

## INNOVATIONS - What, Why, and How AND INDUSTRY

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Our great scholar Cumaratunga Munidasa once said “*Nava Nipayum Nokarana Daya, Samadaa Pal Weyi Ekathana*” (the ‘Nation which doesn’t do novel things - Innovations- will be bogged in the same place for ever’). How true it is!

Well, this applies not only to a nation but to individual industries as well. Recent past shows many examples. If our industries, instead of crying and blaming the cheap imports, took intelligent steps to be innovative and to make their products more competitive they would have by now been commanding a substantial portion of the world market of their respective products. Doing the same old thing, making the same old product the same old way, leads them nowhere. Better competitiveness could be achieved only through two major steps. One is the improvement of productivity through better and modern technology coupled with better management. The other is INNOVATION. In the highly competitive atmosphere of present days it is a case of “Innovate or Perish”. Competition is not only from imports but also from other and more innovative manufacturers.

Our ancient engineers were highly innovative. Irrigation net works and massive structures are ample evidence of their creativity. Era of king Parakramabahu saw the best ship building industry. Occupation of our country by Europeans and the resultant crushing of local talents, particularly from early nineteenth century by the British, prevented us enjoying the benefits of industrial revolution. They not only crushed our technology, but also destroyed our confidence, and converted us virtually to a “nation with slave mentality” which is dependent on west, even to date to a great extent, even for each little bit of technology and machinery, let alone the culture and social values.

They were successful in achieving their aim. It is high time that we wake up from this deep slumber.

Even with such setbacks we were still having a substantial agricultural machinery making industry. We were in the forefront of Tea, Rubber and Coconut processing technology and were exporting “Made in Ceylon” machinery to countries such as Malaysia and India etc., even as late as sixty years back. Since independence we were merely consuming our wealth and resources without replenishing them. So here we are in this pathetic situation now, while many countries such as Singapore, Malaysia, Korea etc., which were far below us at that time, are now way ahead of us thanks to our politicians. Most of our industrialists too were happy as long as they could meet the “bottom line”. They started realizing their mistakes only after they were overtaken by their competitors and also by imports. A few seems to have recognized the need to improve and ‘Innovate’ their products and are doing well. Yet the majority of our industries still seem to have not realized that it is a case of either “innovate” or “get perished”.

### WHAT ARE INNOVATIONS AND INVENTION?

The word “Innovation” is defined as “bring in novelties” “make changes” (thus change with a novelty, make new). Innovative products can be achieved only through Innovative Design. ‘Innovative design’ is conversion of knowledge to technology through creative design, and needs ‘Imagination’ and ‘Creativity’. *Einstien once said: “Creativity is more important than knowledge”.*

**An innovative step may be small, substantial or major, but it should essentially bring in some form of improvement to the product or the process, may it be quality, functionality or performance, safety, market value, or economic. Innovation usually makes an existing product better through a novelty brought in, but if the novel product developed is something completely**

**new, or earlier non-existent then it is called an 'Invention'.** Invention thus is a major step forward in technology front.

Consider the intermittent wiper of a car. Vehicle drivers know that when it is only drizzling, a continuously operating wiper is very inconvenient and thus it has to be manually switched 'on' and 'off' from time to time. An innovative person observed this and developed the intermittent wiper function which is now fitted in almost all present day vehicles. Does this innovation need vast academic knowledge? This may seem a very simple innovation, yet it needed imagination, creative thinking, and an inquisitive mind to make this innovation. This is an example of a small step, but with a giant application. Earlier we used 'fountain' pens. A ball rolled on a layer of 'ink' will get wet and if it is re-rolled on a paper that ink adhered on the ball will be transferred on to the paper, and thus will 'write'. This is a well known fact. So some innovative person made use of this principle to make a ball point pen which has become a part and parcel of our life now.

Hydraulic cylinders were known for many years. But it was not used in steering system of a motor vehicle till one creative person innovatively used it to develop 'power steering' system. 'ABS' braking system as well as 'Airbag' used in motor vehicles, too are substantial innovations.

On the other hand the development of 'laser' is a major innovation and is an invention. Development of the telephone by Graham Bell and Radio by Marconi were major steps forward in Technology and are inventions. Development of Mobile phone, Digital camera and TV are also inventions as they were not available before that.

### WHY INNOVATE?

#### **"Sunset" and "Sunrise" Products and Industries:**

Any item or product, including a system, has its "maturity period", "hay days" and then "gradually becomes obsolete" having been overtaken and superseded by better and newer generation of products. (*This is very similar to the stages of life in a human or any living being*). A product

or a process which is in the stage of losing its competitiveness is called a "sunset", while the newer and better options and replacements which are becoming more and more competitive are called "sunrise". These are applicable to industries as well. Any country or industry should shift from "Sunset" to "Sunrise" as applicable in their specific contexts even for their survival, let alone to prosper. This can be achieved only through continuous and innovative upgrading of products and processes. **Innovations and Innovative Design, carried out in our own country itself, is thus essential to accomplish this.**

### Development Stages

Newly Industrialised Countries (NICs), particularly in the Asian region have gone through several stages which are '**Factor driven**' which covers both 'Import substitution' and 'Export oriented', '**Investment driven**' where heavy investment, including FDIs, on machinery and equipment and other investments including infrastructure development took place, and '**Innovation driven**'. If Sri Lanka is to achieve rapid industrialization, it is necessary that both 'Factor driven' and 'Investment driven' stages be completed quickly while simultaneously jumping to the 'Innovation driven' stage.

#### **'Technology Base', 'Knowledge Base' and 'Patents'**

No idea, concept or discovery is of any use unless and until it is converted to a tangible product through design. Every such design will be an advance in the technology front of a country. A country's development is proportional to its technology base rather than the knowledge base. A "Patent" is a step forward in technology front (while an article in a learned journal is usually only a step forward in the pure knowledge front) and thus the number of "Patents registered in a country **by its nationals**" is a measure of the country's technological, and thus the economic growth. A look at the Sri Lankan patent registry clearly shows where we are heading. According to figures in late 1990s the number of patents registered in USA is in the range of 30,000 per year. Japan too is nearly same. Even the tiny Singapore records around 3000 patents a year.

These figures show the strength of their technology bases and also the prosperity (material). How about Sri Lanka? We registered about 25 to 30 patents per year by our citizens (Now it has increased to about 60). Doesn't this clearly demonstrate our pathetic situation? And amply and clearly explain where we have gone wrong?

#### What should then be done:

Prof Peter Hills once said "*If a country has the intellectual resources to design what its people want and the will to invest in the creation of those products, then it can avoid exploitation by others and provide the wealth that can ensure a happy, healthy and well educated population. It raises itself above being merely a provider of cheap labour and gives its people the means to reap the prime benefits of modern industry*". Though he said this in relation to UK, he seems to have addressed us directly. We are still (to a great extent) mere providers of slave labour, in the form of housemaids, to middle-eastern countries and then cheap blue-collar workers. From recent we have commenced providing cheap white-collar labour as well.

Don't we have the 'Innovative' capabilities? We surely do have. Do we have the will to invest in the creation of such innovations? Well that is a bit doubtful, judging from what we see. How many industries are really involved in innovatively improving their products? Or even are aware, or realized, the importance of innovation? Well there are no alternatives or shortcut methods, other than being innovative, for any industry to prosper or even to survive.

#### HOW TO INNOVATE

Only a very few of our engineers and scientists are really Innovative. Most among them too rely on their intuition and gut feelings for innovations. This was the method of innovation of yesteryears. Innovativeness no longer need be a born talent. It can now be taught, inculcated, developed and nurtured. One of the most important and cardinal point in 'Innovation' is **Not to jump to the first solution that comes to your mind.** Keep your eyes open and **observe**, not merely see. Look for all the, or as many as possible, options

for solving a given problem and select the optimum solution from among them.

Most important advice for 'Innovative Design' is, **"Don't try to find a conceptual design, but let it come through proper analysis"**. Rather than starting with a 'Concept' or a "Conceptual design" the design process is commenced with a clear understanding of the 'User Needs' (or what user expects from the product). From this is derived "Engineer's Perspectives" or the specifications of the product to be developed. Design requirements are divided to several 'Main problems' and each is attacked separately through a process of finding as many solutions as possible. That is;

1. Don't try to solve all the problems at once. Break them down to 'sub problems' and attack each sub problem separately and one by one.
2. 'Don't jump to the first solution that comes to your mind'. Always look for alternatives and different options, as much as you can think of.
3. Discuss with your friends and colleagues and do 'brainstorming', to get ideas from others as well. (*Two or more brains are always better than one single brain*).
4. During this process comes in the "Innovative" part where 'Adaptive Innovation' plays a major role.
5. Through a process of checking compatibility and elimination, arrive at several possible compatible sub solution sets or combinations. These are called 'Candidate solutions. From among these the 'Conceptual Solution' is arrived at after thorough analysis and selecting the optimum of such several alternatives.

Now you have the best possible "Conceptual Design". If you were innovative and creative in arriving at your sub solutions, you now have an innovative conceptual design. An innovative designer may even come up with a design, a solution to a problem of a user, which the user never would have imagined possible. It is now simply a case of detailing the design, which can be done in the conventional or standard manner.

This method had been practically tested and found to be very effective. Experience with our own undergraduates have amply proved this

### **Adaptive Innovation**

Here something or feature already known / used in some other field or application, but not available in the product being dealt with, is incorporated in the new design adaptively to give some improvement(s), some novel feature(s). Here somebody else's invention or available knowledge is made use for better or more applications. For this considerable pre-thinking is needed, assisted by the knowledge and experience of the designer. Actually this is a process where the brain is doing a sorting and tallying process and suddenly finds a tallying solution or option with previous experience or knowledge.

Development of 'laser' was a major innovation and is an invention. This was initially developed for some other application. Then it has been adaptively used in the 'CDs'. Thus laser reader in CDs is an adaptive innovation in that field. Similarly even a simple laser pointer used during a lecture is an adaptive innovation of pointers. Again eye surgery equipment used to remove protein deposits in the 'lens capsule of eye' using laser is an adaptive innovation. Ultra sonic was known for quite some time. But its use for cataract surgery is relatively recent. The development of this instrument for pulverising the hardened lens in cataract surgery is an adaptive innovation. Similarly development of equipment using ultrasonic for crushing or pulverising stones in the bladder are adaptive innovations in that field.

### **Re-engineering**

Another very important method of innovation is re-engineering. Here an existing design (product, machine, equipment, system etc.) is studied very closely and with EYES OPEN, finding drawbacks, defects, shortcomings, etc., with a view to overcome/rectify them, and produce a similar or better item with modifications, and usually with upgrading so that the new product is much superior to the original item. **This is not blind copying.** This is kind of a 'Technological free ride' where you are not paying for the new technology. USA

did it, Japanese did it, NICs and many others are doing it as a standard practice. Why not us? This is one of the best and most economical ways of technology transfer.

### **NEED FOR DEVELOPMENT RESEARCH**

During the above process in certain instances it may be found that the required solutions cannot be found from available technology or there are gaps in technology. At that point research is needed to 'develop' that piece of technology or to fill that gap. That is called 'Development Research' or 'Research for Development' and always a step forward in the technology front. This must be clearly distinguished from 'Research and Development' where research is carried out merely to enhance the 'Knowledge', and if there is a possibility of converting that knowledge to a useful product - that is if it is a '**Technology seed**' - then carry out the required development work subsequently. 'Academic' or 'Pure research' falls into this category and is NOT what we need at the moment. **It is 'Innovations' and 'Development research' that are very important for us now and needed immediately.**

There are many and ample 'Technology seeds' available without going to the expense of pure research. **Patents are an ocean of technology seeds** awaiting to be developed and exploited. There are millions of 'dormant and sleeping patents' available from certain countries which you can get from internet, though unfortunately we don't have our own patents yet on internet, which can be converted to 'technology' through development research.

### **NEED FOR A CULTURE OF INNOVATIONS.**

It is essential to develop a "Culture of Innovations" to develop innovativeness among our engineers and technical personal at all grades. This has to be started from very young age, from schools, technical colleges, at universities etc (fortunately 'Inventors Commissions' seems to have working in this direction with schools and at least some universities have established their own such programmes e.g. University of Moratuwa established 'Inventors and Innovators Society'

recently), to be “infected” to industry and to all other walks of life. This needs only commitment and encouragement from proper sources including academia and the government. Industry will “get into it” the moment they see its advantage to them. It is necessary to create an ‘Innovations explosion’. Graduate engineers and scientists should be converted from employment seekers to employment providers. They should become springs of employment giving employment to others

## DISCUSSION AND CONCLUSIONS

Innovation is to bring in novelties or make changes. Innovative step(s) may be small, substantial or major, but it should essentially bring in some form of improvement to the product or the process. If the product so developed is something completely novel, or non-existent earlier, then it is called an ‘Invention’. Invention usually is a major step forward in the technology front.

No country or Industry can prosper or even survive without being Innovative. Products and industries have to shift from ‘Sunset’ to ‘Sunrise’ and this can be accomplished only through continuous upgrading of them with innovations and innovative design. For Sri Lanka to achieve rapid industrialization it is essential that both ‘Factor driven’ and ‘Investment driven’ stages be completed quickly, while simultaneously jumping to the ‘Innovation driven’ stage.

No idea, concept or discovery is of any use unless and until it is converted to a tangible product. This can be done only through innovative design and each such design is a step forward in technology front of a country. It is the ‘Technology base’ and not the ‘Pure knowledge’ that determines the development rate of a country. Thus it is imperative that we shift from academic and pure research to ‘Development research’ or ‘Research for development’. Patents, active as well as **dormant** and **sleeping**, is an ocean of ‘Technology seeds’ awaiting to be converted to technology for the rapid march of the country to industrialisation. We don’t have to re-invent the wheel or waste our resources on basic research, which may be useful for the developed nations, but must take a ‘Technological free ride’ which was done by all including USA, Japan and NICs as well. So, why not us?

No country or Industry can prosper or even survive without being Innovative.

It is a case of ‘Innovate or Perish’ in the present context. Shifting of industries or products from sunset to sunrise is essential, and that can be accomplished only through continuous upgrading of them with innovations and innovative design

It is essential to commence ‘Innovation driven’ stage without waiting to complete ‘Factor driven’ and ‘Investment driven’ stages.

To Innovate it is essential to have an inquiring mind with creative thinking. Do not jump to the first solution (to a problem) that comes to your mind. Look for all possible options and select the optimum after extensive analysis. Don’t try to find a conceptual design, but arrive at it through proper analysis. Innovative and creative solutions to sub-problems will yield you an innovative design.

Adaptive innovation is very important as most of the innovations come through this path.

Re-engineering is a very cost effective way of technology transfer.

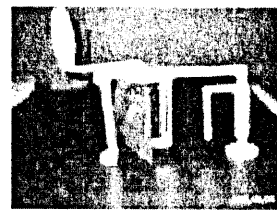
Take a ‘Technological free ride’ without going for ‘basic and/or academic research’.

Development research is essential for Innovations.

Make use of the ocean of ‘Technology seeds’ available in ‘Patents’, **active** as well as **dormant** and **sleeping**.

If we are to have a future it is very important to develop a ‘Culture of Innovations’.

### COCONUT MILK EXTRACTING DEVICE



Simple, easy to operate and low-cost mechanical device to extract coconut milk from scraped coconut is invented by University of Moratuwa.

For more details:

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