SYSTEMS APPROACH: CONCEPT PROPOSAL TO DEVELOP SAUDI ARABIA LOW-COMPLEXITY DEFENSE SPARE PARTS MANUFACTURING INDUSTRIES, UTILIZING TECHNOLOGY TRANSFERS AND BUSINESS INCUBATOR

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ABSTRACT

The overall goal of this projects is to adopt and build on three of the Saudi vision 2030 “thriving economy” theme third-level objectives that include (1) Localize military industry, (2) Nurture and support the innovation & entrepreneurship culture, and (3) Grow SME contribution to the economy.

of the very important initiatives of the adopted “thriving economy theme to our area of concentration is planning to grow the economy by manufacturing half of the defense needs within the Kingdom, with the intention to offset the economy, keep more resources in Saudi Arabia and to create more job opportunities for its citizens”.

The main research question explores how to develop a conceptual model to demonstrate how innovative technological initiatives contribute to localized military equipment manufacturing technology.

The research process includes creating a conceptual model meant to assist with the development of low-complexity defense spare parts manufacturing industries, utilizing technology transfer and a business incubator. The model will include (1) adopting a Systems Approach to better understand the nature and the scope of the problem statement (2) developing a Conceptual Model for high volume, low mix, low complex spare parts manufacturing industries that will contribute to the national defense industrial sector, (3) investigating the adequacy and limitations of the Innovative Concept, (4) validating the model by analyzing the alignment of the concept with the systems methodological strategy.

This project utilizes an applied research (often called action research) as its methodology. This methodology applies a systems approach and related systems thinking to ensure a holistic understanding of the nature of the problem statement.

The literature review bodies clustered beneath the category of “Technology and Innovation Management” and addresses classifications of the major approaches to the issue of localizing the defense manufacturing industry. Moreover, the literature

review in the field of innovation, technology transfers and Systems Science have been analyzed.

While this project is still ongoing, the hypothesis of this conceptual framework will address the need to develop a flexible model that contributes to the current and future challenges as there is a lack of an adequate model to guide Saudi government on how to develop the SME defence manufacturing industries in order to become aligned with their country's vision 2030.

Keywords: Saudi Arabia, Saudi Vision 2030, Systems Engineering, Systems Modelling, Conceptual Model, Capability Development, Technology Transfer, Business Incubators, Manufacturing, Technology Capabilities.

INTRODUCTION

In 2016, the Saudi Arabia government launched its' 2030 vision that sets out clear strategic objectives and expresses the nation's long-term goals and expectations. One of the key strategic objectives of the 2030 vision focuses on the potential for growth in a strong economic environment by supporting economic development through diversification and sustainability (Kingdom of Saudi Arabia, 2017, p. 78).

Saudi Vision 2030 emphasized that the small and medium-sized enterprise (SME's) and national technological advancement are among the most essential elements for the country's economic development, jobs creation, improve the environment for innovation and prompt the growth of exports. To date, the SMEs are not major contributors to the Saudi gross domestic product (GDP) as expected, particularly when contrasted with advanced economies (Kingdom of Saudi Arabia, 2017, p. 78).

As per the Saudi Arabian Monetary Authority (SAMA) the Saudi SMEs add only 20% to the GDP contrasted with 70% of other economies. Regardless of the efforts made by the Saudi government to enhance the business environment, SMEs continued to suffer from 1) the bureaucracy of administrative and authoritative procedures, 2) moderate to poor ability to attract and sustain new talent, and 3) the struggle in obtaining funding. As a result, the proportion of funding for SME is about 5% of the aggregate GDP which considered a small proportion contrasted with worldwide rates (Sama.gov.sa, no date).

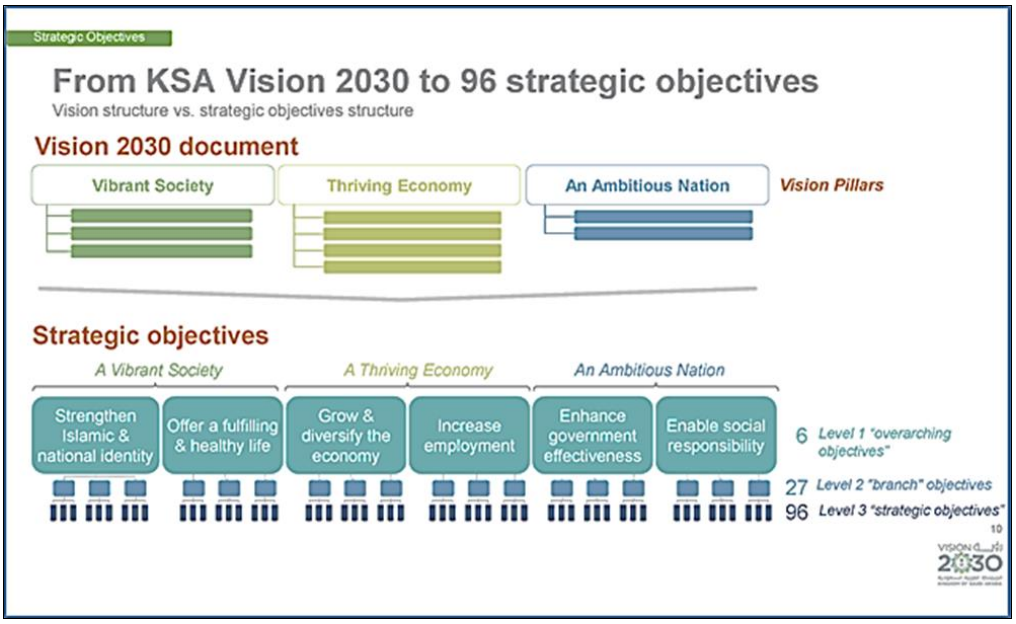

Figure 1 Vision Structure vs. Vision Strategic Objectives

One of the very important initiative of the Saudi Vision 2030 “Thriving Economy Theme” Figure 1. The theme will provide the platform for economic growth by developing investment tool sets that will unlock promising economic sectors, diversify economy, and create job opportunities. This will be achieved by localize over 50 percent of military equipment spending by 2030 and manufacturing half of the defense needs within the Kingdom (Kingdom of Saudi Arabia, 2017, p. 78).

The localization of the Saudi defense industries through direct investments and strategic partnerships with leading companies in this sector, with the intention to offset the economy, keep more resources in Saudi Arabia and to create more job opportunities for its citizens. These initiatives will transfer both information and knowledge in order to establish nationwide body of expertise in the fields of manufacturing, maintenance, restore, studies, and improvement. (Kingdom of Saudi Arabia, 2017, p. 78)

The overall goal of this projects is to adopt and build on three of the Saudi vision 2030 “thriving economy” theme third-level objectives that include (1) Localize military industry Figure 2, (2) Nurture and support the innovation & entrepreneurship culture, and (3) Grow Small and medium-sized enterprises (SME) contribution to the economy Figure 3.

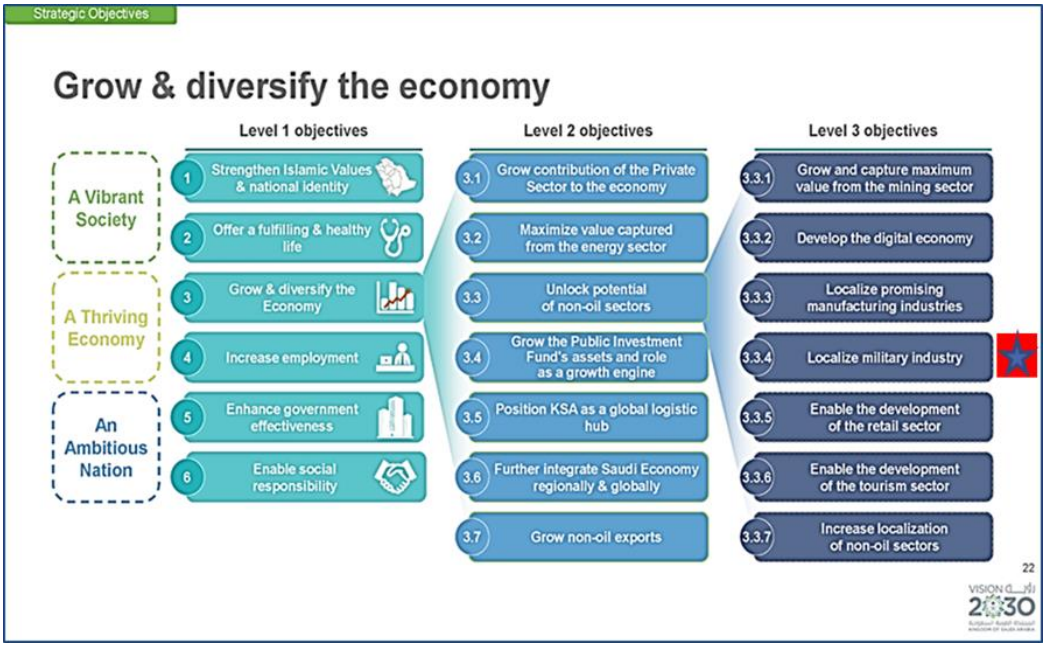

Figure 2 Objectives to Grow & Diversify the Economy

Nowadays, more than ever before, the creation of value, the ability to remain competitive, maintenance of the sustainable growth, and the efficiency of the manufacturing process depend on the development and a proper utilization of the technologies and innovations. The manufacturing of quality, simple, and cheap replacement parts is the process that is heavily dependent on the proper utilization of the new technologies and the innovative potential of the industry. The increase in the volume, lowering the manufacturing cost, and the use of innovations have been the topic of many studies; hence, it is necessary to apply them in order to design a model that can be used at the industry level to promote the efficient, cheap, qualitative, and rapid manufacturing process.

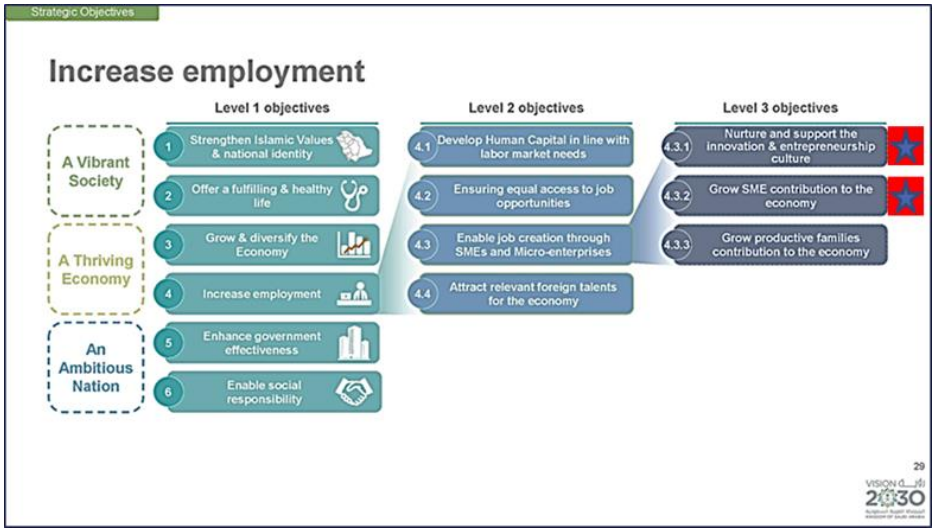

Figure 3 Objectives to Increase Employment

For the purpose of this research the proper environment has to be identified to support the localization of the manufacturing technology capabilities. This environment is defined as it as high volume, low mix, Defense Spare Parts, and low complexity manufacturing (simple schedule with no dependencies, low total cost, tested technology-techniques and procedures, impacts a single department, staffing involves a single department and minimal vendor/consulting activity).

In general, the spare parts, service parts, repair parts, or replacement parts (interchangeably) that are kept in an inventory and used for the repair or replacement of failed units remains an important feature of the maintenance, repair, and overhaul business sector. Besides, the availability of these parts and the ability to repair damaged equipment or replace failed parts with a serviceable (working) replacement are significant contributors to the success of the Saudi defense operations and defense capability/mission readiness.

Saudi defense operations and systems capability readiness are significantly affected by the shortage of these parts due to gaps in the manufacturing capabilities of simple-complexity, and low-cost spare parts. Therefore, this research is an attempt to eliminate the risk associated with shortage of these spare parts, related to the long lead time to import them from outside of Saudi.

The importance of the defense operations capability/mission readiness leads to an outgrowth for spare parts manufacturing capability development. Focusing the effort on innovative manufacturing approach and mass production to manufacture high-volume of standardized low-complicated products such as discrete solid parts (ex. Fasteners, nuts etc.).

This project utilizes an applied research (often called action research) as its methodology. This methodology applies a systems approach and related systems thinking to ensure a holistic understanding of the nature of the problem statement.

Whereas the research process includes creating a conceptual model systematically meant to assist with the development of low-complexity-defense-spare-parts manufacturing industries, utilizing technology transfer and a business incubator. The model will include (1) adopting a Systems Approach to better understand the nature and the scope of the problem statement (2) developing a Conceptual Model for high volume, low mix, low complex spare parts manufacturing industries that will contribute to the national defense industrial sector, (3) investigating the adequacy and limitations of the Innovative Concept, (4) validating the model by analyzing the alignment of the concept with the systems methodological strategy.

MANUFACTURING AND DEVELOPMENT

Developing countries have an economic potential for rapid and efficient growth that developed countries lack. What is more, developing countries currently become more and more attractive for the foreign investments that make their economies a prolific soil for the development of the innovative potential. A variety of authors

including Frances Stewart, discussed the innovative potential of the developing countries considering them to be the most prominent innovative forces (Stewart, 1984, pp. 81–94).

It is evident that developing countries are more likely to implement all the available innovations in an effort to promote their manufacturing process and gain additional resources and economic advantage. Manufacturing is the basis of the country's wealth since it comprises the manufacturing of various groups of goods starting with the products of the home use and ending with the heavy machinery that sustains the technological progress of the nation. It also provides the nations with the opportunity to participate in the process of international trade (Liu et al., 2017, p. 287).

D. J. Nakandala discussed in his study “Acquiring Foreign Technology and Achieving Sustainable Local Innovation Capability: Case Studies From The Sri Lankan Manufacturing Industry Innovation And Development” the way such countries as Sri Lanka utilize the unexplored innovative potential to gain a technological advantage and promote the manufacturing process by making it cheaper and more efficient (Nakandala, 2011, p. 327). As a result, countries such as Sri Lanka, India, Ecuador, and other developing countries become desirable destinations for the investors from the developed countries (Fernández Sastre, Vaca Vera and Vera, 2017, pp. 48–57).

Dominik Matt claims in his research “Achieving Operational Excellence Through Systematic Complexity Reduction in Manufacturing System Design” that the reduction of complexity is the most efficient way to reduce the cost of the manufacturing and increase the efficiency and the value. It is clear that the simplicity is the end goal of all the manufacturers and designers (Matt D. T., 2007, 865–872).

Accordingly, it is the ultimate goal of every manufacturing model to simplify the process of manufacturing and the product as simple as possible. However, the methodology of the model to be develop has to take into consideration the environments in which it would be applied; hence, it is necessary to apply an analytical approach to the model development. This method would allow the analysis of 1) the needs of a particular manufacturer, 2) an understanding of what to be done to make the process of manufacturing more efficient, and 3) the development of a model that would satisfy all the needs (Omar, Diban and Gontijo, 2015, pp. 6169–6174).

It is clear that the development of national manufacturing capacity of simple complexity products represents a significant leverage for progress and innovation. According to Dominik Matt and a different research group, Milad Pour, and Simone Zanoni, the higher the simplicity of a product, the better the product is. It is the ultimate goal for every manufacturer to make the simplest products and of the highest quality; hence, the development of a manufacturing model has to target the simplification of the process and the reduction of the costs associated with the process (Pour and Zanoni, 2017, pp. 610–618).

INNOVATION AND TECHNOLOGY INTO DEVELOPMENT

Innovation mostly viewed as applying improved solutions on problems in order to better meet new requirements, needs that are undistorted or the current market needs. It is applying solutions meet the prevailing needs. Temiz A. et. al. and Ucer A. (2016) in their research papers emphasized in their papers that innovation literature often refers to a generation and adopts (imitating) innovations as important categories. They explained that the generation of innovation refers to situations where organization is the first engine and generates a product or process or technology that was not known before. On the other hand, if organization embraces innovation, it absorbs the knowledge and techniques developed elsewhere that are new to the organization (Temiz, Özkan and Üçer, 2016, p. 1650011).

The need to remain ahead of the competition in the market could serve as a motivating factor for companies to deny their competitors the chance to imitate their innovations in order to maintain their competitive advantage. With this said the application and imitation of innovation is a major driver for economic growth and development and social advancement (Mazurkiewicz and Poteralska, 2017, pp. 457–465).

The early technological initiatives have played a critical role in promoting the economic development of different countries and businesses that were dependent on abundant raw materials to create competitive advantages. Dwindling raw materials have shifted focus to other resources, such as human resources and technology to enhance business competitiveness to guarantee their success and sustainability. In this regard, Andersson et al. reveal the essential literature of technological advances to the success and sustainability of firms in the highly competitive business environment. At the same time, the vitality of ideas and creativity has never been high as it is in modern times (Andersson U., et al., 2016).

One of the most distinguished ideas that were put across by Austrian economist Joseph Schumpeter during the 1930's are the concepts of innovation and the development of innovation management principles. According to his claims in, "significant factor in economic growth, Creative destruction" innovation is a mutative process in the industry that revolutionizes the structures in the economy from within destroying the old order and putting in place the new one (Schumpeter, 2008).

Innovation is vital to the success and sustainability of businesses in the modern business environment. According to Schumpeter in his book "Theory of economic development" and other, development is a historical process of changes in the structure driven by innovation, also Schumpeter defined innovation purpose into five different themes (Schumpeter, Opie and Elliott, no date) and (Śledzik, 2013), (Schumpeter, 1950):

1. The launch of a new product or a new species of the already known product;
2. Application of new methods of production or sales of a product (not yet proven in the industry);

3. The opening of a new market (the market for which a branch of the industry was not yet represented);

4. Acquiring of new sources of supply of raw material or semi-finished goods;

5. New industry structure such as the creation or destruction of a monopoly position.

Schumpeter also argued that there are four dimensions to the process of innovation: 1) Invention, 2) Innovation, 3) Diffusion, and 4) imitation (Schumpeter, Opie and Elliott, no date). However, according to Schumpeter what matters in terms of economic growth, investment and employment are far from the discovery of a new basic innovation but the diffusion of this basic innovation. This refers to the period that people start to realize the economic importance and benefits that come with this new innovation and start adopting and investing in it (Schumpeter, 1950).

SYSTEMATIC INNOVATION

The term 'systemic innovation' has been increasing in use in recent years. The Social Innovation Europe initiative (SIE) put forward an explanation that "systemic innovation is elaborate particular strategies for transforming whole systems", and the report also stated that they are not arguing that systemic innovation is an easy one, in fact, it is extremely difficult to understand an entire system let alone engaging in transforming them. However, the report clearly stressed on the existing importance of systemic innovation now more than it has ever been (Davies et al., 2012).

According to SIE, systemic innovation is "A set of interconnected innovations, where each is dependent on the other, with innovation both in the parts of the system and in the ways that they interact." and argued that systematic innovation is often required to achieve the full value of radical innovations. As a matter of fact, the term was first used to refer to an innovation category that required specialized asset and that complemented its own successful marketing (Davies et al., 2012).

Takey and Carvalho (2016) have a systematic literature review on of the field of systemic innovation and their paper acknowledges the numerous context upon which the term has been used but eventually shut down the less common contexts and focus on the most common and popular contexts: "Systemic Innovation (SI) corresponds to the type of innovation that only generates value if accompanied by complementary innovations. It opposes autonomous innovation, which can be developed independently of other innovations (p.97)" (Midgley and Lindhult, 2017).

They indicted the need for a systemic innovation concept back to the works of Teece (1986) and Chesbrough and Teece (2002), that put across an explanation of how more and more innovations in the commercial setting require collaboration and integration across organizations in order to come up with the required synergies. Organization have to acknowledge that the knowledge that they need to produce the next wave of technology, goods, and services can only be found internally

(Normann, 2001). And, they must not assume that any single innovation can be successfully be pursued outside the scope of a complete innovation system (Chesbrough and Teece, no date).

SYSTEMS APPROACH AND SYSTEM THINKING CONCEPT TO PROBLEM-SOLVING

System is not an easy word to define in any meaningful way. It can mean very different things to different people but attempts to set out simple generic definitions usually fail. Wu. B. (1992) explained in his book “Manufacturing Systems Design and Analysis” that the definition and characteristics of systems may seem abstract and difficult to understand - however, it will not be so difficult to understand the basic concepts of systems when they are linked to real-life examples. A system can be considered as a transformation process that converts a set of inputs into a set of outputs. The inputs and outputs of a system are the main interfaces between the system and the outside world. The process is the totality of the elements of the system, including objects and relationships (Wu B., 2006).

Mizikaci F. (2006) explained in her research paper “A systems approach to program evaluation model for quality in higher education” that the system is capable of being made up of subsystems or parts that make up the whole interaction. Once organized in a coherent way, it should not be viewed as a collection of parts but a functional entity that has properties that cannot allow it to exist independently as a collection of parts (Mizikaci, 2006, pp. 37–53). In order to be viewed as a functioning system, the system has to define its objectives and how to measure performance, the system environment must also be considered as an influencing factor, there must be an absolute determination of resources, the system components must also be defined as well as the management of the system set (Churchman, 1968).

The system composes of subsystems or parts that make up the whole interaction. Once organized in a coherent way, it becomes a collection of parts but a functional entity that has properties that cannot allow it to exist independently as a collection of parts. Functioning system has to 1) define its objectives and measure of performance, 2) consider its environment as an influencing factor, 3) its resources identified, 4) its components defined and 5) the management of the system set (Churchman, 1968).

Systems approach integrates together the analytical and synthetic methods that consist of both holism and reductionism. It was originally proposed alongside the concept of “General System Theory” by Ludwig von Bertalanffy, the theory that laid on the assumption there exist universal principles which are all true when it comes to all systems (Bertalanffy, 1969).

The basic guiding principle in the system theory is that the whole is more or greater than the sum of its parts. This implies that the whole determines the nature of the building blocks and the parts are dynamic and interrelated and cannot interpreted or

understood when isolated from the whole. Systems viewed of having four major characteristics (Banathy, 2000):

1. Systems are goal oriented;
2. Systems have inputs from their environment;
3. Systems have outputs to achieve their goals; and
4. There is feedback from the environment about the output.

Systems approach is applying systems thinking in a systematic and repeatable manner while systems thinking is applying the concept of a system to a situation in order to gain insight and understanding. Also, using the systemic properties and characteristics of a system to understand and make predictions about the problem or situation under investigation. Systems thinking requires us to consider the whole problem together with its context and to understand and appreciate the system structure and dependences between elements of the system in order to predict potential emergent behavior.

MODEL APPROACH TO TECHNOLOGY TRANSFER AND BUSINESS INCUBATOR

While talking about models, we need to take a close look at the aphorism by George E. P. Box, William Hunter and Stuart Hunter “All models are wrong, but they are useful”” (Box, Hunter and Hunter, 2005). . The systems of Engineering Book of Knowledge (SEBOK) gives an array of definition for the term model but only two of such resonates well with our study. “a representation of one or more concepts that may be realized in the physical world Friedenthal, Moore, and Steiner (2009); and Model is an abstraction of a system, aimed at understanding, communicating, explaining, other designing aspects of interest of that system Dori, (2002)”. Based on SEBOK assertions, the following are the uses for models (Bkcase, 2017).:

1. Characterizing an existing system
2. Mission and system concept formulation and evaluation
3. System design synthesis and requirements flow-down
4. Support for system integration and verification
5. Support for training
6. Knowledge capture and system design evolution

Technological transfer holds the key to the success of development in different sectors. Lackéus and Middleton ascertain that technology transfer cultivated through

collaboration between different entrepreneurs is crucial to the creation of products and services that meet emerging needs (Lackéus and Williams Middleton, 2015, pp. 48–73). Additionally, Choi, Hee Jun elaborated that the technological transfer involves several concepts that need to be considered to ensure effective and efficient technology transfer. Some of the notable factors include “conceptions of technology, technological activity and transfer, communication channels, factors affecting transfer, and models of transfer” (Hee, 2009, pp. p49-57).

Therefore, individuals and businesses should agree on a well-developed model to facilitate the transfer of technology between different spheres and contexts. Some of the common technology transfer models include “the appropriability model, the dissemination model, the knowledge utilization model, the contextual collaboration model, the material transfer model, the design transfer model, and the capacity transfer model” (Hee, 2009, pp. p49-57).

However, stakeholders exchanging technology should agree on the best-suited model that meets their individual needs. Nonetheless, some of the models such as appropriability are unnecessary because efficient models sell themselves. However, the knowledge utilization model focuses on strategies that enhance the transfer of technology to desired recipients. Nevertheless, the contextual collaboration model is based on the notion that recipients should construct knowledge because it is impossible to transfer it. The material transfer model emphasizes on enhancing ease of use of different materials such as machines, seeds, and techniques, among others, to help people improve the quality of their lives (Norman et al., no date).

The design transfer model asserts that effective knowledge transfer is only possible if the technology itself accompanies the right to the designs. Nonetheless, the capacity transfer model focuses on the transfer of knowledge that enables recipients to develop technologies that meet their needs. The usefulness of these models is to enable the effective transfer of knowledge. On the same note, (Mazurkiewicz and Poteralska, 2017, pp. 457–465) highlight some of the barriers that hinder the transfer of technology. Innovation is vital to the success and sustainability of businesses in the modern business environment. However, “the application of technological innovations is acknowledged as a driver for economic growth and social development” (Mazurkiewicz and Poteralska, 2017, pp. 457–465).

National Business Incubation Association informs that a business incubator is responsible for supporting young firms to make all of them confident and independent. It should be mentioned that the types of business support provided include a wide range of tangible and intangible resources. For instance, one of the obvious types of tangible support an incubator can provide includes “an operating space and shared facilities” (Al-Mubaraki and Wong, 2011, pp. 756–765).

Moreover, business incubators also provide advice and guidance to help such companies to manage and run their business. To illustrate, their help can positively affect product marketing, funding, and business expansion in general. Consequently, keeping in mind that early stages of development are always full of issues and

challenges for every business, there is no doubt that help, and support given by business incubators play a crucial role for the development of new firms.

The study by Al-Mubaraki and Wong also proves that incubators are very important since that provide the conducive environment for the companies to grow into successful corporations in the future. To be exact, an incubator “provides the tenant with physical operating space as well as shared facilities and resource” ” (Al-Mubaraki and Wong, 2011, pp. 756–765).

This factor helps to transform business ideas into real commercial products that can bring revenues. They are also responsible for providing consultancy and guidance for young firms to overcome their financial burden. At the same time, it is a mistake to forget that some incubators can work better than others. There are many reasons explaining the difference in their performance. For example, they can differ in their sizes, and eventually larger incubators can be more powerful. They can provide more substantial financial support for a more significant number of incubates. Even while new entrepreneurs can have great innovative ideas, not all of them have enough experience. As a result, the services provided by different incubators can vary significantly, and all incubators cannot be successful in the same way.

It is important to note that the U.S. paid significant attention to the incubators throughout the last couple of decades, as they were viewed as the mechanisms to improve the technological and economic growth of the countries. A vast number of scientists and researchers were exploring the phenomenon of business incubators and wrote a lot of articles dedicated to all of the aspects of these mechanisms. They concluded that incubators play the crucial role in the activity of the young companies, as they decreased the probability of errors and to stimulate business creation processes.

Nevertheless, it should be pointed out that the central goal of public incubators was to decrease the expenses for managing business by providing a set of tools and assistance needed for various elements, “ranging from the provision of space, infrastructures and facilities, to more elaborate services” as well as providing technical and managerial expertise and additional help in business plan development" "(Grimaldi and Grandi, 2005, pp. 111–121). At the same time, it is important to highlight that the central source of profit for them include funding from international, national, and regional schemes as well as the fees for the services they offer.

At the same time, there are many sources that discuss the way public incubators were developing in various parts of the planet. For example, in Europe, Business Innovation Centres became the first and most famous ones in 1984, initiated by the European Commission. Their incubating activities included providing a range of certain services to tenant companies, involving “the provision of space, infrastructure, communication channels, and information about external financing opportunities, visibility, etc.” (Grimaldi R. and Grandi A., 2005).

In addition to this, University Business Incubators is one more initiative representing public incubators. However, it should be mentioned that governmental policy-makers often consider science as a foundation for supporting local economies, often asking universities “to lend resources, faculty time and talent to economic development efforts” "(Grimaldi and Grandi, 2005, pp. 111–121). Even since the primary task of all universities is educating, they often decide to contribute to local economies with the help of research, resulting in faculty spin-off ventures, various discoveries, and even inventions.

The study conducted by Al-Mubaraki and Busler is focused on the issues and opportunities of innovation and incubators as a tool for a knowledge-based economy. First of all, they indicate that incubator models should be considered as high technology incubator types that can positively contribute to the development of technologies in all counties, stimulating the introduction of new services and products. Secondly, the authors inform that incubators involve supporting enterprise and innovations to provide as a better environment for development as possible to encourage and maintain the smart growth of young businesses (Al-Mubaraki and Busler, 2017, p. 15).

On the other hand, Al-Mubaraki and Busler show two critical opportunities to keep in mind. Firstly, it is significant to remember that “the sustainability of incubation and innovation programs is based on the high survival rate (81–90%) of small- or medium-sized firm per fiscal year” (Al-Mubaraki H. M. and Busler M., 2017). Moreover, they inform that it is also connected with the creation of high jobs and the amount of graduate and client firms (Al-Mubaraki and Busler, 2017, p. 15).

PHASE-GATE PROCESS AND OPPORTUNITY MANAGEMENT FUNNEL

Phase - Gate model process is a project management technique that mainly involves the division of project activities into parts that are known as stages or phases that are separated by abstract structures that are referred to as gates in project management (Bkcase, 2017)..

A phased approach in decisions came in the execution of huge projects for engineering in the. Due to the applicability and success of this approach other industries that had heavy processes picked up this approach. For instance, the NASA picked up this approach in 1960 in its projects referring to its adapted model as the phased review process. This process main objective is to come up with smaller pieces of the whole process and ensure that the process can be evaluated consequentially. The review process required that each phase must meet a series of set criteria before the process was allowed to move to the next phase (Hine and Kapeleris, 2006).

The phase review process was made of five phases with intervals that allowed for periodic development reviews (Chao and Ishii, 2005, pp. 301–310). The phased approach that was adopted by NASA was considered a generation I process

because it did not involve an external analysis of the market like it is done the new product research and design (Hine and Kapeleris, 2006). . Waterfall process is one of the most known variants of the process that we have just discussed above (Chao and Ishii, 2005, pp. 301–310). Variant put across by Winston Royce's paper on large developments, the waterfall variant had it that each phase was like a series of waterfalls and after a successive phase, the work could not return to a previous phase (Rovce, no date).

More increasingly, Phase-gate processes have been referred to as the front-end loading or big design up front. One of the problems for phase-gate processes is their potential due to the bureaucratic organization to interfere with internal creativity and innovation.

This is because the phase-gate processes are more focused on the phases and the separations rather than coming up with new ideas. A good example of the phase gate process is the opportunity management funnel that is used for decision making. Opportunity management is the process of identifying business development opportunities as well as community development opportunities that could improve or sustain the local economy. The following are the components of opportunity management (Rovce, no date):

1. Identifying opportunities.

2. Evaluating and prioritizing these opportunities - This may involve developing criteria, deliberating, and ranking the alternatives.

3. Driving opportunities - Involves assigning leads, accountability, action plans, and project management

4. Constant monitoring - May require one of the following actions:

5. Advance - Commit additional resources to move the idea forward Rework –

6. More investigation/ rethinking

7. Kill - Stop working on the idea and move on

The purpose of opportunity management funnel is to identify and eliminate weak or ideas that considered bad before money and financing can be introduced to follow through these opportunities. In the context of the phase-gate process opportunity management funnel generates efficiencies where weak and bad ideas are eliminated leaving only the strong and ideas that can be considered as viable (Rovce, no date).

CONCEPT DEVELOPMENT FRAMEWORK

While this project is still ongoing, the hypothesis of this conceptual framework will address the need to develop a flexible model that contributes to the current and

future challenges as there is a lack of an adequate model to guide Saudi government on how to develop the SME defence manufacturing industries in order to become aligned with their country's vision 2030.

The adopted framework will be capable to provide the necessary categories for the concept that are needed for the development of solution. This allows a multidimensional view of the system something has been extremely hard to achieve. The first thing here is to come up with a fitting framework where to fit in the information and knowledge according to the required level of detail. This framework provides the basic building blocks, at this level we assume the absence of any finality in arrangement until the validation of the concept. However, the detail of the information will increase as we progress.

Due to the systemic nature of applied research methodology is a suitable to this work and appropriate to the investigative purpose and nature of this research is Applied Research also referred to as Action Research. Applied research "aims at finding a solution for an immediate problem facing a society, or an industrial/business organization, whereas fundamental research is mainly concerned with generalizations and with the formulation of a theory" (Kothari, C.R.). Moreover, applied research is considered to be non-systematic inquiry and it is usually launched by a company, agency, or an individual in order to address a specific problem.

The applied research can be summarized into three points: 1) Purpose of applied studies is closely associated with the solution of specific problems. 2) Context of applied studies, research objectives are set by clients or sponsors as a solution to specific problems they are facing. 3) Methods of research validity represents an important point to be addressed in all types of studies. Nevertheless, applied studies are usually more concerned with external validity (Bajpai N., 2011).

Inductive reasoning, also known as an inductive approach, starts with the observations and theories which are proposed towards the end of the research process as a result of observations (Queen R. & Squires L., 2011, 300).

It is important to stress that the inductive approach does not imply disregarding theories when formulating research questions and objectives. This approach aims to generate meanings from the data set collected in order to identify patterns and relationships to build a theory. However, the inductive approach does not prevent the researcher from using existing theory to formulate the research question to be explored (Dudovskiy J., 2018).

Concept Development

It is very imperative that we introduce the concept of modelling to aid systems thinking. Also, applying a systems approach and related systems thinking to ensure a holistic understanding of the nature of the problem statement. Also, I need to study both the boundary of the Saudi defense spare parts manufacturing industry - (the system of concern) as well as the boundary of the developed conceptual mode (the

system inquiry). However, due to resource constraints and the nature of the system of concern, it will be very wise to consider examining the system of concern as a “closed” system with clear understanding and appreciation to the “open” system approach.

The efficiency of the concept model has to be held in high regard and the efficiency measurement, and for the concept model to include features that allow for flexibility, and expansion.

Typically, applying Problem Structuring Methods (PSM) that use systems and systems thinking as an abstract framework for investigation, rather than a structure for creating solutions is suitable for this study (BKCASE Editorial Board, 2016, 945, while, systems descriptions are used to map the current situation and describe an idealized model. It is worth highlighting that this method employs inductive reasoning that is based on learning from experience, hence patterns, resemblances, and regularities in experience are observed in order to reach conclusions.

The new concept called 7 Systems for Business Development (7SBD) attempts to show a holistic view of the entire system of interest and allows us to divide and conquer through using the functionality as basis for division, categorization. The 7SBD concept model is compromise of the following seven systems:

1. Strategic System (SS)
2. Sponsoring System (SpS)
3. Supplying System (SuS)
4. Utilizing System (US)
5. Driving System (DrS)
6. Enabling System (ES)
7. Delivering System (DeS)

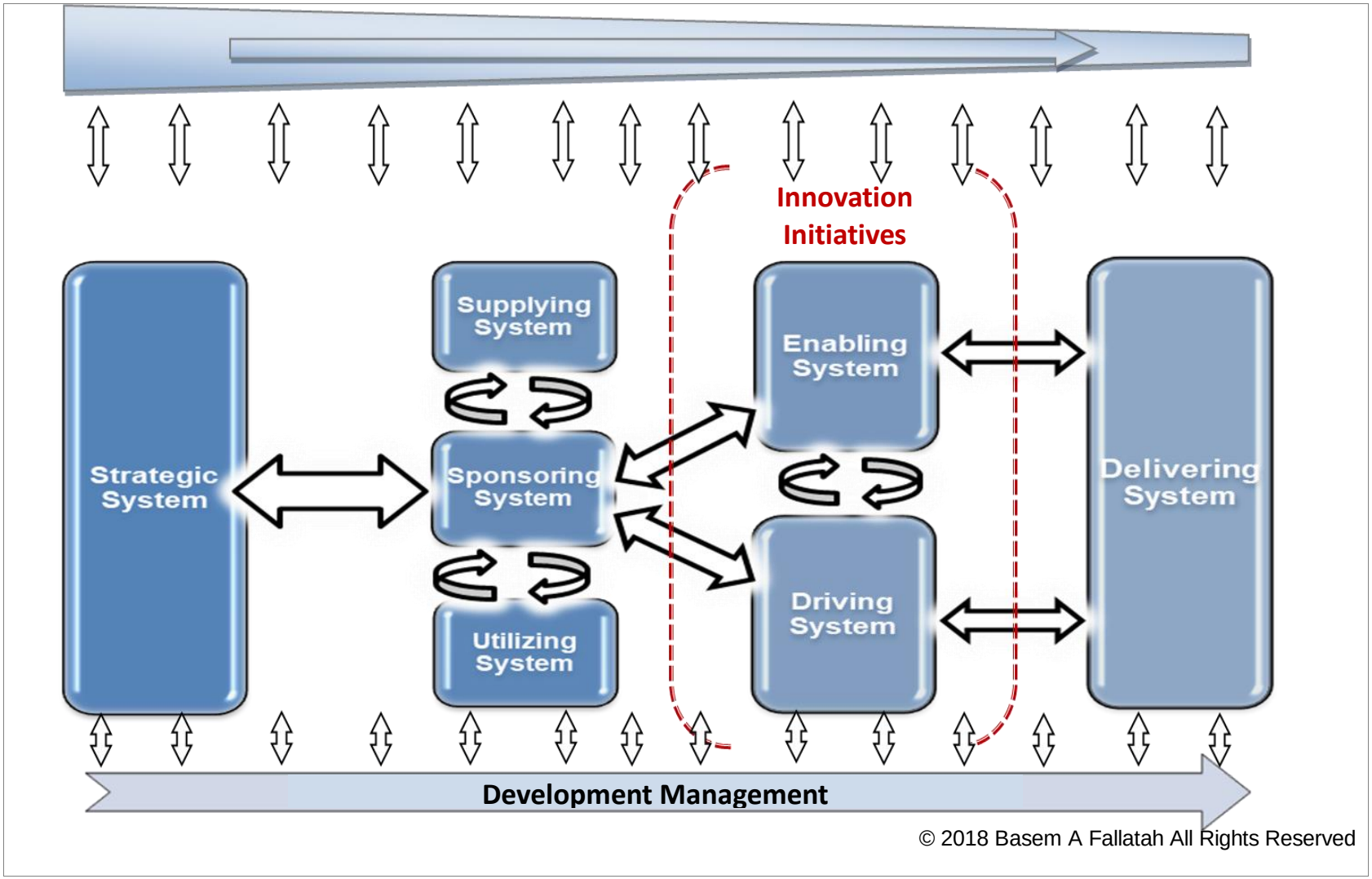

Figure 4 Conceptual Model of 7 Systems for Business Developments (7SBD) (Author Work)

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