to make a "good" decision at this initial stage. For example, to assess the probability for success, which is different form one innovation type to another, one may accept a low chance success given that this research is a breakthrough one.
- If we attain the expected research or idea value, then shall we developed or invest on value scaling given the chance we might fail to scale?
  At this stage many research outputs are at lab scale level where some might think to scale the value up by further development given the initial investment in the idea. Again, the tool should be able to identify the enabling factor at any unique environment and give an advice to the decision maker.
- If we are able to scale or further develop the value, can we attain the intellectual property and what type of IP given the chance of not attaining the IP?
  The legal aspect of the IP makes it difficult to assess since at this level consist of many out-of-control factors where the decision maker should be aware of. In general, lawyers and legal party's advice the decision maker.
- If we receive the IP rights, shall we commercialize?
  The final stage is the commercialization decisions where we will build a framework that starts first will identifying the enabling factors and let the decision maker assess them.

5. Conclusion

The architecture model of commercialization for innovative scientific research is very critical to help bridging the gap between the innovative scientific research and commercialization. The high uncertainty of innovative academic scientific research and the long-term involvement and commitments required for these research makes it very difficult to create a market value for them to attract investors. Creating industry and investors interest in the early stage of the innovative academic scientific research is challenging because of the uncertainty with the outcomes expected from them. Thus, proper assessment is needed and a commercialization model that takes into consideration different factors that should be imbedded in the national innovation system will help to bridge the financial gap for the commercialization of innovative academic scientific research. This paper provides a concept on how to assess innovation for SME sustainability using Decision Analysis tools and concepts.

6. Future Works and Research

This is preliminary concept paper to illustrate how to utilize concepts of decision analysis into assessment of innovation to help SME sustainability. The next phase will be building the model that supports the hypothetical model developed by the authors.

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