

Third Pillar: Knowledge, Innovation and Scientific Research

Overview of Current Situation

The concept of knowledge, innovation, and scientific research expands to include the production and transfer of knowledge in all forms within various education levels, mechanisms of nurturing youth, fostering talents, as well as encouraging innovation, scientific research, and academic cognitive contribution. The definition also expands to include different fields of application through which the effect of knowledge on "quality of human life" could be determined.

The knowledge and innovation environment consists of the following group of elements and components:

- **General environment:** Represents the role of the State in the creation of an environment that encourages innovation, including motivators and constraints, the economic system, policies, legislation, and principles of governance.
- **Infrastructure:** Play a fundamental role in supporting the cognitive and creative production by setting standards and laying regulatory foundations of innovation and scientific research, supporting business and innovation, protecting copyright, ensuring availability of information, financing and encouraging investment.
- **Education and scientific research:** Includes all research organizations and institutions, technical education and vocational training institutions, higher education and scientific research institutions, and research centers.
- **Industry:** Represents all industrial sectors including large, medium, and small scale companies' activities relevant to research and development.
- **Intermediaries:** Includes the institutions that link between industrial innovation, and research and development on the one hand, with academic and research institutions on the other hand.
- **Development needs:** Represents the required demand for innovation, knowledge, and scientific research to fulfill economic and social needs.

The information and communications technology sector in Egypt is one of the driving sectors that encourages innovation and knowledge. The annual growth rate of the number of companies operating in the fields of IT and communications has reached 13.5%.^[1] This sector succeeded in achieving increased growth rates that required speeding up the development of the information technology infrastructure all over the country and increasing the number of graduates from engineering and information technology educational institutes. Also, the research society

¹ Business Monitor International, 2010, Egypt Information Technology Report, Q4 2010

succeeded in achieving many positive indicators such as the average success of Egypt in "Citation Impact Indicator" in the mathematical research field. Moreover, Egypt ranked 48th out of 132 countries in citation impact indicator (H-index) for the year 2013, while Alexandria University ranked 147th in the Times Higher Education World University Rankings for the year 2010, which highlights the first instance of an Egyptian University being classified among the top 200 universities internationally, due to the high quality of mathematics and physics research.

Knowledge, innovation, and scientific research contribute in achieving the goals of sustainable development in general, whether national or international, where the increase in the contribution of a large number of economic sectors in economic activity can be achieved by connecting scientific research outputs and innovation by the needs of these sectors. Also, raising the quality of life of citizens and the development of public services in sectors such as traffic, drinking water, sanitation, housing, energy, environment, health, and education depends largely on knowledge, innovation, and scientific research.

In order to achieve these goals, knowledge, innovation, and scientific research must overcome the challenges they face, especially their poor funding share in the government budget, and from the private sector and civil society. Also, efforts should be made to raise awareness of the importance of these activities to achieve higher rates of sustainable development and to encourage young people to participate in scientific research and innovation through small projects and entrepreneurial initiatives.

The following is a description of the vision and strategic vision of knowledge, innovation, and scientific research and performance measurement indicators and the most important challenges it faces in addition to the most important programs to achieve this vision.

Strategic Vision for Knowledge, Innovation, and Scientific Research to 2030

A creative and innovative society producing science, technology, and knowledge, within a comprehensive system ensuring the developmental value of knowledge and innovation and using their outputs to face challenges and meet national objectives.

This vision is centered on the provision of all necessary factors that enable the conversion of knowledge, innovation, and scientific research into a valuable product that can be measured and satisfies the developmental needs of the State during the next 15 years.

Strategic Objectives for Knowledge, Innovation, and Scientific Research to 2030

The strategic vision for knowledge, innovation, and scientific research focuses on accomplishing three main objectives within the next 15 years, as follows:

Objective	Definition
Creation of a stimulating environment for the localization and production of knowledge	Maximizing knowledge production by enhancing the legislative, investment, and financing environments and providing the fundamental infrastructure
Activation and development of an integrated national innovation system	Enhancing the efficiency of innovation production by encouraging creative production, increasing the links between innovation and developmental needs, the development of basic education and higher education as well as research and development
Linking the knowledge applications and the innovation outputs with priorities	Determining the sectorial priorities and challenges, how to address them by working on increasing the knowledge product for the priority sectors and by raising the local content

The first objective is specialized in developing knowledge by creating a stimulating environment of legislation, investment policies, and financing facilities, in addition to the development of logistics, information technology, and environmental sustainability infrastructure. It also focuses on maximizing economic and social knowledge production.

The second objective is to establish and develop a comprehensive national system for innovation, able to transform knowledge into a developmental value by developing primary education, higher education, as well as research. This objective also focuses on encouraging innovative production, increasing links between innovation and needs, and enhancing the companies' ability to innovate in order to maximize knowledge impact.

The third objective is to determine sectorial priorities and challenges and how to address them by increasing innovation expenditure within various sectors, whether from domestic or foreign resources or from the private sector, with a focus on private sector outputs and increasing the percentage of the sectorial local content.

Key Performance Indicators for Knowledge, Innovation, and Scientific Research to 2030

Key performance indicators include the indicators that currently exist at the levels of inputs, outputs, and strategic results. Thus, current and targeted values, by the years 2020 and 2030, of

such indicators were determined, as well as suggested new indicators that will be added into a suitable framework for the purpose of evaluation in collaboration with the concerned parties, as per the following:

Quantitative Indicators

S.N	Indicator Category	Indicator	Definition	Current Status ⁽¹⁾	2020 Target	2030 Target
1	Strategic Results	Global innovation index (rank)	Measures the relative level of innovation in Egypt through high-impact factors, (e.g. human factors, legislative and economic stimulating environment, infrastructure, creative outputs, and its impact on the economy	99	85	60
2		Innovation efficiency ratio	Measures Egypt's innovation and knowledge efficiency compared with other countries, which enhances the innovation system	0.8	0.85	1
3		Companies' innovation capacity index (rank)	Measures the ability of companies to innovate, which in its turn demonstrates the development of the private sector's ability to innovate	132 ^[2]	100	60
4		Knowledge impact sub-index of the global innovation index (rank)	Measures the utilization development from knowledge production in growth and business management	89	80	60
5		Knowledge transfer sub-index of the global innovation index (rank)	Measures the development in exporting knowledge and consequently it reflects how far knowledge is connected to developmental objectives	69	60	30
6		Innovative products	Measures the development of creative production at	98	85	60

S.N	Indicator Category	Indicator	Definition	Current Status ⁽¹⁾	2020 Target	2030 Target
		and services sub-index of the global innovation index (rank)	domestic and international levels			
7	Output	Information and communications technology sub-index of the global innovation index (rank)	Measures the ICT level and reflects Egypt's progress in using technology as a key factor in the innovation system	73	50	30
8		Public infrastructure sub-index of the global innovation index (rank)	Measures development in providing the required public infrastructure for sustainable development and consequently the tools required for knowledge production efficiency	121	100	60
9		Environmental sustainability sub-index of the global innovation index (rank)	Measures development in stimulating and controlling environmental performance required for sustainable development and consequently required for knowledge production efficiency	65	50	30
10		Knowledge contribution sub-index of the global innovation index (rank)	Measures development in knowledge production at research and innovation levels	71	50	30
11		Intangible assets sub-index of the global	Measures development in the production of registered applications as a result of how far knowledge is linked to	89	80	60

S.N	Indicator Category	Indicator	Definition	Current Status ⁽¹⁾	2020 Target	2030 Target
		innovation index (rank)	business			
12		Digital creativity sub-index of the global innovation index (rank)	Measures development in the production of digital creativity compared with other countries	74	60	30
13		Innovation linkages sub-index of the global innovation index (rank)	Measures development in building linkages and incentives for cooperation between the knowledge productive sector and the beneficiary sector	70	60	30
14		Quality of scientific research institutions	Represents the development level of scientific research institutions	135 ^[2]	100	60
15		Credit facilities sub-index of the global innovation index (rank)	Measures development in facilitating and providing the necessary funds in order to stimulate innovation	123	100	60
16	Input	Investment sub-index of the global innovation index (rank)	Measures development in providing investment in order to stimulate innovation	138	100	60
17		Trade and competition sub-index of the global innovation index (rank)	Measures development in facilitating taxation procedures and achieving transparency to guarantee a competitive environment that encourages innovation	124	100	60

S.N	Indicator Category	Indicator	Definition	Current Status ⁽¹⁾	2020 Target	2030 Target
18		Legislative environment sub-index of the global innovation index (rank)	Measures development in enhancing a legislative environment that encourages an innovation system	131	100	60
19		Business environment sub-index of the global innovation index (rank)	Measures development in enhancing the business environment, which contributes to and enhances the innovation system's efficiency	105	90	60
20		Education sub-index of the global innovation index (rank)	Measures development in education, which is necessary to stimulate sustainable innovation	53	50	30
21		Higher education sub-index of the global innovation index (rank)	Measures development in attracting higher education students	102	90	60
22		Research and development sub-index of the global innovation index (rank)	Measures the development level of R&D and expresses the evolution in knowledge production	50	40	30
23		Knowledge absorption sub-index of the global innovation index (rank)	Measures the knowledge capacity and expresses the technological development level of imports.	119	100	60

S.N	Indicator Category	Indicator	Definition	Current Status ⁽¹⁾	2020 Target	2030 Target
24		Knowledge workers sub-index of the global innovation index (rank)	Measures development in utilizing high-knowledge labor and consequently it measures how far knowledge is linked to business	69	50	30

⁽¹⁾ Source: World Intellectual Property Organization, 2014, the Global Innovation Index.

⁽²⁾ Source: The World Economic Forum, 2013, The Global Competitiveness Report.

Suggested New Indicators

S.N	Indicator Category	Indicator	Definition	Measurement Mechanism
1	Strategic results	Ratio of knowledge economy contribution to GDP	Measures how far the economy of research and development is contributing to GDP, representing the importance of the knowledge economy in Egypt's priorities	All expenditures on innovation and R&D shall be calculated. Expenditure includes government, private sector, and civil society from domestic and international resources as a percentage of GDP.
2		Social return on investment in innovation	Measures the impact of expenditure on innovation on Egyptian society and turns it into financial returns in order to ensure the development of an environment that encourages innovation	A combination of qualitative and quantitative indicators, measuring investments returns of innovation on society in general
3		Ratio of local content to gross national manufacturing	This indicator shows how far local content is contributing to gross national manufacturing in order to measure the development of knowledge localization	The ratio of local content in the various productive sectors shall be determined upon accurate collection of data and classification into sectorial indicators and then the overall percentage shall be calculated
4		Sectorial ratio for local component to gross	This indicator shows how far local content is contributing	

S.N	Indicator Category	Indicator	Definition	Measurement Mechanism
		national manufacturing	to gross sectorial manufacturing, which illustrates Egypt's progress in knowledge localization in areas of national priority and interest	
5	Outputs	Number of small and medium companies contracting with government	It represents the government's efforts towards knowledge localization through contracting with small and medium-sized companies	Sectors with high priority at the national level shall be determined in light of fully integrated future studies and then limit the number of small and medium-sized companies contracting with the government in those sectorial fields
6		Number of international awards in the innovation field	This indicator shows Egypt's global place among others in the innovation field	Internationally recognized awards related to innovation, knowledge, and scientific research shall be determined and then limit the Egyptian share of such awards
7		Number of newly founded companies in each sector	This indicator expresses the priority sectors	Limit the number of new companies in sectors with high priority
8		Ratio of companies practicing innovation and R&D for each sector	This indicator represents the number of companies efficiently contributing to the role of the private sector in developing and growing knowledge as well as the ability of the government to stimulate such contributions, which serve sustainable development priorities	Limit the number of companies practicing innovation and R&D in sectors with high priority
9		Number of patents per sector	This indicator represents the ability to innovate in the priority sectors in order to	Limit the number of patents in sectors with high priority

S.N	Indicator Category	Indicator	Definition	Measurement Mechanism
			localize knowledge and protect its rights	
10	Inputs	Ratio of sectorial budget expenditure on innovation, research, and development	This indicator represents the development of innovation at sectorial level and emphasizes the national priorities of sustainable development	Measure the percentage of expenditure on innovation and R&D to the gross expenditure on sectors with high priority
11		Ratio of companies' contributions to total sectorial expenditure on innovation and R&D	This indicator measures the contribution of the private sector in developing knowledge, which serves the priorities of sustainable development	Estimating the percentage of company contributions to total expenditure on innovation and R&D in sectors with high priority
12		Ratio of international funding for innovation, research and development to total funding	This indicator represents the ability to attract foreign investments to priority sectors, in order to transfer and localize knowledge	Estimating the ratio of international funding allocated for innovation and R&D to the total funding allocated for various national priority sectors
13		Ratio of foreign funding to small and medium companies	This indicator represents how far knowledge is localized in terms of knowledge transferred from abroad to small and medium-sized enterprises	Measurement is performed by determining the percentage of international funding allocated for innovation and R&D of the total expenditure of small and medium-sized companies on sectors with high priorities

Challenges of Innovation, Knowledge, and Scientific Research

Challenges related to innovation, knowledge, and scientific research are divided into three main groups:

The first group is characterized by its high impact and relative ease to control, hence it attracts the biggest share of attention as they could be encountered and overcome much easier compared with others. It includes:

- **Legislative system being poor in motivating and protecting innovation:** There is an absolute necessity to review legislation relevant to innovation protection, and develop an incentives structure, governmental expenditures, and protection of intellectual rights in order to achieve a motivating environment for innovation.
- **Poor coordination between social needs and innovation:** This can be observed in the low proportion of local content in several vital sectors as well as not taking advantage of scientific research outputs in facing the main challenges encountering Egyptian society.

The second group of challenges could be overcome, yet it has a relative and limited impact, including:

- **Inefficient sectorial planning:** Sectorial planning must be focused on defining national priorities and linking them to the system of innovation, knowledge, and scientific research to achieve high levels of competitiveness and sustainability for industries and strategic sectors in Egypt.
- **Lack of a comprehensive mechanism connecting knowledge with innovation:** Due to the lack of a proper comprehensive mechanism to connect knowledge with innovation, the development of curricula and educational methods became irrelevant to beneficial social or economic innovation production, which in its turn led to significant imports of technology.
- **Insufficient economic and financing incentives for innovation:** Limited low expenditure allocated for scientific research and development has a negative effect on knowledge production as a result.
- **Medium and small companies' inability to produce and market innovation:** Due to the high costs of such activities, this consequently undermines their financial capacities.

The third group of challenges is characterized by its high impact and its long-term nature to be overcome:

- **Poor innovation culture of society:** This is one of the most difficult challenges facing the development of innovation, knowledge, and scientific research in Egypt, due to decades of inherited negligence, whether in the terms of instilling the culture of innovation in youth, or in fostering talents in schools, or in creative appreciation and motivation.

- **Poor awareness of the importance of intellectual property and its protection:** In light of the limited implementation of Intellectual Property Laws in Egypt, researchers and innovators do not enjoy their intellectual rights. Violations and infringements are not being prosecuted properly because all parties, whether producers or consumers of innovation, are not aware of the importance of intellectual property protection and its role in motivating and protecting innovation in Egypt.

Innovation, Knowledge, and Scientific Research Programs to 2030

In the comprehensive framework, strategic objectives of innovation, knowledge, and scientific research and performance indicators identified to measure the extent of progress provisionally made until these objectives are achieved and its positive outcome on the future visions of innovation, knowledge, and scientific research in Egypt by the year 2030, in addition to the government program policies, programs, and projects for 2016-2017 in order to develop innovation, knowledge, and scientific research, the following are the most important programs identified that are expected to make great contributions in achieving these visions, objectives, and indicators:

Legislation and Governance

Carrying out legal reform related to knowledge and innovation:

- **Program Description:** A comprehensive review of all legislation and laws related to knowledge and innovation in various sectors such as higher education, scientific research, investment, tax incentives systems, governmental expenditures, and intellectual property protection. It can be done through serious communal dialogue in which all of civil society and the private sector are represented, to contribute in the formation of a motivating environment for the production of knowledge and innovation. The review and amendment of this legislation is scheduled to be performed by the year 2017. This is a low-cost program.
- **Key Elements:**
 - Reviewing intellectual property legislation and implementation methods to promote the protection principles of knowledge, scientific research, and innovation.
 - Reviewing the investment law in the manner that provide incentives for investors investing in scientific research, as well as to motivate them to re-invest a minimum share of profits in the areas of research and development in their business.
 - Reviewing legislation on university regulations in the manner that integrates innovation into the course of career progression and promotion, in order to encourage the academic role in innovation.

- Reviewing the taxation legislation governing the investment system in the manner that grants tax exemptions for research and investment in high-risk activities in terms of research investment volume or its returns.
- Reviewing higher education legislation in the manner that motivates high-impact innovative and research production.
- Reviewing scientific research legislation to provide innovators at universities and research institutions with the right to establish and incorporate companies without prejudice to their academic and research responsibilities.
- Reviewing the legislation governing the customs system in the manner that motivates and protects the local content in the industry.
- Reviewing the laws of tenders and auctions in the manner that gives priority to national companies, products, and services.

Developing and restructuring the knowledge and innovation system:

- **Program Description:** Enhancing the efficiency of knowledge and innovation management systems through the restructuring and implementation of rational governance rules and regulations in a manner that achieves coordination and integration among them and the strategic priorities for sustainable development. The implementation of this program is scheduled to start by 2016 and to be fully implemented by 2030. This is a low-cost program.
- **Key Elements:**
 - Mapping innovation priorities through liaison and coordination among all outputs of future plans at the national and sectorial levels.
 - Achieving full integration among the ministries relevant to pre-university, university, and technical education as well as scientific research, to enhance institutional efficiency and to achieve better utilization of resources with respect to governance, management, rationing, and development of scientific, informational, educational, research, and innovative work.

Programs to Support Achievement of the Vision and Strategic Objectives

Adopting a comprehensive program to promote an innovation and knowledge culture:

- **Program Description:** Encouraging creative thinking and the development of an innovation culture among youth and community through achieving integration between the concerned parties by a number of motivation and awareness initiatives. The implementation duration of this program is expected to start by 2016 and to continue until 2025. This is a medium-cost program.

- **Key Elements:**
 - Reviving exploration centers in schools in order to support and develop talents required to serve national priorities.
 - Developing educational curricula and expanding the application of methods and tools that encourage creative thinking and develop the culture of innovation.
 - Expanding academic programs specialized in the field of innovation management in order to prepare and develop domestic qualified cadres.
 - Implementing adequate media coverage to spread success stories, awareness of the innovation concept, and its importance.
 - Launching a number of innovation events, competitions, and awards in the priority sectors in collaboration with private sector companies.

Developing a comprehensive program to stimulate innovation activities by SMEs:

- **Program Description:** Creating a motivating and enabling environment for small, medium-sized, and new companies allowing them the ability to innovate and maximize their investment returns and linking it to the national priorities in a manner that contributes to the maximization of competitive advantages and the added value of the domestic product. The implementation duration of this program is expected to start by 2020 and to be fully implemented by 2030. This is a high-cost program.
- **Key Elements:**
 - Creating innovation clusters in the high priority fields to maximize the competitive advantage and the added value of the domestic product.
 - Establishing entrepreneurship incubators to enable new, small, and medium-sized companies to innovate.

Activating public–private partnerships to support and stimulate innovation:

- **Program Description:** Supporting the partnership between the public and private sectors to maximize the volume of investment in innovation and the creation of possible conditions to ensure rewarding returns, as well as integrating the knowledge output with the market needs. The implementation duration of this partnership is expected to start by 2016 and to be fully implemented by 2020. This is a low-cost program.
- **Key Elements:**
 - Adopting a package of financial and marketing incentives to encourage the private sector in order to innovate.

- Expanding partnerships between academic and research institutions and the private sector in order to link knowledge outputs with the needs of the market.

