

Indigenous Technology and its Commercialisation

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"Small industry is the backbone of a nation" - this saying is well established in the developed world but not so in the Third World. It is because we have not understood the real meaning of the phrase "Small Industry". Small industry that can form the backbone of a nation can only be the ones that are based on home grown technology for products that are used by the people in the immediate neighbourhood within the country. We will discuss shortly why this is important, but before doing so we might as well discuss some basic points, how we define indigenous technology, etc.

1. What is indigenous technology?

The answer is hidden in the phrase itself, 'technology that originates from within'. When technological designing of a product or its process is done by local innovators using their own talents, we would call it indigenous technology. If at least some indigenous design is not present we would not call it an indigenous technology. To illustrate, in a Television assembly industry, the whole design is done elsewhere, all the parts and components including the housing or cabinet are chosen or made, standardized and collected in a kit form by one or more foreign firms. The local producer has only to place the components in the right places on the printed circuit board, solder them, fix the various parts in the cabinet, and interconnect them. This nowhere requires the brains of local technology innovators. Only during testing of the devices some engineering knowledge is required. So we call this an assembly industry. It uses local labour but is not an indigenous technology based industry. On the other hand, when in the eighties some local technology innovators started making voltage stabilisers on a commercial scale, they designed and made their printed circuit boards, transformers and cabinets. Some copied the electronic circuits from elsewhere

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and adapted them while some designed the circuits themselves. They had to innovate and improvise devices and gadgets needed for the manufacturing process as well, as importing such things would be much beyond their project costs. Possibly some of them took some help from foreign designs, but had to use their own talents in improvising the product using components that are available in the local market, whether imported or locally produced. These electronic industries can be termed indigenous technology based as against Television assembly industry, though outwardly the final working of both would look similar; therefore, policymakers find it very difficult to distinguish between the two.

Similarly when a car or a truck comes out of the production line of an assembly Industry in Bangladesh, there is no touch of local technological innovation. It imports all the parts for a vehicle in a package and just fixes them at the designated places. On the other hand the three wheeler vans and passenger vehicles, in the name of 'Nasimon', 'Bhatbhatia', etc., that the local small innovators developed using diesel engines meant for shallow water pumps are indeed indigenous technology based products. The whole design of the vehicles are indigenous, there have been many ingenious improvisations in using parts or components made out of locally available raw materials, not necessarily meant for making vehicles. Unfortunately there has been a strong negative media campaign against these vehicles, and these are now 'officially' banned in Bangladesh, thanks to the rich vested interest groups which see these as potential competitors and which exercise a great influence on the national policymakers. The quality of these vehicles is not as bad as the media portrays them, otherwise they would be facing accidents every day, since thousands of them ply around the whole of the country in spite of the 'official' ban. Some of these vehicles are much better than the Mercedes Benz of the 1930s. While we should have taken steps to support these semi-educated innovators in improving the quality and finishing of these vehicles employing educated engineers of the country, we have taken the opposite step of banning them altogether. If we had promoted them as suggested, we would now be exporting these vehicles to other Third World countries. Unfortunately, almost all of our policymakers are without technical background and they do not understand the importance of indigenous technology based industry. This is how our Government policies play a negative role sometimes.

2. Why is indigenous technology important?

There may be many arguments in favour of indigenous technology based industry. The foremost would be the *enhancement of the quality of life of the*

common people. Usually local innovators face a problem in their own lives or in the lives of people around, and they try to innovate a technological solution to that problem. Soon this becomes a product and if commercialized, can reach many more people as there is a ready market. It also creates an economic activity in which many followers can join later.

From the above scenario one can guess that since the technology is locally innovated, when such an industry grows it creates a network of backward linkage for supply of component parts. Since these rely on local expertise and locally available raw materials, the technology is usually within the grasp of many others, and the network builds up quickly. This has not been possible with foreign technology based industries in the past in our country since a huge technology gap exists with the western world. Philips electronics can be cited as an example, which started in the nineteen sixties. A condition was given that gradually they will have to include components made locally into their products, but it never happened, since we did not develop any homegrown industry that can supply the components with the quality they need. India, on the other hand made strong policies to support home grown technology based industry right since partition in 1947, which allowed local industrial infrastructure and expertise to grow. Now when Suzuki wanted to establish a car assembly line they could choose some parts from local producers resulting in Maruti-Suzuki cars. We have not been able to integrate local technology with any foreign technology based industry set up in our country till now.

An indigenous technology based industry hardly needs a capital to start. Usually the innovator makes a prototype using his/her own resources, and sells a few at first. With the return s/he makes more, and corrects and modifies the design if necessary based on customer feedback. No technology can work perfectly from the first day that it is developed. It is true even for the West. If one sells a large number of products and finds out later that there was a serious fault, think of the consequences; it will be the end of that enterprise. So through limited marketing the entrepreneur builds up confidence and grows. When such an industry grows the entrepreneur learns the tricks of the trade through real life feedback, which is adapted to the particular socio-econo-political situation, unlike foreign bred management practices which cannot be applied here directly. Most of the time such an industry builds itself into a network which patronises each other and there is very little requirement of formal bank loans at the early stages. It is only when such an industry acquires sufficient experience with successful entrepreneurship and confidence in their products that it may want to expand and go for bank loans. Therefore finance is not really a problem for initiation of such indigenous technology based industries. Customers and other entrepreneurs

support such nascent innovative enterprises due to an innate cultural urge which the modern economic theorists could never comprehend.

It needs to be emphasized by repeating the scenario in the industrially developed West. The backbone of their economy is still innovative technology based small industries. Microsoft, Apple computers, Hewlett Packard, Ford all started from garage sized endeavours.

Among the Third World countries, India and China are coming to the global scene in terms of industrial contribution in a big way. This has been possibly only because they did not listen to the advice of international experts or banks or donors in the past sixty years or so, rather they took policies in their own way, to strengthen their own technology base through nurturing home grown technology based industry. It takes a long time, 30 years or more, to incubate such enterprises, and it is really difficult for most policy planners in the Third World to have such deep understanding and foresight. The five year term is the maximum that an elected Government can look forward to and therefore they look for short cuts, which in effect go in the interest of the multinationals and their promoters which influence the policies of these countries. India and China had some personalities who could lead the nation to come out of such influence, and the results are there for all of us to see.

3. Commercialisation by innovator necessary

When an innovator designs and develops new equipment from scratch its manufacture and marketing can successfully be done only by the innovator, the technology designer, no one else. No established businessman, however successful he or she is, how much money he or she puts into it, will not be able to carry the project through to success. This is an important message that I want to put across which I learnt the hard way, through my own real-life experience. Now when I look back to industrial development in the West, the same picture emerges. If one looks at all the giants in industry like Sony, HP, IBM, Intel, Ford, Toyota, Honda, Marconi, General Electric, and going further back into the great players of the industrial revolution like George Stevenson, Cartwright, Wedgwood, Arkwright and others, all successful business ventures were initiated and piloted by the technology innovators themselves.

Why? To understand we need to discuss the processes that need to be followed in order to take a new technology based product from the laboratory to a successful business. Briefly the steps, together with the challenges, can be summarised as follows.

4. Steps from design to manufacture

I.

The first step is in designing and developing a basic working model of a product that the designer feels can get a market. Here the designer's ability to understand the people, their culture and habits, market dynamics, etc. plays a very important role. Choosing a wrong product may lead to wastage of money and effort. Besides, the challenge is very daunting in the Third world since the people have become used to high standards of products imported from the industrially developed world. The customers will tolerate a few defects in products from developed countries, but not a single one from an indigenous product. Therefore the challenge is more than that faced by early developers in the industrialised world.

II.

Next the working prototype should be tested in the laboratory, home or office of the designer or at the premises of technically sound close friends. This is needed so that the continuous performance of the product may be monitored. Many weaknesses of the design will be revealed at this stage. Unless these are addressed to and improved upon, the product cannot be taken for commercial marketing. The effort will have to end there.

III.

Upon feedback of the above initial trial the product have to be redesigned in a user friendly way for use by general people, which can be manufactured with available production technology at an affordable price. In some situations the production processes and technology for these may also need to be innovated and developed. This is a very important industrial design step.

IV.

Limited field trial should be given to the industrial prototype by distributing to a limited number of users who will cooperate by providing the designer with important feedback. Therefore, users should be chosen who have sympathy and trust in the designer, and with whom the designer has direct contact, and who will bear with failures and interruptions in service. There may be situations when the product may cause harm and injury to people and their property, and one has to be very careful about the safety aspects in the product design.

V.

Based on the user feedback the design should be modified and improved further. Often the cabinet design (housing of the equipment) and user interface to the product becomes more important than the technology of the product itself.

VI.

If everything goes well, the product may now be manufactured for limited marketing. It will be found that the product failed to perform properly at some places, due to situations or due to manners of use that the designer never imagined of. Sometimes serious problems arise which have to be addressed urgently and solved in order to keep the reputation of the product and of the manufacturer. This creates a very challenging situation. Sometimes the problems are very subtle and sophisticated and the innovator finds it difficult to solve it. S/he may need the assistance of other experts which presents a very difficult situation, and an innovator without sufficient funds may find it almost impossible.

VII.

At this stage much information will be available that will have an important bearing on the decisions related to the product. In the worst case the product may not get any buyer, or the technical challenges cannot be solved, and it may have to be dropped totally. In a less unfortunate scenario the product may need to be redesigned to make the product more attractive at the price asked for. In the best case scenario if the designer took care of the issues properly beforehand, the product will need only a few modifications to carry it along further. After such modifications, the product will still need further limited marketing. Only when the return of products from customers due to manufacturing defects, malfunctioning or inability to use, etc., falls below 1% that it can be taken up for large scale manufacture and marketing.

VIII.

In most probability the processes for certain manufacturing steps, and quality testing of the product will not be available off the shelf. Even if it is available from an industrially developed country, it is likely to be prohibitively expensive. So the designer has to innovate, improvise and develop these items too.

5. Decision making needs the innovator

It is clear that all the above steps need a lot of technical innovation, expenditure and patience before a product can give a return on the investment. At least two years is a typical timeframe if the required technical expertise is readily available. In Third World countries like Bangladesh where industrial revolution has not taken place, and where businessmen are mostly traders gaining a quick return on their investment, the patience for such long periods cannot be expected. This is more so for a technology that is untested in the market before, and by people who may not have been able to establish adequate credentials for their technology as yet. On the other hand a technological product is like a baby to the innovator, s/he will go a long way to see that his/her baby is nurtured to adulthood, even if it needs overcoming a lot of barriers and results in temporary losses. Besides, it is only the technology innovator who knows his/her own abilities, and how far s/he can take his/her product.

Therefore the decision making authority of such a business should lie in the hands of the innovator him/herself. If it lies in the hands of anyone else, the company will not be able to succeed eventually. One might argue that not all technology innovators turn out to be good entrepreneurs. True, but it's only those that can become both are our best bet. They need to be nurtured and supported by policies of the Government and of the society.

6. An R&D based industry, not an ordinary industry, can absorb other innovations

Usually the technology entrepreneurs start off with almost zero capital, relying only on their talent and innovation, which is never understood by our policymakers who borrow their concepts from the present situation of large and medium industries in the West through the academic courses on economics and business management. They never got to know what went behind the real development in the West during the industrial revolution, and what even now goes behind the growth of recent giants like Sony, Ford and the like, all of which started from innovative efforts in a small space like a garage. When such an R&D based small industry grows large, it can promote and absorb innovations by later generation innovators. An R&D based industry usually has the infrastructure and manpower to turn a technological innovation into an industrial product through a process known as industrial design. None of the large industries set up in our country has such capability, since they only depend on turn-key industrial machinery and processes. This is a crucial point which is not at all understood by our policymakers, not even by our intellectuals at the Universities. For this reason

we have been hearing the slogans of 'University-Industry interaction' since decades. These intellectuals still wonder and ask why the industries do not put money to the Universities in Bangladesh. Why should they? They do not need any technological brainpower for running their turn-key projects, nor even for product innovation. If they give some money for charity that is a different issue, it is never a 'University-Industry interaction'.

7. Suggestions for the technology innovator turned entrepreneur

Having placed the argument that the technology innovator should him/herself become the entrepreneur I will give some suggestions for a technical innovator to begin a manufacturing business based on own design.

a. How to choose a product

The best choice for starting a product comes naturally. If one feels that he/she needs a technical solution to one of the problems that he/she encounters frequently, and if others face it too, that can be the indicator for a new product. Behind every product, whether it is the ceiling fan or refrigerator or shoes or the floor sweep, people had felt a necessity, and some innovator probably built one for him/herself first. Seeing that it may have a demand among the fellow people the person tries to make more and sell. This quickly gives a feedback as well, whether the product is going to catch a market or not.

Next, one has to see if the cost of the product would be competitive if a similar product, whether local or foreign, is already available in the market. As a rule of thumb, consumer items that are usually produced in very large quantities in the industrially developed countries are not suitable for local production in the Third World. One may place digital wrist watches, mobile phones, etc. in this category. It is difficult to compete against such imported products since economy of scale plays a big factor, not to mention the flashy cabinets which will be almost impossible to make in a Third World country like Bangladesh. It is also not wise to go into components like IC's, resistors, capacitors, etc., of the electronic industry for which the unit cost is very low, and has to be produced in millions to make an industry viable. However, in specialized equipment such as Electro-medical equipment, professional laboratory equipment, industrial equipment, agricultural machinery, there is an opportunity, since these are produced in small scale, and to remain in competition, companies have to invest a lot of money for continuous R&D. Since the cost of expert manpower for such R&D is very high in industrially developed countries, the price of such equipment tends to be very high too, and this gives a window of opportunity for the technologists of the

Third World. They can make such equipment and sell them within their own countries profitably at fraction of the prices of the comparable imported ones.

The functionality of such professional equipment is more important than the flashy outlook, and this is a favourable point for the Third World designer. Therefore one should keep the above points in view while choosing a product for local designing.

b. Assessing own ability

One has to assess one's own capability sincerely and realistically; whether he/she is technically sound enough to handle the problem, and to improve the product when need arises. Just copying an existing product without having the basic technical expertise will not lead one far, and the entrepreneur is sure to fail when faced with competition. Therefore, one has to go for a product in which he/she has a sound technological base to start with.

c. SWOT analysis

Since there are many products in the market already, one has to be extra careful. One needs to find out whether there are similar products elsewhere and whether the one in mind can stand a competition if there is. This calls for a SWOT analysis. SWOT is an abbreviation standing for, "Strength, Weakness, Opportunity, and Threat". The words speak for themselves, and one has to assess the SWOT of the product with an open mind. Discussing it with sympathetic but critical friends and experts would be useful, because an innovator may find it difficult to see the oppositions and threats to his/her own products.

Of course sometimes one has to take risks, and the intelligence and experience of the innovator is of prime importance here, since others may not understand the value of an innovative product. Well known examples are the Computer and the Photocopying machine. At one point, IBM, the giant in business machines, discussed in its board meeting that 10 or 15 computers can solve the problems of the whole world, so it is not worth going into this product. They had to reverse their decision within a few years. Rank Xerox employed a market survey team to assess the marketability of their new innovation - a photocopier machine. The report was highly negative, that people would like to copy by writing instead of investing in such an expensive machine. Since the innovator was in a decision making position, the company went ahead with the product in spite of the negative market survey report. The result is before all of us. Conventional market survey does not always work when the product is entirely new. Therefore trial marketing is your best bet. When I developed a new product, Over and Under

Voltage Protector (OUVP), later termed 'Volt Guard', in 1981 after all our household appliances were damaged due to a sustained 400volts on the 220volt line, I talked to a few local industries. No one got interested; they were scared to invest in a new product that is not known in the world market. In 1989 I turned myself into an entrepreneur, side by side with my University job, together with a couple of ex-students. We personally met people at their homes and offices carrying a variable transformer to produce high voltage and to demonstrate the protection that the new device offers at a low cost. We tried to convince people that we need such protection very much for all our appliances because of the extreme abnormalities of power lines experienced in Bangladesh, which is not experienced in the industrially developed countries, and that this was the reason for its absence in the world market. I wrote educational advertisements and articles in the media to explain the necessity of such a product, we presented our products in exhibitions and fairs, and gradually the new product established well in the Bangladesh market, with others making similar products of late. Even there were brief introduction of similar foreign products in the market but they could not survive the power abnormalities here, and the local voltage protectors, and stabilisers with built in voltage protectors still reign the market.

d. Going slow, and going for quality

It is not a good idea to go for a large scale production using a newly developed product right at the beginning. One should go slow; in phases, which will give valuable feedback whether to continue with the product or not. Of course, in a small scale one will be limited by many things. Procuring good quality raw materials, making a good housing or cabinet become difficult challenges. One may have to test each individual parts or components at procurement. This may add some cost, but quality is the best bet, without this one cannot sustain for long. People are prepared to pay a bit more for quality. Besides, in the Third World cost of intelligent manpower is much less than that in the West, so such testing will not increase the price significantly.

One should not worry too much that a product cannot be given a nice looking finishing as the imported ones. It is impossible in a small scale production, and in a Third World setting. Here again, the role of the innovator comes into play. Making the best of whatever facilities and materials are available one can try to design and give the best possible finishing. If the inner quality and performance are good and the cost is competitive one may succeed even with less attractive finishing.

e. Initial finance and cash flow

With the revenue earned from selling the first few items one can make more. Eventually when one establishes a mark in the market, suppliers will come to the doorsteps with offers. If one can sell well these suppliers will be ready to give credit as well. Therefore finance is not a major problem for the really innovative technologist turned entrepreneur (sometimes called 'Technopreneur' though it has not become popular).

Since the beginner will be starting off without much cash in hand, one has to take care of selling in credit. Initially it feels attractive that one can sell more if credit is given, but soon the entrepreneur will realize what a great mistake it was. Soon there will be a shortage of cash flow, and this can ruin a business within a short time. It is better not to sell than giving credit; it is the rule of the game.

f. Marketing, establishing brands

As mentioned before, one first starts selling the products to people known personally and who have trust in the innovator. Gradually when the small enterprise starts to grow and wants to sell to a wider population, to people who do not know the innovator personally, this poses a new challenge. Here there is no alternative to advertisement and a 'brand name'. Apparently it appears as a load on the limited resources, but it will soon pay off. If one can maintain a good quality of the products, people will be ready to pay a higher price for that, but one needs advertisement for people to know, and to opt for the quality product. Once the brand name is established in the market, things get easier.

Many small manufacturers in our country start off selling their products to wholesale distributors, but they will mostly squeeze the small entrepreneur out. This will also not allow the improvement of the quality of the products, because that will need putting a higher price tag, which the wholesalers dislike. Therefore one should start with one's own marketing campaign, wholesale people and distributors will flock to the manufacturer when a product and a brand name is established. Then one can dictate one's own terms for the business. It is a game of establishing pecking order, who can peck whom as in community of chickens. If one cannot be in the commanding position, he/she is ruined.

g. Growing bigger, borrowing from banks

As one gets bigger and gets more confident on the quality of the products and in his/her ability of managing more people and the organization, one may think of borrowing from banks to expand the business. Getting bank loans before one has

made oneself ready may pull down the earlier success. It is a new challenge, and unless one has developed the capability, chances of success are remote. This is the reason for so many failed enterprises.

h. Creating network

As one establishes in the market and starts to produce more, one will have to learn to sub-contract manufacturing of some of the components of the products. There will be enterprises which are already in the trade, even some of the manufacturer's own workers may start such enterprises. One has to use this facility well, co-operate with the others, and give them necessary feedback to improve on the quality. Sometimes one may have to help the sub-contracting enterprises with technological solutions as well. Such a network help minimize the size of one's business which may go beyond grasp if one tries to manufacture everything.

i. Exporting

When one has created a large infrastructure for manufacture and for marketing all throughout the country, the entrepreneur is automatically ready for export. If a product has a demand at home, it must have a demand abroad, particularly in Third World countries having similar economic and social conditions. There is a very good chance that such efforts will succeed, since it comes with a strong local background. Besides, in such technology based products one will not have to beg for quotas from other Governments, as often happens with labour oriented industries.

7. Conclusion

I have tried to present a picture of the scenario that will help both the technology innovator and the policymakers to understand the direction of industrialization that we need. There is no alternative to indigenous technology based industries that cater to the improvement of the quality of life of the common people. Although many policymakers suggest that technology can be purchased, in fact, this is never possible. One has to go through the whole process of R&D to be in a position where he/she can even copy a foreign product by understanding its basics. No one in the current world gives out industrial technology, one has to develop one's own. Exploiting cheap labour for products used by people in economically advanced countries remote from us makes us completely dependent on them. Ready-made garments based on foreign designs and foreign raw materials, computer data entry and handicrafts, all for foreign consumers, may

look attractive at present, but will not take us very far in sustained industrialization. We have to appreciate that there goes on a process of establishing a pecking order globally as well, and unless we increase our own inherent strength, no amount of shouting and invoking of words like kindness and humanity will not get the desired actions from the world community in the short or long term.