

Engineering Research : Its Scope in Bangladesh.*

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ABSTRACT

Developing nations heving an ailing economy do also need engineering research. But they should be able to differentiate the fundamental research from the applied one and these should be weighted in accordance with the national need. Hence the research policy of such a country should not be the same as that in a developed country. A new term 'Appropriate Research' has been introduced.

Some examples of gainful research areas have been put forward. It is quite important to avoid duplication in research at this stage of economy.

1. Definition of Research and of the field of Engineering.

According to Webster [1] research means 'critical and exhaustive investigation or experimentation having for its aim the discovery of new facts and their correct interpretation, the revision of accepted conclusion, theories or laws in the light of newly discovered facts or the practical applications of such new or revised conclusions, theories or laws.'

The field of work wherein scientific knowledge is applied to industrial problems has become known as "the field of Engineering"[2].

2. Fundamental and Applied Research.

Engineering research can be both fundamental and applied. There may be various objectives

of fundamental research. It may try to clarify certain facts theoretically, which are known from practical applications and/or experimentation. On the other hand, it may result in some new ideas/basic principles, which may perhaps be utilized at a later stage to invent and/or to improve certain processes or techniques. And with the help of these processes or techniques human beings will be able to manufacture products, which otherwise could not be produced by conventional methods or could be manufactured only at a very high cost.

In the case of applied research the stress lies mainly on the immediate practical value. Hence the time lag between the research and the application should be theoretically negligible.

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In recent years 'the contrast between industrial research and fundamental research has lessened considerably' [3].

3. The constraints of engineering research in Bangladesh.

Before we come to discuss the scope of engineering research in Bangladesh, let us take some time to acquaint ourselves with the conditions of Bangladesh. The engineering activities of a country depends on its socio-economic structure, its geographical and climatic conditions as well as on its political factors.

Bangladesh is a densely populated developing country. It is far below the take-off stage of Rostow's S-curve of economic growth. For our engineering activities we are to import machineries, spare parts, raw materials etc., which swallow crores of taka from our hard-earned meager foreign currency reserve. For the import of spares for the jute industry alone, we spent annually over 20 crores of taka before 1976-77 financial year. Thus our currency becomes shaky in the international market. As a result our currency had to be devalued twice to less than 50% of its original value within a post-independence period of barely 4 years. In the international market its value is even less.

Consequently, if it were possible to stop such imports (import-substitution), we could not only save our foreign exchange, but we could provide jobs to a sizeable fraction of our unemployed people. Such imports have another undesirable consequence. Due to various reasons, the developed countries have experienced a very rapid technological development in the last decade. New processes are always being invented, which are more economic than the latest ones. Thus we see that the price of NC-machine tools has been reduced by a half and more over a span of 7 to 10 years. Hence there is a trend in those countries to design a product for a shorter span of life. This trend was just opposite quarter of a century back.

In a developing country like Bangladesh, where there is an acute shortage of capital, we are compelled to look for machines of longer life. Such examples are not rare, where machines cannot be run because of a simple part, which the producer company is no more manufacturing.

Now the question is, whether we should concentrate on either fundamental research or applied research or both. If the answer is both, then again, what weight is to be given to each.

Before we answer this, we can state that we have limited resource, which we can divert to research. Research allocations can be increased substantially if such allotted resources regenerate themselves; i. e. if such research programmes help to increase the national income. Research works such as [4] are quite interesting, informative and fundamental. But if we carry out such research works, it has a lot of disadvantages. Firstly, it has no direct application in our country in the near future. Instead it is helping to improve the development in developed countries (brain-aid!), which are in a more favourable condition to deploy their resources to such research programmes. At the same time we can see innumerable number of publications and some dozens of dissertations on Group Technology in developed countries like Benelux countries, U. K., East and West Germany etc. This applied research on group technology has a tremendous impact on the design of products [5] and of jigs and fixtures [5] and partially on the production methods reducing the cost of production.

Hence there should be nothing wrong, if our research aims at the wheels driving of our retrograding economy. The author does not, thereby mean that we should concentrate our efforts only on applied research. Our fundamental research at present should have short term objectives, namely immediate benefit to the national economy. For example, how solar energy or tides or perhaps

even cyclones can be harnessed to generate power, or how available natural gas or other raw materials can be processed to yield high energy but cheaper food products. Or how transistors can be manufactured from cheaper indigenous raw materials.

In conclusion it can be said that we should concentrate our effort on such types of research which will be most productive under the conditions prevailing in Bangladesh. We may term this as Appropriate Research.

4. Probable fields of research in Bangladesh.

The scope of engineering research in Bangladesh is so vast that it can not be discussed in short but certain important fields will be identified.

1) Agrobased industries :

Not only that most of our people are employed in agricultural sector, but also this sector contributes the lion share towards our GNP. Hence any development in this sector will have a sizeable impact on our national economy. For example, jute and jute industry alone, if properly thought out and practiced, may act as the leading sector for the take-off of our economy. Intensive research is to be carried out to substitute cotton by jute fibers, to make insulations and other possible products from jute. Recently there is a tendency in the shoe industry to use jute products.

We should be in a position to manufacture jute machineries and spare parts. This is also valid for other agrobased industries.

II) Management and Management Information System (MIS)

It will not be much exaggerated, if we say that our industries and offices are facing acute management troubles. Not only that we take wrong decisions, but also in many cases we fail to take any decision.

One of the causes of management difficulties is absence of or wrong MIS. The author has already

proposed some methods [5], which are at least partially correct for our country. Prof. Noiret [6] has underlined the importance of information system in a developing country (namely Argentina).

III) Group Technology (GT)

It has already been mentioned that Group Technology has already been successfully used in industries of developed countries. In this technology according to their dimensional and functional similarity the jobs are classified into various groups. Thus the design and the production of jobs cost less. The cost of jigs and fixtures are also reduced. Solaja and Urosevice [7] have shown that this technology is also useful for developing countries.

The author proposes to extend the conventional boundary of group technology from the grouping of jobs to the grouping of factories, i. e. different factories producing similar products will be grouped together. Every factory will manufacture a given set of parts/products, which will be required by other members of the group. Since most of the factories are nationalised, the implementation of this proposal will be advantageous. Furthermore in many factories all the machines are not fully utilised now. But after grouping their time utilization will be much higher. Even in capitalist countries individual concerns are now having 'marriages'. Furthermore, many of the factories in the capitalist block are getting their parts from countries in the communist block.

IV) Industrial Engineering/Ergonomics

In many factories the workers work under such poor environmental conditions and have such uneconomic physical movements that they become very quickly fatigued. The productivity is consequently very low.

V. Maintenance

Because we are to import most of our machines, they should be maintained for longer life. In our country there are many machines, which

remain out of order over 25% of the productive time. This is very much precarious, when the production schedule is to be well balanced or it is a continuous processing industry like sugar mills etc.

VI. Construction.

In the completion of a building, bridge or of a project we can use the network analysis and thereby reduce avoidable delay and cost in its completion.

If it were possible to develop bricks of higher strength to weight ratio than that of the present ones, the steel requirement would have been much less. Thus the total cost could perhaps be less.

In German Democratic Republic a statistical analysis was carried out to find out the frequency distribution of the dimensions of the beams for single unit houses. They found out that similar beams occur quite frequently and cover more than half of the total requirement. These beams were precast in large scale, which resulted in the reduction of the cost of housing.

4. Cooperation between research organisations and industry

Cooperation between various research organisations

There must be a good understanding and cooperation between the researcher and the industry, specially in the field of applied research. The reasons are : (1) the researcher must know where and how the problems appear, (2) the industry must know where it can look for the solution of its problems and (3) at least a part of the research expenditure, if not the full, is to be borne by its user.

The past mentality of the industrialists and Sector corporations that the solution of the problems is to be sought in foreign countries only, does not exist any more. Private Industries and sector corporations are coming up with their problems to the local research organisations. The researcher must also come forward to take up this giant task.

Our country has different research organisations in different capacities. Because of resource constraints, we cannot afford to work on the same problem at different research stations. Every organisation should inform other organisations of its activities.

There should be regular contact amongst the organisations. There can be a central committee to coordinate the research problems of different organisations. In this respect Bangladesh Council for Scientific and Industrial research (B. C. S. I. R.) has a great responsibility.

6. Proper environment for research.

For any research work the researcher must be mentally as well as physically prepared for it. He must have sufficient time to work on the problem. He must also have proper facilities as experimental set-up, instruments, computers etc. He must know, how far this or similar problems have been solved in other countries. This can be achieved by keeping necessary up-to-date journals and also by exchanging ideas with researchers at home and abroad.

Experimental facilities are usually very costly. On the other hand, it may not be possible to utilize such facilities exhaustively, in one organisation. This may be for example in the case of a medium size computer. A computer of this size is usually necessary for the dimensions of the engineering problems. But there may not be sufficient problems in an organisation to justify its purchase. Then it can be solved in that, the research organisations make a central fund to purchase such costly facilities, which will then be used by the member organisations. The central committee, as proposed earlier, may be responsible for its proper running.

7. Conclusion

Our national economy is now passing through a critical stage. This is also reflected in the activities of our industry. It is high time that we perceive the problem and concentrate our efforts individually and collectively.

We see that our scholars go abroad and solve the problems of those countries brilliantly. There is no reason, why the same people cannot solve the problems of their own environment.

Our Government, industries and research organisation must come forward sincerely to tap this resource. Our researchers must also face these problems boldly and squarely.

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