

REQUIREMENTS FOR RESEARCH AND DEVELOPMENT (R&D)

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A number of attributes that a researcher possesses contribute immensely to the quality, efficiency and effectiveness of research. These could be broadly categorized into either personal or professional. Personal attributes could be, for example, ability to work in teams, leadership, commitment, tolerance and determination to name a few. The professional attributes are essentially related to competence in the subject matter. Through working with researchers (only in the selected areas of engineering research) for sometime, I have observed that if potential researchers could be moulded from early stages (for example at undergraduate level) so as to develop some of the basic attributes and skills, which would facilitate research work, the output of research could be vastly improved. Such pre-conditioning of prospective researchers is essential to develop, maintain and sustain a research culture in a research organization. Given below are some of my observations, which highlight areas needing an early development.

- In a country like Sri Lanka, where R&D expenditure is very small, it is necessary to channel the R&D funds into more productive research. Knowledge and skills in the following areas would support this.
 1. Identifying research needs through proper need assessment mechanisms. Engineers should be aware of these mechanisms and how to apply them in the field environment.
 2. Developing the research needs into a well-focussed research problem, which is manageable.
 3. Preparing and developing a research proposal for funding
 4. Designing research projects and conducting them in a scientific manner
 5. Analysing and evaluating research results
 6. Presenting R&D findings

Observations have revealed lack of skills and competence, among engineers, in addressing most of these issues in a professional manner. Many have even shown inability to appreciate the need for such elements in a research programme.

- All commercial R&D (these should be the focus in a country like Sri Lanka) essentially should end up with a marketable technology,

- product or service. Ability to appreciate marketing needs of R&D results would be very useful in achieving this. For example,

1. Engineers must be able to appreciate and assess the marketability of R&D products and technologies. In the process he/she should be able to transform the raw R&D results into a commercial products/technologies, which should include features that help attract the customers. Some basic knowledge of 'Marketing' would immensely help engineers in this endeavour. Unfortunately, many R&D engineers are not reactive to such needs.
2. Ability to assess and value the quality of work in every step of a product development process in relation to limitation of processes being employed and performance expected thereof are very important criteria for carrying out R&D successfully. Lack of knowledge and understanding of valuing the work being done are seen to be a major obstacle for carrying out quality research and product development. Basic understanding of process limitations is very essential, for example one should know what can be and what cannot be done by welding, soldering, etc. Basics of these are covered in the undergraduate programmes, but what is needed here is the practical side of these processes. There had been incidences that some have tried to prevent leaks in welded joints by applying fiber glass resin, to prevent leakage in the flanges some have attempted to use higher thickness of jointing material without success, instead of machining the flange surface square. Such misuse of engineering basics is called "Engineering Blunders". There are hundred of other examples to substantiate these shortcomings.
3. There is general lack of competence in appreciating, valuing and taking measurements in R&D work. Engineers must be able to appreciate and value the importance of measurements in R&D work, for example setting up experiments, organizing measurements, maintaining objectivity of measurements, etc. Also, they should understand the importance of replicability of R&D measurements and results.
4. Some techniques in conducting survey-based research would be very useful. These techniques are important in conducting survey-based research in assessing R&D needs, assessing social impacts of new technologies and products, etc. Special skills required are designing survey based research studies, preparing and administering relevant questionnaires and other data collection methods, using statistical techniques for analysis of data and results interpretation.
5. Skills in mathematical modeling and simulations of engineering processes can lead to more efficient and effective research. Initiation and knack for using such techniques by R&D engineers (in Sri Lanka) seems to be very low. Basic problem being the lack of knowledge and competence in such techniques. Engineers engaged in R&D work must be able to appreciate the strength and capacity of such techniques in R&D environment and then develop competence in using them in related R&D work.



When it comes to popularise and then commercialise R&D products, technologies or services costing is an important factor. It is the general observation that R&D engineers are not very conversant with factors, which decide the final price of a product, service or a technology. Some basic exposure to practical aspects of real costing would be very useful.

Indicated above are some basic knowledge and skills that an R&D engineer should possess, if he is to carryout research in an efficient and effective manner. While it is well appreciated that a basic knowledge may be given at undergraduate level, comprehensive skill development programmes may require additional programmes, may be as continuous professional development (CPD) programmes.

The observations made above are related to professional competencies, which are technical in nature. However, there are personal attributes as mentioned at the beginning that need to be addressed too. These few observations are based on my personal experience, working in an R&D environment for over 15 years.

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He counts over 25 years of professional experience of which last 15 years has been in engineering R&D. Currently, he holds the position of Deputy General Manager (Projects), National Engineering Research & Development Centre of Sri Lanka.