

Research institutes complement universities by providing targeted focus on particular research topics

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Abstract

Research capacity and capabilities often differentiates developing and developed economies, and has been linked to the innovative capacity of a country at developing new products and services using knowledge gained from basic science research. Thus, countries with significant manufacturing capabilities at leading edge products and skilled manpower able to perform high end trouble-shooting and problem-solving often take the plunge in directing more resources into building a vibrant research ecosystem aimed at specific areas of science and engineering thought to be capable of powering economic growth. However, the key question continues to be: the relative emphasis between universities and research institutes given that both perform complementary roles in enabling research and development activities and capacity building. Specifically, the traditional focus of universities lay in fundamental research into natural sciences and engineering, while educating the next generation of scientists and engineers in the process. On the other hand, research institutes are often developed as specific centers of excellence such as in nanotechnology and stem cell biology, thought to be important to developing critical foundational capabilities in nascent fields. However, research institutes with narrowly defined research focus areas often lack the ability to think out of the confines of a research area in seeking complementary synergies with allied fields in solving important problems in science and engineering that often spans multiple overlapping fields. Hence, research institutes' roles in society, and specifically, contribution to the development of a nation's scientific capacity and capabilities rest critically in its organization, particularly its mission and focus areas. Typically, broadly defined research institutes gain greater synergies between different fields hosted outside or within the same institute; thereby, enabling the education and development of scientists able to grapple with interdisciplinary problems of importance. But, at the fundamental level, research institutes serve a singular and unified role: devotion of more resources and manpower to important problems that hamper the development of new methodologies and ability to understand nature, which, from an economic perspective, serve as future growth engines of a mature economy.

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As a country develops and its economy matures, there would be a need to expand from standard manufacturing that produces daily use goods and services, to value-added manufacturing

that generates new products that hopefully defines a new category of services and manufactured goods. Herein reveals the importance of research and development, as well as innovation to providing the creative ideas that would sow the seeds of new products, and maybe, new industries.

But, what should a country do to get there? Specifically, what can a country do to propel itself into the league of innovators, rather than staying in the framework of manufacturers? Casting a glance at the developmental trajectories of advanced economies, countries leapfrog into the innovative economy after they have amassed a critical mass of mid-range and advanced manufacturing capacity and capabilities, which also has the add-on effect of training a sizeable population of trained technicians and engineers able to learn and adapt new technologies to local needs.

Once a country has significant manufacturing capabilities, one important area for the economy to focus on would be to develop its innovative and research and development capacity through the education of scientists and engineers able to undertake research activities for developing new manufacturing technologies, as well as understanding the natural world. The latter is crucial, for investments in basic and fundamental research yield understanding that underpin further research into developing new technologies and products from basic knowledge.

If research is important for training the necessary manpower to propel the economy to its next stage of development, a healthy research ecosystem comprising universities and research institutes is a must. Specifically, universities serve the traditional manpower training role through its research-based postgraduate programs, while also seeking out new facets of basic knowledge of the natural sciences and engineering, and at the same time, developing applications and products out of new knowledge gleaned.

Research institutes, on the other hand, serve the complementary role of providing the facilities and environment for dedicated research programs aimed at developing the economy's capabilities at delivering new innovative capacity (i.e., manpower training), as well as new products, applications and technologies. The last is important, because it is through technology development and methodology improvement that a nation move up the ladder in innovation.

But, what is the place of research institutes in the research ecosystem? Doesn't it overlap in function with the universities? The answer is no. Research institutes, whose focus are research areas of fundamental importance to the basic sciences and engineering, would deliver by serving as focus innovation hotbeds for targeted research into specific areas of importance to the country such as basic areas of cell and molecular biology, nanotechnology, and bioprocessing. Hence, research institutes created to investigate, holistically, specific fundamental areas of science and

engineering such as cell biology, bioinformatics, nanotechnology, and biotechnology, would likely deliver greater dividend than similar research institutes aimed at specific research areas such as colloids and surface science, where a broader research focus such as materials research and engineering would be able to draw on more areas to seek complementary focus points of incision into a hard research problem.

Hence, research and innovation are key areas of focus for middle-income countries aiming to move up the economic development ladder, after they have accumulated significant capability in manufacturing and engineering through a sizeable talent pool skilled in technical troubleshooting. Investments in creating an innovative ecosystem would naturally direct substantial funds into universities and research institutes. In particular, research institutes serve the often misunderstood but critically important role of allowing a nation to focus on specific areas of science and engineering for creating new knowledge and capabilities to propel an economy forward. Specifically, using public research funds, well-conceived research institutes that focus on broad areas of fundamental interests such as cell and molecular biology, would continuously innovate and re-invigorate as research problems shift and trends realign in research. Therefore, research institutes occupy an important place in the research ecosystem, complementing the universities in allowing more human resources to be directed at specific areas of contemporary worldwide interest, while helping provide training facilities and programs for the next generation of scientists and engineers.

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