
Research Projects and their Significance - Prof Sohan Wijesekera

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Preamble

Generally it is considered that research projects and their execution is an important topic for university students who have enrolled for either bachelors or postgraduate degrees, and for university academics who supervise their research projects. Sometimes a few persons from the industry and several among general public are also interested to find out how research projects are executed and what their outputs are. I know that today our audience consists of these categories. In our country this interested population is rather small and hence the significance in relation to carrying out research/ including a discussion of several key points related to their execution/ may be worthwhile. Accordingly I thought I would talk about this topic in general.

What is Research ?

Research is commonly and simply defined in the dictionaries as, investigations carried out in order to establish facts and reach conclusions.

However, for scientists who are making attempts to do worthwhile research, such investigations should be logical, systematic, in-depth and rigorous. Also it is important that these investigations are properly conceptualized and designed using specific procedures supported by theory and evidence.

The next question is "Do we like research ?

This is a question which had been troubling me for a long time. I love research, but I have not been able to find many, who would actually appreciate research. In fact at the discussion tables one finds that a vast majority do appreciate research, but off the table they do not commit to enhance research capacity. As a result/ we do not see a flourishing research culture in the industry, whether it is the private sector or

the public. We are yet to see practicing establishments encouraging their staff to obtain research degrees. We do not notice the professional institutions promoting research in a meaningful manner.

Let us take a critical look at this. If there are research jobs that are interesting or at least well paid, then it is obvious/ that we would observe many who aspire to become researchers. Let me ask you whether you had ever treated 'Research' as a career. How many of your parents or known friends are in to research careers ? How many job vacancy advertisements have you seen ?

You must hold your answers. It is because I am going to raise a few more questions and you would like to answer all of them together.

In Sri Lanka the proportion of research shouldered by universities are much more than the other agencies. Even at universities, the research jobs are temporary and insecure; unless you find a vacancy in the cadre. However, such vacancies are quite limited and hence very competitive. Most sought after university research jobs are combined as research and teaching appointments. However, University academics also often complain that the support for research is a trifle.

Even though we see a hardly conducive setup either at the industry or at the universities, we note that there is a compulsory research project that has to be undertaken for graduation. The University Grants Commission stipulates that in order to advance as an academic, it is essential to possess at least a fulltime two year research degree under your belt. The University Grants Commission further says/ that there should be/ a significant number of research publications to support your promotion as a professor. It is not only the universities that compel an undergraduate to do the research project, the industry consultative process thus far had never questioned the usefulness of a research project when a graduate is absorbed to the industry.

So if I ask you why do you like research ? Why would you want to do a Research Project ? then would you tell me various positive reasons ? or would you tell me that you are compelled to do research and you have no other option but to carry out a research project?

Is it important to do research ?

Let us look at the other side of the coin. If the universities insist on Research/, and if the industry does not object or raise eyebrows/ with regards to conducting research, then there must be a set of very strong points/ to carryout research/ or in other words, there should be very good reasons to train all graduates in the execution of research projects. What are these pluses?

If we pause for a while and take a relook at what is research, then we would refresh that, Research is carrying out logical, systematic, in depth and rigorous investigations which are properly conceptualized, designed using specific procedures, supported by theory and evidence, in order to establish facts and reach conclusions.

Now you would see that, if we could inculcate this practice of conducting research among our younger generation, then when they grow up and join the workforce, they would be well aware of the method to scientifically tackle a problem. Then not only the lives of individuals and institutions/ but also of the nation as a whole/would be very easy. It will be very easy because such an approach will make optimum use of time and would reduce the trials and the errors in our efforts. In very simple terms, the knowledge on the practice of research would influence getting rid of today's most frequently seen day to day practice of re-inventing the wheel.

The knowledge in scientifically tackling of problems will ensure a productive nation and the inevitable result would be development. Enhancing the capability of a workforce/ is widely known as the reason/ for Sustainable Development.

Research is also known for its high return on investment. According to a Technical Memorandum to the US Congress in 1986 which is called Research Funding as an Investment, states that the research returns are in excess of 40%. According to a report in 2012 by Center for American Progress, the return on investment for publicly funded scientific research is between 30 percent and 100 percent, or more. In June 2012, the Director of National Institute of Health USA had cited data showing that every \$1 of research funding returns \$2.21 in goods and services in Just one year. It is widely known that research spending of a country would not

only help improving the lives and living standards of community at large, but also helps to generate significant domestic economic activity such as generating jobs, economic activities in research and technological capacity, additional investment etc., while spurring scientific innovation.

The importance of inculcating the right methodology is well known to all developed nations and to those who we note as rapidly developing countries. They devote sufficient funds for research without hesitation. They know that the returns are high. Now you might ask "How about us in Sri Lanka ? ". Allowing you to find that answer by carrying out your own research, let me get back to the topic and cite a recent news item from Australia.

The first hearing-implant was done in France in the year 1976 and had been patented soon after. In 1977 Australia filed another patent for an innovative hearing aid technology. Australian government states that the returns from this investment would distribute roughly \$1 billion per year by 2022 and within Australia . This is a contribution from just one patent. Securing patents is not an easy task. Yet it is worthwhile and the amounts from breakthroughs are formidable. The Australian government in their recent budget have very ambitious plans for research spending. Their target is to be in the forefront of the technological innovations. If we invest today, our country may not be able to acquire patents either tomorrow or the day after. But certainly we can start the journey today. In this effort, the practicing community and the academia should work together.

At this point we need to note that the foregoing discussion had been about worthwhile research. Worthwhile research is, work that will get wide recognition, that would be used by many, and what may be important for many. Only worthwhile research would make contributions towards national prosperity.

In Sri Lanka the most often heard comment about research is that the research spending thus far had not demonstrated worthy results other than preventing brain drain to a limited extent. Though this expression should be discarded without batting an eyelid, it may be good to make one comment just prior to it. For worthwhile research to spring and bear fruit there should be, One (i), a research culture and Two(ii), a critical mass. Those who plan investments which are of prime importance for the country may have to do more to at least have one of the above concepts in place.

The start of teaching research ?

Having discussed the reasons and found that at least there are very valid reasons as to why we need to carryout research, we now need to discuss when to start teaching 'how to carryout research ". In my opinion, we need to start from the day one. Though this would have been a difficult task, a decade or two ago, we now find that today's infrastructure provides a great opportunity for an early kick start . Infrastructure and continuous financing are not the only things that are required. Most importantly we need to possess sufficiently trained human resources to teach how to carryout research.

Since research is to follow the correct methodology when executing a meaningful investigation, the first step towards the goal should be with respect to the methodology. The "meaningfulness of investigation" would come along the way, "as you advance in your career". What we need to bear in mind is that if a person absorbs a flawed methodology, then most likely it will remain as the crookedness of a dogs tail.

Therefore, it is important that we possess trained human resources to teach how to carryout research. Web searches reveal that in USA, the research methodology is embedded from childhood and starts from the elementary school which is primary k2 and at an age between 5 and 7 years. In this education system, the process starts by teaching a student on how to read and reference just a few lines. Then the objectives are gradually enhanced through the High School, where they learn how to write a research paper and all they should know about plagiarism. Guidebooks for teachers are on the web and can be downloaded free.

In Sri Lanka, the situation is quite different. The research project competition for school children promoted by the National Science Foundation of Sri Lanka does include several guidelines developed by scientists and university academics. If an attempt is made to do a literature review of open access research project guidelines written for school children, then it is possible to significantly contribute to improve these support material.

In our case, carrying out a research is introduced only at the university and this is also at the tail end of the undergraduate life. During our time/ the research project was in the final year, it was optional and even if it was carried out, was not

accounted for. Presently a research project is compulsory and from approximately a year ago it starts during a very brief semester at the end of the third year.

The point I want to raise here is that even now, the student-experience with the research project is very brief, inputs and guidance are sporadic. Then, upon graduation, they reach the industry where the majority has had similar or lesser experience with regards to the conduct of research. We need to consider these points and take immediate steps to evaluate the situation, if we know the value of doing research.

Even after hearing the setup in our country, one would still ask why we introduce research at the tail end of university undergraduate education. Frankly, I do not know why we do it at the tail end. I also cannot understand why we do not include a course module in research methods. However, I do know that universities are chosen to execute this task because university academics are the best available group with a proven track record.

If you compare our education system with that of USA, it is as if our system injects a dose of fertilizer to a plant at its maturity, whereas in USA, fertilizer is added in small doses throughout a plants growth period. Next if you compare pursuing research after graduation, then in Sri Lanka, it is similar to almost zero care while the opportunities in the industry is far more in USA. In order to support my view, let me compare available US statistics pertaining to research spending in all three kinds of research. Namely, Basic, Applied and Development Research. In the US, universities perform approximately 54% of basic research. However out of the total expenditure on research only 20% is for Basic research while 60% is for development research.

To me, the most important component in an Undergraduate Research Project is the transfer of methodology. It is this that they would carry to the practicing arena. If you take the thesis of an undergraduate project, then there should be a clear demonstration of the knowledge and use of correct methodology. This is the Cake. In my opinion, the topic "that is investigated" to arouse the interest in the execution of final year research project, is the icing on the cake.

It is sad to note/ that today most of the academics in our universities, due to many reasons concentrate on the icing and not one the cake. This prevents us from driving the nail deep into an undergraduate so that the importance of systematic

work stays fixed throughout their career or life. I am certain that all of you would agree with me.

Now let us look at how we at the universities had performed. If we at the universities had embedded the method of executing research within our graduates, if we had done the job to a reasonable degree of satisfaction, then we should see our graduates who are holding leading positions in the industry valuing the need to do research. Had they been properly educated, then they would demonstrate their vision to encourage research at their institutions, exhibit that they support their staff obtaining postgraduate qualifications, display their willingness through collaborative research projects with universities.

We need to question, do we see this light even at the horizon ? The answer is that undergraduate research project has to first target baking of a tasty cake and then focus on the appearance of icing.

For the Students

I have now put the cards on the table. I have raised sufficient concerns about research, importance of research, the way Sri Lankans are trying to implement the teaching through a research project, its adequacy and the sufficiency of industry inclination. It is important for the students to understand that the opportunity given to you in the Final Year is probably the only one or the first if you had chosen a research career. My appeal to you is to grab this opportunity, and embrace the opportunity and then apply the sixth law of work stated by Professor William Frederick Book. He was a Professor of Educational Psychology at Indiana University who said that it is important to Learn to adjust yourself to the conditions you have to endure, but make a point of trying to alter or correct conditions so that they are most favorable to you.

Students need to understand that there is a big difference between a design project and a research project. The design projects often deals with working towards a solution for a set of specified requirements, while a research project focuses on an investigation in an unknown territory. Most design projects would require/ working with guidelines/ whereas very often research projects would lead to the development of guidelines.

Therefore a student carrying out a research project should perform all tasks as if he or she is stepping in to an unknown territory. It is like a video game where the player is moving by foot without any other assistance/ and permission is granted only to lift one leg at a time. There is loose soil everywhere except along the right path. In order to win, players are recommended to probe with one leg while the other is firmly on ground.

Similar to this game, a researcher should also be inquisitive and must move forward only after a situation analysis at each step. Justification of each step is the core of a good research.

Students of the present era usually find this a bit annoying. The present day younger generation who I categorize as Digital Natives, have an inherent weakness which we the Digital immigrants do not have. You belong to the digital era of broad bandwidth surfing, where an answer which is right or wrong is displayed at the moment you post a query. We on the other hand belong to the period of the slide rule where the order of magnitude of an answer/had to be known/ to get an accurate result.

You are in an era in which information required are posted instantly online. A search engine would provide a split second answer to your question. Main weakness that had been noted is that during online research, students unsuccessfully scan pages and pages of text as opposed to reading for comprehension. Those who carryout research projects are expected to read, interpret and analyze new information. My observation is that most of you are not used to this. Therefore It is necessary to keep in mind that through the research projects, you are now learning a new, a more structured and a sustainable practice. You need to make a few changes and this may be irritating at the beginning. Though these may initially appear as sacrifices, you will realize that you are better off in the long term.

Before I windup, let me tell you the main hurdles we come across during our efforts to supervise a successful research project. We feel that our students should improve their English language skills. This is a must because many of you have studied your A Levels in your mother tongue and upon entry to the university you face "an uphill task with the studies" due to the sudden change in the medium of instruction. In this context the most difficult part in the research projects would be in the speed reading of technical literature. Therefore special efforts should be taken in this direction.

The other is the IT skills. We are aware of the mundane manner, most students and teachers treat these two subjects at Advanced Level. Studies have shown that worldwide, 21% of productive time is lost due to inadequate digital skills and it adds up to over 500 hours per person per year.

The completion of a good research project requires a significant amount of digital skills in reading, planning, computing, report writing and making presentations. Students who have good digital skills would definitely have easier lives. This alone would not suffice, they have to learn to read, analyze and document. This is hard work and you are urged not to underestimate the work loads.

Under these circumstances You need to be a genius to produce worthy research results.

The famous Thomas Alwa Edison (1847-1931) had once said that genius is 99% perspiration and 1% inspiration.

Sir Isaac Newton(1645-1727) also had quoted similarly; "If I am anything, which I highly doubt, I have made myself so by hard work".