www.irmbrjournal.com June 2016
International Review of Management and Business Research Vol. 5 Issue.2

Intelligent National Innovation System for Regional Development in Egypt
A Proposed Conceptual Model

MAHMOUD ELSAYED HASSANIN
Lecturer of Management and Economic
Faculty of Financial and Administrative Sciences
Pharos University at Alexandria, Smouha, Alexandria Egypt
Email: mahmoud.hassanen@pua.edu.eg
Tel: +2-01007214742

MOHAMED AHMED HAMADA
Lecturer of Information Systems
Faculty of Management Sciences, MIS Department,
Modern Science and Arts University, 6th October City, Egypt
Email: mmhamada@msa.eun.eg
Tel: +2-01003606673

Abstract

In Knowledge-Based-Economy, capturing and leveraging the value of innovation is generally held to be the path for sustainable wealth creation and regional development. In globalization knowledge era, intelligent National Innovation System (NIS) can accomplish noticeable standards of welfare and regional economic development. The Egyptian national innovation ecosystem is not serving the economic development well. Although, there are some activities that have been spent in establishing the national innovation ecosystem but the results were not as predicted. Academia entities - that are called the innovation factory - are working in isolated islands. Additionally, industrial sector is not linked to the scientific producers as well because of many critical reasons. Therefore, it is an essential requirement to have a future innovation strategy. A part of this strategy is building an intelligent innovation system to effectively connect these isolated components and to provide practical solutions to some of the existing social problems. This research provided a proposal of intelligent NIS for regional development- that gathers, organizes, and leads the national commercialization innovation practices. This model is a comprehensive system that can be customized to work simultaneously as a national innovation system and as a regional development system. This model tried to achieve many benefits (e.g. to accelerate the economic growth, solve the social problems with scientific ways and to allow the contribution of the innovation ecosystem in the country modernization). This proposal used the artificial intelligence as an analytical tool to analyze, match and suggest innovative solutions to every region based on specific criteria.

Key Words: *Open Innovation, Artificial Intelligence, Knowledge Economy, Data Warehouse, Regional Development.*

Introduction

Innovation is a multi-player-multi-activity work that needs concentrated and well-functioning network association, communication and harmonization among the innovation ecosystem entities. The

establishment of an advanced dynamic knowledge society is an essential goal for Egypt by commercialization of the academic research through industrial sectors. During the period of 1985 to 2005, many long-term innovation policies and initiatives were created by the Egyptian governments and several ministries created some innovation policies, players and bonds. As a result of the importance of these innovation policies and activities to renew Egypt, they have been evaluated by the European Trend Chart on Innovation. According to this evaluation, these innovation activities are obvious but incomplete strategy, (OECD, 2010).

On the other hand, the Egyptian authorities have a clear understanding of the need for advanced stages to deal with the systemic nature of innovation and to utilize resources in different ministries in a rational and coherent method to find practical solutions for the social problems. The Egyptian innovation ecosystem components (e.g. Industry, Academia and other stakeholders) are not capable enough to produce technologies or products to satisfy their specific needs. Of course, there are some successful trials, but the majority of the innovative ideas to generate products / service must be imported from abroad either by foreign partners or local agents. Then, these ideas have to be commercialized by local producer throughout a well-established technology market, (Hahn and Köcker , 2008).

However, Egypt has an enormous science inheritance and huge numbers of researchers to depend on them. Unluckily, the Egyptian scientific and innovation ecosystem has faced a lot of obstacles that prevent it from doing its potential part in the knowledge-based-economy. The existing transformation of Egyptian society is a golden opportunity to mitigate long years of poor financial aid, shortage of effective strategic innovation management, huge spiral bureaucratic system,- lack of managerial practices and ignorance of the potentiality of scientific applications in modernizing the Egyptian economy, (Bond, Maram, & Soliman, 2013).

The Egyptian global innovation index ranking has deteriorated during the last ten years. The following table shows a global innovation index ranking comparison analysis between selected Middle East countries that have some sort of similarities in the socio-cultural aspects but for sure, they have totally different approaches in utilizing innovation strategies for the national and regional economic development.

Table 1: Global Innovation index ranking -Comparison Analysis, (WIPO, 2007 - 2015)

	Egypt	Israel	Cyprus	Turkey	U.A.E	Saudi Arabia	Tunisia
2005	100	22	34	58	47	43	76
2007	76	18	45	51	14	32	64
2009	74	23	33	67	26	54	62
2011	87	14	28	65	34	54	66
2013	108	14	27	68	38	42	70
2015	108	22	34	58	47	43	76

The Egyptian innovation ecosystem has experienced a lot of problems such as: 1) there is no centralized long-term innovation strategy to produce national science, technology and innovation; 2) Many of the ecosystem entities are still in the stage of creating their full collection of capabilities and responsibilities. A small number of centers have still not finished procedures required for contracting all the resources to comprehend full operational capacity, (Bond, Maram, & Soliman, 2013). On the other hand, many entities have made significant success for being nationally known innovation players (e.g. Smart Village).3) Despite most of these entities represent essential instruments for structuring and applying innovation support policies and programs, they are working in isolated islands and there is no national network that union all of these activities to the development of the society, (Bond, Maram, & Soliman, 2013).

Essential innovation entities such as chambers of trading, universities, research institutes, vocational training centers, financial support organizations and business and technology hubs are in place to support the Egyptian industry. Unfortunately from an innovation side, they have dissimilar strengths and weaknesses, and till now, most of them are not completely utilized or connected. There is a need for innovative policies and procedures to support the current institution and union all of them in a smart, effective and well connected network, (OECD, 2013).

Therefore, the Egyptian innovation ecosystem should be analyzed to discover the obstacles to find practical solutions and to mitigate the gap between plans and actions. The system requires a strategic vision, future insight, reforming its infrastructure and to remove the related obstacles in order to effectively and efficiently exploit the national resources. Part of this strategy is to use the artificial intelligence in creating a coherent national innovation system that can serve the society as a problem solver and as a pool for selecting the smart innovation solutions customized based on specific criteria (e.g. culture, economic, political, resources etc.). The goal of this paper is to answer the following research questions:

1. What are the components of this system?
2. What is the mechanism used in running this system?
3. What are the expected advantages of this system?

Literature Review

Regional Development

Innovation activities are considered as an essential player in regional development by introducing the knowledge platform utilized to introduce innovation solutions for economic and social problems. An innovation ecosystem stakeholder can play a highly important role as an innovation factory and knowledge producer to its regions. Recently, higher education is being challenged to become more responsive to the social needs and to emerge from its narrow-minded absorption with the separate concerns of ivory tower academia, (OECD, 2010).

It is a well known fact that regional development is about social as well as economic cohesion within as well as between regions. Regional development can be seen as a wide range of activities to mitigate regional economic deficiencies by supporting employment and wealth-generating economic activities in regions. Historically, regional developments policies tried to achieve these economical objectives by providing large-scale infrastructure development and by attract external investments to the region, (OECD, 2013). Unfortunately, the results were not successful as needed because the old policies could not mitigated regional problems despite the public funding and efforts.

Therefore, the policy makers started to acquire the contribution of university as a knowledge producer in transferring this knowledge to the society. This era has been called the first academic revolution, (Etzkowitz, H. and J. Dzisah., 2006). Concurrently, the university played a role as a generator of knowledge-based-enterprises (start-ups, joint ventures and entrepreneurs). This notion was called the second academic revolution. The invention of 'knowledge Management' and the development of 'intelligence' offer knowledge production centers that have the organizational capabilities to mixture the on-the-shelf ides, create and visualize new innovative ones, a superior importance. Traditionally, universities as public or private institutions require to carry out different tasks (e.g. educate and impart expertise, preserve a top rank in the national and international competition and provide knowledge to the society), (Strauf, S. and Scherer, R., 2008). The global dynamic changes for example: globalization, internationalization, massive competition and diffusion of knowledge- have enforced the society's policy makers to enlarge the role of the university to include not only teaching and researching but also regional development under the name of the entrepreneurial university or (the Triple Helix Model) , (Etzkowitz, H. and J. Dzisah., 2006).

Although, this model was a promising mechanism in regional development but it focused on specific components (e.g. industry and government) that are parts of the university ecosystem. These models failed to accomplish the full integration between the social stakeholders and could not achieve significant results in regional development. Therefore, developed countries (e.g. Germany, Japan, China, Finiland, South Korea, USA and Denmark) exploited the National Innovation System (NIS) as a main tool to achieve the development and prosperity of the society. Additionally, NIS allows some developing countries such as: Turkey, South Africa, Ireland and Brazil, to attain large steps in economic development and to solve many social problems in local societies. Building a coherent strategy that encourages the innovation nationally to solve the nation's problems and regionally to mitigate the local society's problems, is an essential step in developing the country. Systematic approach is a vital way for evaluating implanted innovation for a country's economic system. It gives the ability to focus not only on system components but also in interrelationship between those components. The effectiveness of innovation system depends on successful and smooth flow of knowledge among society's partners (e.g. Universities, industries, research institutes and Government agencies), (De Backer & López-Bassols, 2008).

The Egyptian Innovation Ecosystem

However, the Egyptian national innovation ecosystem is not efficiently exploited and requires reformation of the infrastructure. The Egyptian innovation ecosystem consists of the following components that are shown in (Figure 1)

Figure 1: Egyptian Innovation Ecosystem

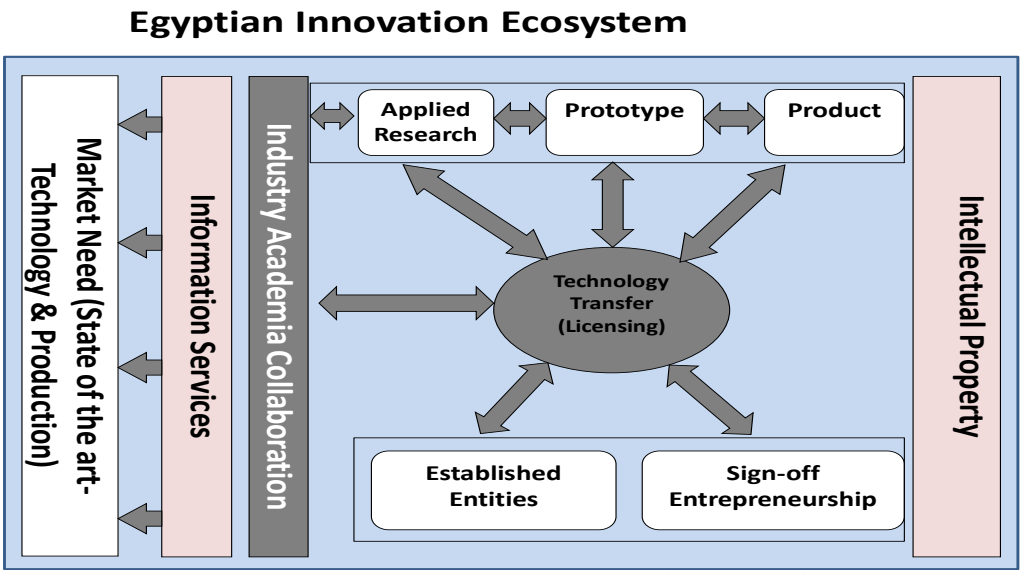

Figure 1: Egyptian Innovation Ecosystem (STDF, 2012)

Components of the System

1) The box that includes the applied research, prototype, and product shows the "Research commercialization phases". This component includes funding agencies that provide financial aids and grants to inventors (e.g. Agriculture Research & Development Fund, Industrial Modernization Center (IMC) - Science & Technology Development Fund (STDF), Information Technology Industry Development Agency (ITIDA), Misr El Kheir (MEK), Research and Development & Innovation Program (RDI));
2) The "Innovation supportive tools" is represented by the rosy boxes and includes (e.g. intellectual property and information services);

3) The "Innovation Actions" are shown by the gray. It contains the following two components:
   a. "Industry - Academia relationship" establishes links between the industrial and the research communities, which are missing to a great extent in Egypt. It encourages the industry to believe in scientific research as a reliable solution to their current and future needs and thus facilitates the technology transfer process from academia to the industrial and government entities, ((Hahn and Köcker , 2008).
   b. "Technology transfer" circle. Technology Commercialization is further divided into transferring technology to established entities through licensing/selling its Intellectual Properties and starting-up new ventures to capture the value of the technology. Meanwhile, entrepreneurship involves activities undertaken to transform inventions into new products, services, methods, and innovations that have economic or social benefits and most of the time leads to starting new ventures "Start-Ups". Depending on the type of technology and its market potential, inventions can be commercialized at any stage of development: applied research result, prototype, or product, (STDF, 2012). The innovation cycle starts with an invention that is ready to be commercialized or utilized for the benefit of the society. The commercialization of an invention can take place at any phase whether the invention is an applied research result, prototype, or product. This depends on many factors like the nature of the technology and the market needs. This is represented in the following diagram by having an arrow connecting each one of the "Research commercialization phases" to the "Technology Transfer" activity, (Galal, E., 2001).

The Egyptian Innovation Ecosystem Barriers

The system has many problems and cannot service the Egyptian economy well. The following section explains the related barriers to every component. For the purpose of this research, the author focused only on the innovation information system and related networking barriers.

Research Commercialization Phases Barriers

Researchers must search scientific publications in Journals and databases before starting their research to find out the topic gap and literature review. However, Majority of them have no access to international patents and copyrights databases to update their knowledge and to avoid reinventing the cycle. Additionally, there is no integrated network between academia entities that allows researcher to look for the lab equipment needed for their research. This equipment may be available in other institutes but nobody knows and if they are known, there is no access to them. In some academic institutes, it is permitted to use this equipment with a prepayment. This facility is valid in a limited scale and not utilized in an efficient way to satisfy the researchers' requirements, (Galal, E., 2001).

Technology transfer Barriers

The majority of the research entities and institutes are working in an isolated environment. On the other hand, some of them are not aware that there are other components are working in the same technology transfer field. There is no knowledge sharing and collaboration. They do not believe in networking due to many problems (e.g. governmental regulations, lack of trust, looking for self-appreciation, lack of integrated database and lack of innovation activities done by every entity), (Mowery, D. and Sampat, B., 2014). Every innovation needs a supportive and attractive market to efficiently and effectively utilize this new idea. There is a lack of Egyptian governmental support. Many of these inventions provide practical solutions for national social and economic problems (e.g. rice straw recycling and irrational usage of water). Unfortunately, there is a lack of strategy to introduce these inventions to the decision makers - at all governmental levels, (STDF, 2012). Researchers face many difficulties to meet any of the officials who can accept these inventions and turn them into real products and solutions. Additionally, there is no reward and incentives system that encourages the private sector to commercialize the university applications which can solve many national problems, (STDF, 2012).

Entrepreneurship Support & Spin-Offs Barriers

Despite there are some businesses and research incubators working in Egypt, there is no integrated network that allows establishing integrated relationship. As a result, some successful stories in these entities (e.g. Egyptian smart village) cannot be replicated or transferred because there is no way to exchange experience, training, mentoring, financial issues, stakeholders' requirements and structured business model.

Industry Academia Collaboration Barriers

There is no a common portal that allows access to the social and industrial problems. Many researchers complete their scientific research without looking to the problem's big picture. Therefore, many research results and solutions are not practical because it requires the business to replace its production line, increase the location area or even change the factory location, increase the power consumption or modify the products which could be impossible for many companies. There is a need for an integrated database that allows storing the industrial and social problems for future research to allow researchers to consider the business aspects from industry point of view and to know the social and business requirements, (R., Kashyout, B., & Sheta, 2013).

Additionally, the Egyptian industrial sector has no coherent link with the academia. Of course, there are some exceptions but the majority of the industrial entities is not aware of the academia inventions and considers them as a low-class quality production or impractical applications. Consequently, there is a need for a platform that allows the publication of Academia successful inventions' stories to build trust and permits strong long-term relationships.

In some universities, technology transfer office plays a central role in linking industry with Academia through promoting the university invention for few companies. However, the office does not play the opposite role of transferring the business requirements and problems to the researchers which ignores the most important element in new global marketing era that called" Customer-oriented approach". There is a need for a portal that allows industry to access their needs and requirements, (Greenhalgh, C. and Rogers, M., 2010).

Innovation Tool Box Barriers

Intellectual Property (IP)

There is a problem in intellectual property system in Egypt. The Egyptian Patent Office (EGPO) introduces a partial permission to the inventions patented in Egypt, (Galal, E., 2001). It publishes a periodical list of submitted patents that successfully pass the evaluation stage. Any researcher wants to look for a specific patent must sign a paid request and wait for a specific time to get the result. There is no online complete log-in to patents practical contents which hinder the Egyptian patents applications from local or international awareness, (Egypt Intellectual Property Law, 2002).

Information Service

The Egyptian institutes deal with all information as a military secret due to cultural problems which prevents entities from finding information about innovation activities in Egypt. Some entities build their own information system network but it is very limited and only accessible by their members. Academia inventions have no categorization mechanism that allows industrial and other stakeholders to differ between patented inventions and other available for license or even for sale, (Bond, Maram, & Soliman, 2013).

The Proposed Model -Intelligent National Innovation System (INIS)

The Architecture of the Purposed System

The process of designing IIS requires a holistic view of the sets of the different components that should be coherently connected and effectively managed to achieve the desired goal. The basic components of the system are shown in (Figure 2):

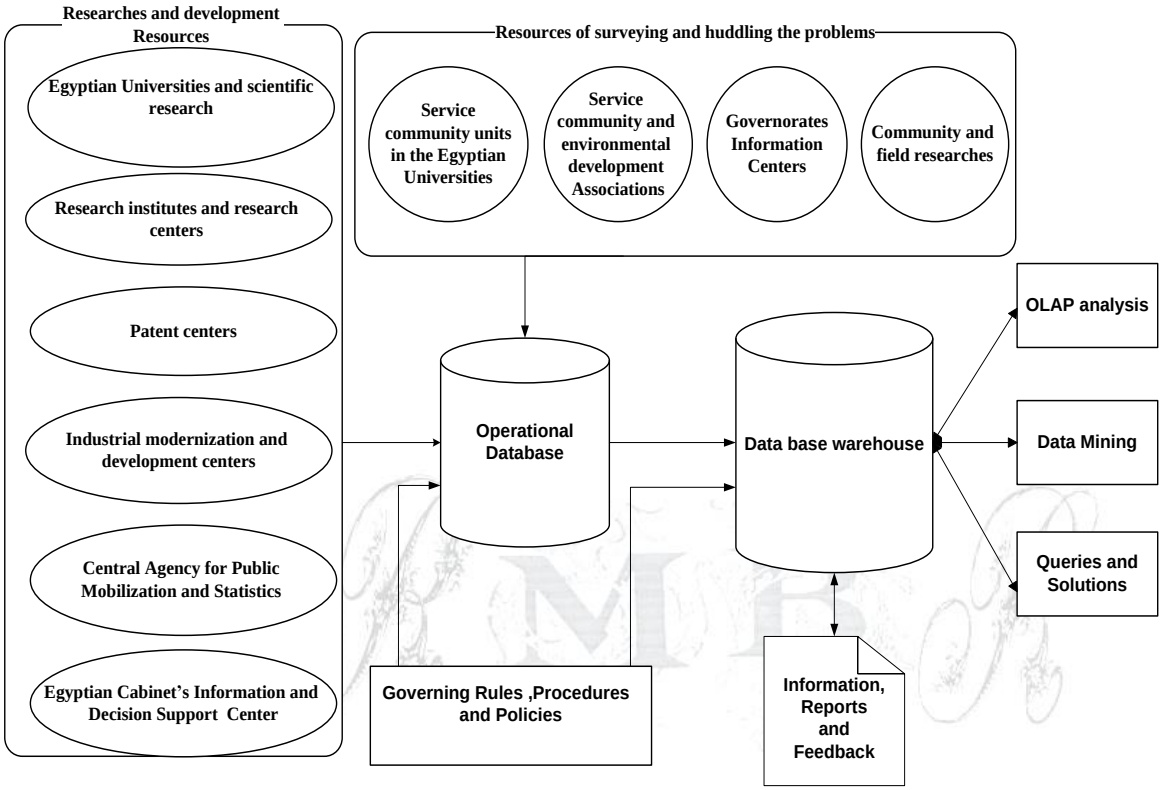

Figure 2: The structure components of the model

Integrated Research and Development System

These are the main infrastructure of the system to gather and store the innovation ecosystem basic components and available capabilities in every entity through an integrated database. This database should include the following information such as:

1. Up-to-date inventions. graduation projects and patents produced by universities, students, staff, and scientific institutes teams), (Bond, Maram, & Soliman, 2013)
2. Lab tools and equipment that available in all ecosystem entities with their capabilities and the procedures and fees –if any- required to use them (e.g. Universities, research institutes, governmental centers and private sector)
3. Technologies available for commercialization and licensing (e.g. universities, scientific centers, individuals and industry, Technology & Innovation Centers (TICs))
4. Investment opportunities and financial support agencies (e.g. ATTID, Nahdet El Mahrousa , Masr Alkhair, Agricultural Research & Development Fund, Industrial Modernization Center (IMC), Information Technology Industry Development Agency (ITIDA), European Union) with information about available funds opportunities, applications, process, terms and regulations)

5. Patent produced by research institutes, private sector and individuals and recorded in The Egyptian Patent Office (EGPO) and copyright centers
6. Entities that provide support for innovation and available services they offer (e.g. Technology Innovation and Entrepreneurship Center (TIEC), Technology Transfer Offices (TTOs) in these universities: Alexandria, Helwan, Cairo and Assuit University)
7. Co-operative research opportunities with local or foreign entities (e.g. European Union, Masr Alkhair, Academy of Scientific Research and Technology: Invention & Innovation Development Agency (IIDA), Newton-Mosharfa Organization, Ford and Fulbright), (R., Kashyout, B., & Sheta, 2013).

Social and Economic Problems Classifications System

This system is responsible for gathering and classifying the social and economic problems that face the industrial sector and different regions to find scientific and practical solutions to eliminate or mitigate their side effects. Then in future, the system can be supplied with new ideas required to achieve the economic development and welfare for the community. These problems should be gathered from:

[1] Service community units in the Egyptian universities and local governmental agencies
[2] Ministries Sectoral Decision Support System (DSS) (e.g. Environment, Finance, Foreign Affairs and Immigration, Industry and Trades and Economic etc.)
[3] Information and Decision Support Centre (IDSC)) related to the Egyptian cabinet
[4] Questionnaires and direct interview with every local region populations
[5] Foreign agencies reports (World Monetary Fund, United Nations, European Union and World Trade Organization and other international agencies), (STDF, 2012).

The System Databases

This IIS depends on two levels of databases to store, organize, manipulating and analyze the gathered data:

- Level I: - Operational Database: It is responsible for collecting research data from the first source (Integrated Innovation Entities System resources), as well as the compiling and collecting the social problems in the surrounding society from the second component (Social and Economic Problems Classifications System).

- Level II: - Analytical Database: It is a Data warehouse that is based on the artificial intelligence methods and techniques. Also, the analytical methods and Data Mining are used significantly to match the solutions with the actual problems and choose the most appropriate one.

Communications Networks

Communication network is one of the most important components to achieve the successful implementation of the IIS. Therefore, the system should depend on the most reliable methods of communication networks to inter-connect the components of the system and to achieve the desired goals. Virtual Private Network (VPN) is considered the suitable choice to accomplish the ease of use and reduce the communicating costs.

The Governance of the System

A set of procedures and governing rules are required to regulate the communications between entities and allows a smooth data flow. These procedures answer the main five functional questions (What, how, when, where and why). In addition, these procedures explain the operations, authority, responsibilities, management and the structure of the system.

System Security Tools

The system should include a range of modern and appropriate security tools. These instruments must be compatible with the importance of the system and the volume of information and data contained in this system. Additionally, the security tools safeguard and maintain the confidentiality of data, information and systems infrastructures as well as maintain the privacy of the communities, institutions and the other public / private components participated in the system.

System Data Flow

The systems data flow shows the main cycles and processes within the system operations. Figure 3) exhibits Data Flow Datagram (DFD) of the purposed IIS.

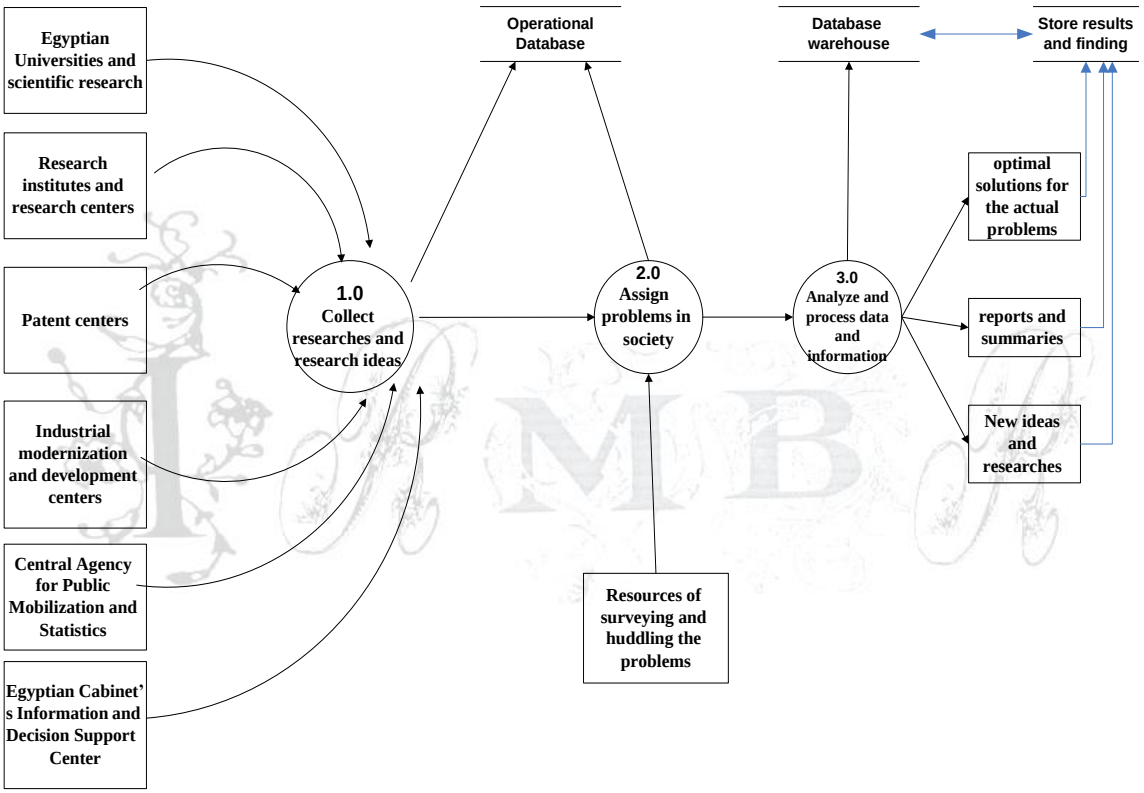

Figure 3: The System Data Flow

It represents the main operations of the innovation system that include the following processes:

1. Collect the researches and research ideas from the system data warehouse.
2. Assign and define the actual problems in the surrounding society.
3. Analyze and process the data and information that are collected in the system by using the methods and techniques of artificial intelligence and data mining, (Ouda, H.; Ahmed, K., 2014).
4. Specify and determine the optimal solution for the current problem of the society. The solution should be chosen among available alternatives and customized based on the required situation.
5. Propose and suggest new ideas and researches for the problems that did not be solved with the existent possible solutions.

6. Create and develop a set of reports and summaries that help public communities and institutions in making decisions pertaining to the process of community development and infrastructure process, (Galal, E., 2001).
7. Display a group of quick queries that benefit the community services.
8. Store all the results and findings that have been reached and linked them to the analytical database (Data warehouse) to facilitate the process of reusability of the same solutions to similar problems in the community or use them in other areas of the society. A learning organization approach is required, (R., Kashyout, B., & Sheta, 2013).

The Expected Contribution and Added Value of the System

Initially, the system can create an integrated online-collaboration base accessible by the local communities and contains all the required information about the innovation ecosystem entities (e.g. capabilities, activities and services) and current economic and social problems. This platform will save time, resources and prevent duplication of efforts. In addition, it could be an advanced stage in aligning the research community to achieve the centralized innovation strategy to modernize Egypt, (Mowery, D. and Sampat, B., 2014). Additionally, this system can be customized to integrate the current innovation entities databases to its data warehouse to save time and avoid starting from scratch. As a result, this intelligent system will promote the open innovation culture by allowing researchers, industrial sector and other stakeholders to search the Egyptian patent databases for free. As a result, innovation actors will be up-to-date with recent innovative ideas that can be applied and commercialized - in their areas of interest, (Chesbrough, H., 2006). And the system can be integrated and channeled with international databases (e.g. World Intellectual Property Organization (WIPO), European Patent office's (EPO) and USA Patent and Trade Mark Office (USPTO)) which allows marketing the Egyptian innovation and the increase opportunities of commercialization and effective exploitation of the system, (Galal, E., 2001).

On the other hand, the system is based on a customer-oriented approach. It means that the system allows innovation actors and researchers during their literature review period before starting the research to discover social and economic research gaps and industrial requirements. This step will save time, cost and will guarantee the practical applications of the invention because it is produced based on real customer requirement, (R., Kashyout, B., & Sheta, 2013). However, the system will play a vital role in protecting innovative ideas, patents and technologies recorded in the system through facilitating the procedures. As a result, the system will encourage innovation stakeholders to record their inventions and innovative ideas to be under the protection umbrella, (Galal, E., 2001). Moreover, the system can play an Innovation Decision Support System (IDSS) through generating regular periodical reports that include the ecosystem activities and up-to-date ideas and information, (STDF,2012). Consequently, the system encourages the open innovation culture. Therefore, researchers can complete others' patents and innovative ideas through open access patents. Meanwhile, collaborative research projects will be easier to be formed and connected, (Chesbrough, Vanhaverbeke, & West, 2006).

The system has a virtual map of all available scientific lap instruments and equipment in all innovation ecosystem entities (e.g. universities, research centers, private sector and governmental agencies). Most of these technological tools are very expensive. Therefore, this map will allow the full utilization of available resources through permitting the researchers from anywhere to use this infrastructure which will add value to the research and researcher. Meanwhile, the usage of these resources could be for suitable fees which can generate resources for these entities, (Tantawy H. and Becheikh M., 2012). The Funding agencies can use this platform to monitor their funds and the results of the research. Additionally, it could be used to find new innovative ideas deserve to be funded and supported, (R., Kashyout, B., & Sheta, 2013). Most of the generated innovations face marketing and commercialization obstacles. This system can play an essential role in promoting these introduced technologies and find a suitable market to be sold, (STDF, 2012). Finally, the system can play a vital role of building credibility and trust between industrial sector and

Academic entities through keeping industry aware of up-to-date inventions, patents and licensing opportunities, (Tantawy H. and Becheikh M., 2012).

Conclusion

Innovation can play a vital role in mitigating many of the Egyptian social and economic problems and can be integrated in the regional - economic development. The proposed Intelligent Innovation System is a unique approach that combines the advantages of NIS (e.g. idea bank, centralization, large resources etc.), the advantages of artificial intelligence and the advantages of RIS such as: customization, ease of use and the compatible solutions. This holistic system can be used as an advanced tool to solve the social and economic problems through building a large pool of innovative solutions customized based on the regional differences and characteristics.

References

Bond, M. (2013). Science and innovation in Egypt. Available at: http://royalsociety.org/policy/projects/atlas-islamicworld/egypt.

Chesbrough, H. (2006). *Open Business Models: How to Thrive in the New Innovation Landscape.* Boston, USA: Harvard Business School Press.

Chesbrough, H., Vanhaverbeke, W., & West, J. (2006). Open Innovation: Researching a New Paradigm. *Oxford University Press* .

Chiara V., Maria C., and Karen V. (2011). Integration and Selectivity in Open Innovation: An Empirical Analysis in SMEs. *World Academy of Science, Engineering and Technology* , 59.

De Backer, K.; López-Bassols, V.and Martinez C. . (2008). Open Innovation in a Global Perspective: What Do Existing Data Tell Us? 2008/4, . *OECD Science, Technology and Industry Working Papers, OECD Publishing, doi:10.1787/230073468188* .

Etzkowitz, H. and J. Dzisah. (2006). The Triple Helix in Development: Circulation of Elites among University-Industry-Government. *Conference on The Triple Helix Paradigm for development: Strategies for Cooperation and Exchange of Good Practice* .

Galal, E. (2001). The Developing Countries' Quest for a Code. International Technology Transfer, the Origins and Aftermath of the United Nations Negotiations on a Draft Code of Conduct. *The Hague: Kluwer Law International* , 199-208.

Government, E. (2002). *Egypt Intellectual Property Law.* Cairo: Available at http://www.wipo.int/clea/en/details.jsp?id=1301.

Greenhalgh C. and Rogers, M. (2010). Innovation, Intellectual Property and Economic Growth. *Princeton University Press.*

Hahn and Köcker . (2008). The Egyptian Innovation System- An Exploratory Study with Specific Focus on Egyptian Technology Transfer and Innovation Centers. *Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, German Technical Cooperation. http:/* .

Mowery, D. and Sampat, B. (2014). Universities in National Innovation Systems, in J. Fagerberg, D.C. Mowery, and R.R. Nelson, eds., Oxford Handbook of Innovation. *Oxford: Oxford University Press* .

OECD. (2010). Reviews of National Policies for Education: Higher Education in Egypt. *Paris: OECD.*

OECD. (2013). Regions and Innovation: Collaborating across Borders, . *OECD Reviews of Regional Innovation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264205307-en* .

Ouda, H.; Ahmed, K. (2014). Public Universities Faculty and Leaders' Perspectives on the Role of Public Egyptian Universities in Developing National Innovation System. *Journal of Education and Practice , Vol.5,* (No.36).

STDF. (2012). Egypt Innovation Ecosystem. *STDF. (2012). Egypt Inn Egypt Innovation Support Department - Science & Technology Development Fund, Cairo, Egypt* .

Tantawy H. and Becheikh M. (2012). How to promote open innovation in Egypt? answers from the Egyptian national innovation survey. *Entrepreneurship and Innovation: Shaping the Future of Egypt* .

Watkins, A.; Papaioannou, T.; Mugwagwa, J.; Kale, D. (2015). National Innovation Systems and the Intermediary Role of Industry Association in Building Institutional Capabilities for Innovation developing countries: A Critical Review of the Literature. *Elsevier: Research Policy* , 1407–1418.

WIPO. (2007). *Global Innovation Index Ranking.* World Intellectual Property Organization.

WIPO. (2009). *Global Innovation Index Ranking.* World Intellectual Property Organization.

WIPO. (2011). *Global Innovation Index Ranking.* World Intellectual Property Organization.

WIPO. (2013). *Global Innovation Index Ranking* . World Intellectual Property Organization .

WIPO. (2015). *Global Innovation Index Ranking,* . World Intellectual Property Organization.

Yasser R. ; Kashyout, Abdel-Hady B. ; Sheta, Walaa M. (2013). Egypt's Science and Technology Parks Outlook : A Focus on SRTACity (City for Scientific Research and Technology Applications). *World Technopolis Review: World Technopolis Association. doi: 10.7165/wtr2013.2.2.96* (2), 96-108.