INNOVATION AND CREATIVITY: A MUST NOT ONLY FOR SURVIVAL BUT ALSO FOR PROSPERITY

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Modern economies should be aptly termed innovation or creative economies

Modern economies are often called knowledge economies because they rely on knowledge for survival and sustenance. The period within which knowledge is said to have reigned the world spanned roughly for about five decades starting from the middle of the 20th century to its end. During that period, the development of knowledge creating activities, namely, education, training and learning received the highest priority in public policy making. However, with the onset of the 21st century, the order of the world has substantially changed making knowledge a necessary but not a sufficient condition for continued prosperity of nations. In the current context, knowledge still has to lay the foundation for a nation to survive, sustain and prosper. It has now been recognised that with knowledge, there should be two other conditions that have to be put in place for knowledge to deliver its intended promise. They are 'innovation and creativity' which are used interchangeably to denote the same requirement. Hence, modern economies are called 'innovation economies' or interchangeably, 'creative economies'.

Need for using knowledge in practice has been emphasised all the time

Thus, a nation desirous of surviving and prospering should necessarily embrace 'innovation and creativity' with fervour and reverence. Even in ancient times, it was recognised that knowledge without ability to apply in practice did not serve the person who has acquired knowledge or the society he lives in. Chinese philosopher, Lao Tsu who lived in the 5th century BCE is said to have emphasised the importance of practice when he said that 'knowledge is a treasure, but practice is the key to it'[1] . The 4th century BCE Indian Guru, Chanakya, also known as Kautilya, said in Chankya Neethi that 'there is no use of knowledge confined to books only' meaning that knowledge, for its proper benefit, has to be applied in practice[2] . Alison Wolf, London University's Professor of Education, has argued in her 2002 book 'Does Education Matter? Myths about education and economic growth' that education matters only if it is relevant education and there are conditions conducive for the application of that education[3]. Hence, a mere knowledge building does not support a nation today. What would support a nation is the application of that knowledge in practice on a continuous basis.

1. See: https://www.goodreads.com/author/quotes/2622245.Lao_Tzu?page=2
2. Ethics of Chanakya, (Translator: Tantrik Yogi Ramesh) Sahini Publications, 1998, p 101
3. Alison Wolf (2002) Does Education Matter? Myths about education and economic growth, Penguin Books.

In recognition of this requirement, countries like South Korea have been trying to establish 'creative economies' and not mere knowledge economies in the 21st century[4].

Knowledge that creates 'inventions' should be followed by 'innovation'

It was the Austrian-American economist Joseph Schumpeter who made the distinction between knowledge and application when he emphasised that inventions made by scientists and researchers should be followed by innovation by entrepreneurs. To complete the process, two other activities have to be undertaken: diffusion of that knowledge of innovation in the economic system so that there would be massive imitation of same by others[5]. He showed that inventions made by scientists, researchers or engineers are converted into usable goods and services by entrepreneurs by resorting to the process called innovation. Accordingly, without innovation, inventions just remain prototypes created by scientists with no benefit to society. Hence, modern economies should be properly termed 'innovation economies' or 'creative economies' and not mere 'knowledge economies'.

This paper presents how emerging economies like Sri Lanka should establish innovation or creative economies in order to generate long term prosperity for people.

Inventions do not help unless they are commercially used

Knowledge will enable researchers, engineers or scientists to create new things which are known as 'inventions'. There are thousands of such inventions made by knowledgeable people every day. But not all these inventions lead to creating a commercially viable new product or service. For instance, there are stories of some Sri Lankan youth inventing remarkable new products such as a 'sea-water driven motor car' or a 'multi-tasked paddy-thresher'[6] . While such inventions have their own merit, they may not be commercially viable at the current stage of technology due to higher costs of production compared to available alternatives. Hence, they just remain as prototype inventions incapable of going through an assembly line of a factory that depends on commercial viability for its survival. Joseph Schumpeter says that these inventions are used by entrepreneurs by converting them into commercial production lines[7]. That process is called 'innovation' or 'doing things differently in the realm of economic life'. According to Schumpeter, innovation leading to continuous economic growth of a country is a process and it consists of 4 stages[8].

4. See: http://english.motie.go.kr/wp-content/uploads/2014/10/Koean-Industrial-Initiative-for-the-Creative-Economy.pdf and visit: https://ccei.creativekorea.or.kr/main.do
5. https://www.academia.edu/5396861/SCHUMPETER_S_VIEW_ON_INNOVATION_AND_ENTREPRENEURSHIP
6. Media regularly report on such cases highlighting that such inventions should be converted to commercial production by the government.
7. Schumpeter, (1934) The Theory of Economic Development, (Translated by Redvers Opie)
8. This section draws heavily on: https://www.academia.edu/5396861/SCHUMPETER_S_VIEW_ON_INNOVATION_AND_ENTREPRENEURSHIP

Researchers lack capacity to use inventions commercially

The first stage is the invention where a researcher or a scientist, through elaborate experiments, comes up with a prototype of a new product. At the time of creating these inventions, the scientist or the researcher concerned has no idea about whether they would be commercially viable. He only knows that it would change the prevailing world habits or systems. Commercial viability comes from two other factors. One is that there should be a demand for the new product in preference to what is presently available in the market. The other is that the producers should be able to produce it at a cost that would generate him a profit when he sells it at prevailing market prices. If these two conditions are not met, the prototype invention will just remain an invention only on paper.

It is entrepreneurs that generate innovations

In the second stage known as innovation, enterprising people will draw, according to Schumpeter, on the discoveries of scientists or inventors and convert them to commercially viable products or services. By doing so, they create new opportunities for investment, growth and employment. But for them to do so, there should be mechanisms for making such new discoveries available to them for using in commercial production and guaranteeing their right to use them known in economics as 'property rights'. This involves linking research institutions with business. In the case of private research institutions, the question does not arise since private researchers should necessarily have to sell their research outputs to those who could use them productively. The problem arises with respect to state owned universities and research institutions which are normally reluctant to pass their research outputs to private sector owned businesses. They may be willing to share their knowledge with state owned businesses, but such businesses do not have proper business acumen to convert a research output into a viable market product.

Steve Jobs innovated the Macintosh desktop invented by Stephan Wozniak

Hence, inventions per se do not lead to economic prosperity. There should be entrepreneurs who are willing and able to convert such inventions into marketable products. A good example is provided by Apple products. According to the biographer of Steve Jobs, Walter Isaacson, the first Apple Macintosh Desktop was invented by engineer Stephan Wozniak[9]. However, he was not an entrepreneur but a shy engineer. It was the enterprising Steve Jobs who carried the project forward and mobilised the resources needed for producing the Macintosh desktop computer on a commercial basis. So, if the innovator Steve Jobs were not there, the world would not have got the path-breaking Apple products that revolutionised the world's information and communication technology applications.

9. Walter Isaacson, (2011) Steve Jobs, Simon and Schuster. New York

Innovations should get diffused

The third stage is called 'diffusion' or making available such knowledge to interested parties through the market mechanism. According to Schumpeter, it is the entrepreneurs who perform this task as well. Diffusion is a concept first put forward by Researcher Gabriel Tarde in 1903[10] when he said that knowledge disseminates over time taking the shape of a slanted English letter 'S'. This is because every new product has its own 'product life' growing rapidly in the initial stage and then coming to a peak before it starts to decline again. At this stage, a new product will take the place of the old discarded product. Tarde identified 5 stages of the innovation process: Initial knowledge from the invention done by a researcher, forming an attitude on the invention, deciding whether to adopt or ignore the invention, using the invention in a commercial production and confirming the decision to adopt the invention continuously. Once one innovator comes to the market, there will be others who would follow his lead. It then leads to more inventions and innovations.

Successful innovations are imitated like a pandemic

The final stage arises from diffusion where other entrepreneurs would imitate the initial innovation. At this stage, innovation spreads across the economy like a pandemic. There will be hundreds and thousands of new entrepreneurs who would imitate the initial trailblazers. This was evident in the computer industry. Before 1970s, it was the mainframe computers that ruled the world. But after Stephan Wozniak and Steve Jobs broke the rules by producing the first Apple Macintosh desktop, a new desktop computer industry was developed throughout the globe. Then, it was a series of new inventions and innovations that started to supply the world with laptops, tablets, phablets and now hybrid tablets[11].

Government's role is to promote innovations

Thus, it is not knowledge per se that would usher prosperity to Sri Lanka. It is the conversion of knowledge into marketable goods and services through innovation, spread of the information on innovation through diffusion and imitation of such innovators that would bring a continuous high economic growth to a country. Hence, the role of the government is to create an environment conducive for invention, innovation, diffusion and imitation. This is where Sri Lanka lags behind many nations in the world as revealed by the latest Global Innovation Index or GII published by Cornell University, INSEAD and World Intellectual Property Organisation for 2015[12].

10. Katz, E. (2006). Rediscovering Gabriel Tarde. Political Communication, 23 (3), 263-270. http://dx.doi.org/10.1080/10584600600808711
11. For details of the on-going battle for supremacy in ICT, visit: http://www.gizmag.com/
12. Available at: www.wipo.int/econ_stat/en/economics/gii

Sri Lanka is a laggard in the global innovation club

Taking into account some 79 different aspects relating to an innovation economy, GII has calculated an innovation score for 141 countries. Of them, Sri Lanka has scored 30.79 marks out of 100 ranking at 85 globally. Historically, Sri Lanka has been a low-level innovation economy and the current GII has confirmed it, though its score and ranking have slightly improved in 2015 compared to 2013. In the latter year, Sri Lanka's score was 30.4 and its ranking was 98. Hence, Sri Lanka's current position is an eye-opener for the government which is interested in establishing a 'knowledge based competitive social market economy in the country'[13].

Sri Lanka's innovation efficiency is low

The index value is the combined outcome of two sub-indices, one on innovation inputs and the other on innovation outputs[14]. The ratio of outputs to inputs depicts the innovative efficiency of a country. If a country has an innovative efficiency ratio of more than or close to one, that country has a high innovative efficiency. Sri Lanka in this case has an efficiency ratio of 0.76[15] needing much improvement on the innovation front. The innovation inputs consist of five broad categories, namely, institutional structure, human capital and research, infrastructure, market sophistication and business sophistication. In innovation outputs, there are two categories, namely, knowledge and technology and creativity. In all these categories, Sri Lanka's performance as an innovative economy has been far from the desired. It also opens a wide policy corridor for Sri Lanka government to adopt for implementation if it is really interested in building its knowledge base and its application in business.

Spend more on research and development

The report has highlighted that it is research and development that leads to technological inventions. A country should secure its technological potential by investing a sufficient amount of resources in R&D. Sri Lanka's current R&D expenditure stands at 0.2 percent of its GDP in 2013 in comparison to a world average of 1.7%. In the case of highly innovative countries like Israel, R&D expenditure has been as high as 4% of GDP. Sri Lanka is currently planning to increase its expenditure on education progressively to 6% of GDP. It is necessary that at least a half of this expenditure be incurred in the R&D area in order to gain the full technological potential that is necessary for Sri Lanka to elevate its status from a lower middle income country to a higher middle income country within the next decade.

The report has also presented six key principles which a country has to follow in order to make it an innovative nation.

13. For a detailed analysis of this economic ideology, see Wijewardena (2015) at http://www.ft.lk/article/469707/Part-I-%E2%80%93-The-promise-of-a-Knowledge-based-Competitive-Social-Market-Economy-What-does-it-herald-for-Sri-Lanka
14. The Global Innovation Index 2015, p 9.
15. Ibid. p 278.

Introduce innovations across all the industries

Principle 1 requires a country to have an innovation policy aiming at improving innovation in all the industries. A country seeking to move from an upper middle income country to a rich country should necessarily improve innovations in manufacturing industry in general and high-tech industry in particular. However, for a developing country like Sri Lanka where innovations are at a low level, it is necessary at first to improve innovations across the economy. Sri Lanka has been concentrating on producing simple products for the global market by using simple technology as revealed by the Economic Complexity Atlas prepared jointly by Harvard University and the Massachusetts Institute of Technology[16]. The problem with such a production structure is that any other nation can copy it and become a competitor thereby out-beating Sri Lanka easily. A case in point is Sri Lanka's garment industry which is threatened by low cost labour countries like Bangladesh and Myanmar which have easy access to simple technology in the industry[17].

Don't allow inefficiency of one sector to rub on others

Principle 2 is a further development of principle 1. It highlights that a country should support through its innovation policy, all types and phases of innovation not necessarily confining itself to high-tech industries. This is because the innovation gains in high-tech industries are negated if other sectors in the economy are lagging behind causing their inefficiencies to rub on improved sectors as well. Hence, it is a macro level efficiency improvement that is needed rather than the efficiency improvement in a given sector of the economy that leads again to the development of a dualistic economy.

Go for disruptive innovations

Principle 3 requires a country to adopt what is known as 'disruptive innovations' so that a country can directly get itself linked to the advanced economies in the world. This is what Joseph Schumpeter termed as 'creative destruction'. The mistake which many countries do in introducing innovations is to go for marginal improvements in the existing industries. On one side, such marginal improvements are incapable of generating a sufficient prosperity for the nation. On the other, they also widen the technological and innovation gap between the country concerned and other competitors making it difficult for competing with them in the global markets.

16. See: http://atlas.cid.harvard.edu/explore/tree_map/export/lka/all/show/2013/
17. For Bangladesh's production mix, see: http://atlas.cid.harvard.edu/explore/tree_map/export/bgd/all/ show/2013/

Make available capital goods at an affordable price

Principle 4 relates to making available capital goods imports, especially those products relating to information and communication technology, at an affordable price keeping such prices low. This is to enable a country to replenish its worn-out capital quickly. If it is not done, innovation processes started by the country lose steam midway, productivity improvements stagnate and competitiveness started by businesses starts declining. The way-out for countries to do this, according to the report, is to keep tariff and trade barriers low so that advanced capital goods can be acquired to make their economic enterprises competitive with the rest of the world. This is highly pertinent if Sri Lanka plans to develop a competitive healthcare sector to attract healthcare users from the rest of the world. Sri Lanka's close competitors in this area like Thailand and Singapore have already equipped their healthcare facilities with most modern medical equipment.

Support key innovation inputs as well

Principle 5 highlights the need for supporting the key innovation inputs on a wider scale. In addition to the availability of 'best-in-class' ICT, the other inputs such as reliable digital infrastructure, a skilled workforce and new knowledge should also be available to businesses. It is necessary to support both the production and the transfer of such key innovation inputs to businesses. For instance, if a state owned research institution comes up with an invention, the government should have clearly laid out policy principles for private businesses to acquire such inventions having paid the due amounts to such research institutes.

Create a dedicated outfit to implement national innovation strategy

Principle 6 is concerned with developing a national innovation strategy and suitable organisational structures to implement such strategies. Successful innovation nations have benefited from the creation of such dedicated organisations to carry their national innovation strategies forward. If such organisations are established under the direct supervision of the head of the state, it would immensely facilitate them to attain their goals easily by coordinating with other state and private organisations.

Hence, it is necessary for Sri Lanka to create an innovation economy if it is to survive and prosper.

An innovation economy uses ideas as raw materials

An innovation economy differs from a traditional industrial economy in several respects[18] . First, in an industrial economy, it is natural resources, labour and capital that matter as inputs for economic activities. But an innovation economy is ruled by 'ideas' that are used in actual businesses that harness those inputs. Second, an industrial economy focuses on mass production for use by customers. An innovation economy too produces for consumers but gives priority to design and quality based on information and communication technology. Third, industrial economies are organised as large corporations that depend on economies of scale. Innovation economies, on the other hand, are composed of small scale entrepreneurs who use networks and agents to do business.

18. http://www.channelingreality.com/Corporations/Collaborative_Economics_RoleInnovationBrokers_KnowledgeEconomy_web.pdf

Fourth, the success of industrial economies is based on labour and its availability, quantity of products, low costs and ability to control organisations and markets. Innovation economies depend on talents, speed of delivery, innovation flexibility and customisation of the products for success. As such, an innovation economy is a further step forward from an industrial economy and effective user of new knowledge that is being produced throughout the globe.

Researchers should be linked to industry

Hence, it is vital that, if an economy is to prosper, knowledge-makers should be effectively linked to business and industry. In the past, this did not matter so much because it was the inventors themselves who put their inventions into commercial production as well. But today, inventions are made at a rate and all inventors are not entrepreneurship-savvy. This makes it necessary for outsiders who are enterprising to absorb inventions and make them available in the form of goods and services to consumers. Large companies have the capacity to acquire and command over inventions without the help of an outside party. But small start-ups and entrepreneurs need the services of networks and agents to get connected to funding, inventions and markets. Such innovation facilitators are called 'innovation brokers' who have now become an important element in a proper innovation economy system.

It is not human capital per se but creative capital that matters

Thus, a country interested in creating an innovation economy should put all the four essential ground conditions in place if it is to succeed in its attempt. First, knowledge has to be created by its universities and research institutions. Then, such knowledge should be made available to prospective entrepreneurs for use in commercially viable productions known as innovation. Once the initial entrepreneurs become successful, that knowledge, both invention and innovation, should be disseminated across the economy to facilitate others to imitate the original inventors and innovators. To create the necessary ground conditions for this, an invention-innovation-diffusion-imitation nexus has been suggested by involving three partners of progress holding keys to success. The first key involving the creation of knowledge is held by academia in universities and research institutions. They are guided by ethics of conducting research and have to work on cooperative researcher networks that nourish and cross-fertilise each other. The second key involving the task of putting the inventions into production is held by industry that delivers prosperity to the nation in the first instance and to the globe subsequently. The third key involving facilities for stable and productive interaction is operated by the government. Its job is to combine three interrelated aspects of economic prosperity: technological development, political support and social and cultural orientations involving economic progress. These three partners together contribute to teaching and training, research and development and producing human and creative capital. It is to be noted that it is not mere human capital but creativity in human capital across all the three partners, academia, industry and government that delivers prosperity to a nation.

The overstretched Sri Lankan universities have been staffed with routine capital and not creative capital

Knowledge creation is the foundation of an innovation economy. But who creates new knowledge? Those are universities and research institutions. These institutions together, in any country, sit on a vast resource in the form of human capital. In Sri Lanka, human capital at universities is overstretched to teaching undergraduates who are admitted to the university system in large numbers year after year without improving educational facilities. On top of this, universities have competitively increased the number of courses and credit hours which an undergraduate should complete in order to acquire his degree qualification from a university. To facilitate this dual vicious circle, university academia has overstretched its capacity. The result has been pernicious. Human capital in universities has become a routine capital and not a creative capital as required by an innovation economy. Hence, it is necessary to convert routine capital into creative capital in order to promote the creation of new knowledge by them. Once they start creating new knowledge, they should be linked to industry through an effective mechanism so that what is created by them is used for the benefit of the nation as a whole.

Break the research silos of Sri Lankan research institutions

Sri Lanka's research institutions at present operate in 'research silos' with no connection to industry or use of their research outputs as inputs in industry. They too sit on a vast amount of human capital which is not used effectively to create new knowledge that leads to innovation by business and industry. One has to just examine the qualifications of the researchers attached to the Department of Agriculture to gauge this point. Despite the large number of researchers in the Department, Sri Lanka still produces its agricultural produce in the same way it had produced it a century ago. Take for example rice. When other nations have gone for value-added products out of rice, such as 'rice bran oil', an edible oil that is rich with nutrients, Sri Lanka still processes rice in the same old manner and use rice only as the staple food of its people. The same observation can be made about the sectoral research institutions such as the Tea Research Institute or the Rubber Research Institute or the Coconut Research Institute. In the case of tea, Sri Lanka still uses tea only as a beverage. There again, it is by using the traditional method of brewing tea in hot water and drinking it as a hot drink. Many extracts could be derived from tea that could be used in value added products in both the perfume and pharmaceutical industries. It is an eye-opener for Sri Lanka's tea industry to learn that tea extracts are now used in perfume industry on a large scale after getting patent rights for the same[19]. In this connection, the Industrial Technology Institute or ITI has come up with a number of breakthrough inventions in the recent past and are looking for viable and productive linkages with industry to put their findings to practical use in producing commercially viable products and service[20].

19. A list is available here: http://www.fragrantica.com/notes/Tea-106.html
20. Visit: http://iti.lk/en/

Research should encompass all the sectors in the economy

New research by Sri Lanka's universities and research institutions should cover research in all three major sectors of the economy, agriculture, industry and services. There should be both intraconnection and interconnection of the research outputs produced in a given sector. Intraconnection means that a research output produced in respect of a given sub-sector, for example, use of a genetically modified crop yielding a higher output, say in rice, should lead to production improvements in other sub-units of the same sector. In the rice example, the yield improvement should lead to improvement of yields in other crops, say tea or coconut or fruits. Interconnection means that research done in agriculture should generate output increases in other sectors. For instance, rice bran oil formula developed in the agriculture sector should lead to manufacturing of rice bran oil in industry and marketing of same in the services. Such an approach to research is known as 'holistic' or 'integrated' approach to research. That is what Sri Lanka needs at the present time.

Corporations are increasingly relying on outside research

The connection between the world's industry and research has gone through a massive transformation today. In the initial period where industries were localised in the regional cities like Detroit for motor cars, Sheffield for steel, Mumbai for textiles, inventions were done by entrepreneurs themselves and it was hardly that facilities at universities and research institutions were utilised by industry. The same continued in the second era where government sponsored industrial parks were established. Industries were required to bring in technology and inventions to host countries and host regions. Today, that isolated existence of research and industry cannot sustain itself for two reasons. One is that invention and research requirements are rising dramatically in a fiercely competitive world. Hence, industries and entrepreneurs are incapable of meeting those requirements through only research done in-house. The second is that entrepreneurship has become a specialised talent and not all inventors are skilled in that talent equally. Hence, the two types of work, namely, invention and innovation, have to be separated with each group specialising only in its area of competence. Accordingly, industry has to depend on research institutions and universities for inventions and research institutions and universities have to depend on industry for innovation. This linkage is now being established in a different kind of a production model.

The dead Sheffield has been converted to a vibrant research town

An example of this new model is the Advanced Manufacturing Facility set up around the University of Sheffield, UK with many giants of industry and commerce being located there[21]. The need for establishing such advanced manufacturing facilities has become a sheer necessity: the need for competing successfully with low-wage and low-cost countries. Hence, it is necessary for advanced economies to bring out continuous innovation of production and processes involved in manufacturing.

21. Available at: http://www.brookings.edu/research/opinions/2015/03/25-manufacturing-innovation-district-sheffield-england-katz-kline

To do so, they have to engage in applied research, investment in sophisticated plant, technology and investment, automation of manufacturing processes through robotics, and developing a highly skilled workforce. All these four requirements are now met in one location where industry has been linked effectively to research and knowledge creation.

Co-existence of small start-ups with giants in industry in Sheffield

Sheffield had been famous for quality steel products for decades. It was such a popular world brand, instead of calling 'Made in England', steel product manufacturers in Sheffield were successful in developing their own brand name, 'Made in Sheffield'. Like Ceylon Tea, it instantly denoted quality and reliability. This was not to be for long after Sheffield began to experience fierce competition from other countries that also went into the same production line such as Japan, South Korea and now China. Consequently, Sheffield lost its glamour as well as economic base. Now to regain that lost glamour and lost economic base, Sheffield has established an Advanced Manufacturing Park around its University which functions as the key knowledge creator. It provides advanced manufacturing companies with industrial expertise, cutting-edge machines and equipment and solutions to complex industrial issues. More than 100 giant manufacturing companies including Boeing, Rolls-Royce, BAE Systems, Hitachi and Tata are located in Sheffield Park. Along with these giants, a large number of small and medium size start-up research developers have also been set up in the Park in an incubator facility so that they could benefit from the practical exposure they would get. In addition, apprenticeship is provided to young workers to train them on the job thereby demonstrating that, to be creative and skilled, one need not have to acquire a four year university degree.

Similar to the Sheffield Advanced Manufacturing Park, advanced research towns have been established around almost all the leading universities in USA. MIT, Washington and Boston are some examples. MIT has introduced a special innovation initiative to link the academics and its students to industry fruitfully[22]. George Washington University in USA has introduced a scheme to commercialise the technology developments done by its researchers[23].

Time for Sri Lanka to tap its dormant resource base in universities and research institutions

Sri Lanka should now consider linking its universities and research institutions to industry, both local and foreign. For that purpose, universities and research institutions should be funded adequately in the first instance and forced to earn their living by selling their invention outputs to industry later. Ronald Reagan managed to do this while he was Governor of California between 1966 and 1975[24]. He cut the university funding and forced them to earn their living.The result was that state funded universities in California, in competition with private universities, began to produce new research inventions that finally led to the development of Silicon Valley in California.

22. https://innovation.mit.edu/
23. http://technologies.research.gwu.edu/technologies
24. http://www.newfoundations.com/Clabaugh/CuttingEdge/Reagan.html

Sri Lanka should not go for this type of a 'penalty option' waving a stick at universities but use instead a 'carrot option' which would incentivise them to get linked to industry. What is needed for incentivising them is to share the earnings, may be 90% by the university and 10% by the Treasury after putting rules for accountability in place. It is suggested that a special Cabinet sub - committee be set up immediately in order to identify different universities and different research institutions as 'invention creators' and establish industrial parks around them to put those creations to actual productions.

Conclusions

Sri Lanka's future depends on how far it could create an innovation economy by using its existing resources and drawing on inventions and innovations made elsewhere. The country's present production structure consists of producing simple products like garments, plantation crops and export agriculture crops as revealed by the economic complexity atlas prepared by the University of Harvard and Massachusetts Institute of Technology[25]. This structure should be changed if Sri Lanka is to survive in a fiercely competitive market and generate economic prosperity for its citizens. It requires the government to play a facilitating role by creating the conditions conducive for people to come up with inventions and entrepreneurs to use such inventions in the production of marketable goods and services – a process known as innovation. When such innovations are introduced by entrepreneurs, the knowledge so generated should be diffused among the population enabling the other prospective innovators to imitate ideas across the economy. For this to happen, it is necessary to convert the country's present human capital to 'creative capital' that would continue to create new things through its knowledge application and commercialise the same through innovations.

25. http://atlas.cid.harvard.edu/explore/tree_map/export/lka/all/show/2013/

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