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Multi-disciplinary Experimental Research, Innovation and Commercialization – A Sri Lankan Perspective

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"Research" is a common word in use with many varying meanings in the present world. However, when the term "experimental research" is referred, it carries a definite concept which is a key tool board of the modern research scientist. It can be simply explained as "**a study that strictly adheres to a scientific research design**, which includes a hypothesis, a variable that can be manipulated by the researcher, and variables that can be measured, calculated, and compared. The research scientist collects data and results which either support or reject the hypothesis". This may be complex and tedious in execution than said, with respect to subjects and problems handled. However, clear, and deep knowledge in basic concepts of experimental research including identification and define of a research problem, hypothesis building, drawing of research objectives, experiment design, reliable execution of experiments and data collection, statistical data analysis, drawing conclusion and reporting, is a much-needed pre-requisites for successful completion of a research leading to new knowledge and innovations.

The research and innovations are being positioned on very high note in current global economic and political context, even we, as a nation have failed to pay sufficient attention so far. Even now, it will not be too late to understand the role and gravity of research, innovation, and commercialization in social and economic development, and try to bring up much needed attitude, cultural and policy enhancements in all sectors including school education, university, scientific community, and industry. In this scenario, here, I am trying to discuss some of my thoughts on the above areas with my learnings and experience in research, innovation, and their commercialization in local Sri Lankan conditions during past two decades.

Global Innovation Index (GII), is an indicator used by World Intellectual Property Organization (WIPO), to assess the level of innovation and commercialization in each country at global level. GII value is based on two basic sub-indicators, innovation input index and innovation output index, which are composed with five pillars (Institutions, Human capital and

research, Infrastructure, Market sophistication, and Business sophistication) and two pillars (Knowledge and technology outputs and Creative outputs) respectively. Each of these pillars described an attribute of innovation and comprise up to five indicators and their scores are calculated by the weighted average method. (https://www.wipo.int/edocs/pubdocs/en/ wipo_pub_gii_2016-annex1.pdf) According to GII ranking of year 2019, Sri Lanka is positioned at 89th place, below than all the countries in the region. The position in this GII shows a good corelation with wealthiness and economic strength of countries, the top ranked countries are with richest global economies and shared all top 20 leading global companies (all these companies are technology/innovation driven). This strongly suggests that any nation with a true intention of having good economic status, need to focus on research, innovation and commercialization.

We as Sri Lankans, are still seating behind in this area and relies on old type source of income (foreign) according to the report of Export development Board (EDB) Sri Lanka, in year 2020, only 11% of total exports came from innovations/technology related products/services, which mainly include the ICT. Almost 90 % is still remaining on conventional agricultural products and raw minerals. This strongly suggest that we are not properly oriented research and innovation in the way of national economic and social development. Thus, let us have a critical look into current scenario of research, academic, innovation and technology business in which we are also having a part to play. As per the GII, five different segments are considered as key inputs for innovation, however here in the analysis of Sri Lankan situation, extent of investment (institution & infrastructure cover here), human capital, researcher work climate and culture, business climate and innovation and regulatory and policy are considered.

Right proportion of investment on segments related to innovation inputs is the key for development and sustainability in this area. Our national investment in research and development sector recorded the least value in the region which was 0.13% of GDP in year 2018 where the southeast Asian region value was 0.6% and average of global investment was 1.6 % and countries at top of the GII ranking spend around 2 to 3% of their GDPs. However, just unplanned loading of investments also will not give favourable results as there are other critical sectors to be move along with the investment to harness the results of the investments. Increase of investment in innovation inputs in Sri Lanka need to be done with properly aligned policies. Along with the investment, human capital is the most critical factor in research, innovation and commercialization. Even though Sri Lanka is reported to record highest literacy rate in the region for longer time along with free education up to higher

education level, we are having the lowest scientists/researcher density in the region. Active researcher per 1 million of the population is the indicator use to assess the human capital in GII, where it is around 150 to 200 in our region and in top ranking countries this is higher as 2,000 to 4,000. Unfortunately, in Sri Lanka this was reported as around 100 in 2017 (NSF report).

It is apparent, collectively the low investment and low human capital in innovation inputs mainly contribute the low innovation outputs, however, still an argument exits in our innovation outputs in the areas of low and middle end technologies which could be possible with the available resources and investment. Major contributors for very low level in commercialization of research innovation is our poor research culture and unconducive policies in bioprospecting, regulation, monitoring, etc., with traditional business culture with low level of business innovations.

Majority of our experimental research carry good invention with technical merits which basically contributes to publications and as a partial qualification for academic degree. But its maturation to innovation is not sufficiently powered or attained most often. This step essentially demands a multidisciplinary approach with experts in the areas beyond your technical subject such as Intellectual property (IP), legal, entrepreneurial expert, investor, process engineer, environment expert, costing and financing experts, marketer, ICT expert, etc., which seems lacking in our system very much. Further, development of an invention to the level of innovation high depends on the extent of knowledge developed in specific area, this need long term (may be 10 yrs) consistent work on the same area covering all aspects related to bring it to a level of feasible business. Few areas to be concern are raw material/input availability, value addition to waste, energy, target market, marketing strategy, product/service quality maintenance, sustainability, cost of investment and cost of operations. In the event of manufacturing industries and related innovations, as a small nation we face very specific problem of scale of business and technology as our local market is comparatively small, making it difficult in product price competition with most of similar or completive products from global mega scale manufactures. One good way of handling this is to specifically focus our research on very specific high value added products targeting markets beyond Sri Lanka. Focus on quality and specificity (market) over quantity will give you a change to get good margin and advantage in price competition. However, still there is an issue of capacity (over capacity) of machineries which we import for these industries, making it running at under capacity, again contributing to higher cost of production. This need be addressed by local engineers with the support of national authorities.

We at the level of scientist and budding scientists need to think different to change this “Hen and Egg” scenario of low innovation output and low investment on innovation inputs. I hope the idea put forward at the first international undergraduate research symposium of Ruhuna University, organized by RUSREC will help to induce some way forward thinking among young researchers who can bring much needed changes to this country.