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A FRAMEWORK FOR PREPARING QUALITY PROJECT IN CHEMICAL ENGINEERING STUDENT TOWARDS WAYS OF THINKING AND ACTING LIKE PROJECT MANAGER

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A Framework for Preparing Quality Project in Chemical Engineering Student towards Ways of Thinking and Acting like Project Manager

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Abstract – One of the challenges faced by students that are involved in the acquisition of an engineering degree, as higher education are related to the difficulties of development of a academic research project. Such challenges are surrounded by incorrect determination of the research scope and complexity, the erroneous estimative for the research conclusion or even finishing with poor quality as something that were not expected by the advisor and other evaluators. These elements culminates in the application of project management that is being studied by institutions and industries over the years and which aims to improve the process of project development in general, including academic projects aimed at scientific research in the university. From the presented scenario, the general objective of this paper is to provide general framework for preparing quality project which helps to improve thinking and acting quality of students.

Keywords: Project, Project Management, Chemical Engineering, Higher Education

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1. INTRODUCTION

Project management has become a distinctive way to manage business activities nowadays. Hence, project managers play a key role to manage a project. A generally accepted definition of a project manager is 'the person that is assigned to ensure that project objectives are achieved'; the project manager is the person responsible for the day-to-day management of the project and all of its elements.

As project contain many tasks are performed concurrently with each other contain defined constraints that require one task to be completed before another starts particularly from both theoretical and practical perspectives undertaken to create a unique product or service.

In project management research from the perspective of its relationship to allied disciplines in the engineering field and provides a view of the progress of project management as a research-based academic discipline. The evolution and trends of project management research are analyzed by exploring, identifying, and classifying engineering management journal articles on project management in the allied disciplines. The analysis of project management research in the allied disciplines reveals an explosion of popularity and strong interest in project management research. Result of this study help us better understand the how to write project as a field of practice and an academic discipline, and allow us to provide suggestions for future project management research opportunities. The framework builds a scaffold around eight points relating to project objectives:

- To enable students to explore the wide range of topics, gives an opportunity for innovation, search for professional literature and apply the problem solving approaches.
- To help students in setting projects goals and utilizing of available resources in terms of faculty, staff, library, laboratory etc. in an optimum manner.
- To develop managerial skills in students while working in a team, creative skills by demonstrating novel engineering solutions, communication skills while presenting their end application and an awareness of social and ethical ramifications of their work.
- To teach writing a technical document and help students to represent the professional literature.
- To train students to apply the scientific methods and the problem solving approaches studied in earlier courses to

meet the project goals with the use of advanced software tools, applications and hardware tools.

- To help students in utilization of the available resources in terms of faculty, staff, library, laboratory etc. in an optimum manner
- To develop managerial skills in students while working in a team, creative skills by demonstrating novel engineering solutions , communication skills while presenting their end application and an awareness of social and ethical ramifications of their work.
- To teach writing a technical document and help students to represent the professional literature

2. SELECTION OF BROAD AREA OF PROJECT:

1) Chemical Engineering Studies & Surveys: This includes support for carrying out chemical engineering studies / surveys including techno-economic analysis, simulation modeling and studies etc; and development of State chemical engineering database, chemical engineering resources; State chemical engineering policy issues; specific status reports etc: The activities under this head should lead to specific action plan for project generation.

2) Location specific research & technology development: Support for identifying/ projectising chemical engineering programmes and for development oriented location specific research and technology development.

3) Pilot scale demonstration projects: Pilot scale demonstration projects including field trials etc based on technologies developed by Central Chemical Engineering Agencies/ Labs/ Institutions etc. relevant to the State needs.

4) Replication of success models: Replication of successful projects/programmes in other interested States based on successful experiences of a State chemical engineering council/ State chemical engineering institute/ NGOs etc.

5) Joint Programming: To evolve and support certain joint programmes focusing on multi-sectoral area based approach to rural/ regional development in cooperation with multiple State & Central Institutions, NGO's and State Chemical Engineering Councils. These areas should be so identified where Chemical Engineering intervention could significantly improve the existing socio-economic conditions.

6) Information exchange & experience sharing: This would include meetings/ workshops and other means of information exchange and interaction of Chemical Engineering experts and / or of Chemical Engineering field activists etc: Workshops on dissemination of specific technology, Project/programme formulation workshops.

7) Awareness & Training: Awareness and Training on specific innovative technologies/packages developed/propagated by State Chemical Engineering department/ Council requiring special Chemical Engineering inputs and also on specific Chemical Engineering topics/themes and management of State Chemical Engineering programmes.

3. PREPARATION OF PROJECT PROPOSAL

1. Selection of the Topic

This is the most important area where majority of the students get confused and have number of doubts. Therefore it is advised that the student should discuss the topic with the concerned Guide. The Project coordinator after having necessary sittings with student should suggest name of project supervisor pertaining to the area. Here it is essential that student and supervisor's area of interest should match to enable to work effectively and faster. While selecting the topic following points should be considered.

- The topic should be relevant and contemporary
- It should base on real issues
- Availability of data should be taken into account
- Time available at hand should be considered
- It should not be imaginary or unreal
- It should cover broader area of effect
- It must be specific
- It may be interdisciplinary
- Applicability of it should also be considered

Following are some of the guidelines to prepare the synopsis/ project proposal.

- The project should have a clear title

- A concise introduction of the subject should be given.
- Importance and significance of the subject should be highlighted.
- Objectives of the study should be clearly mentioned.
- Hypotheses to be tested should be properly sited.
- Research methodology of the proposed project to be undertaken should be well described.
- Expected contribution of the proposed project should be well defined.
- Chapterization should be given in the synopsis.

2. Problem Identification

Problem identification involves a lot of background work in the general area of the problem. Normally it calls for the use of prior experience, typically experience you may not yet have. It requires an ability to look at domain and to identify the issue the needs to be addressed and the problem to be solved. It also requires an understanding of the theoretical issues by which we can model the problem. So, the first thing you need to do in your project is become an expert in the problem at hand: a problem-domain expert. At the same time, you also need to know how to handle the tools that will enable you to solve the problem. These might include the operating system, the programming language, the application programming interface (API) definitions, class libraries, toolkits, or any application-specific analysis utilities. That is you also need to become a solution domain expert. The only way to become an expert in both the problem domain and the solution domain is to learn as much as possible about the area and to learn it as quickly and efficiently as possible. Many people come unstuck at this first step and they launch themselves into a frenzy of unstructured research reading much but learning little.

3. Defining Research Problem:

The student should discuss the subject of research project with his supervisor before deciding the research problem and the title of the project. The research process begins with selecting and defining a research problem properly. It is essential here that student himself is clear about the problem that prevails somewhere in some organization. He must have sensed the symptoms of the problem. He himself must be aware that it exist and is a cause of dislocation of work or causing some unrest in the organization. "Research problem, in general, refers to some difficulty which a student experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same".

The research problem exists where:

- Organization or individual are living in an environment which is uncontrollable
- Where there are more than two alternative solutions or courses of action
- There is more than one outcome
- Each alternative offers different outcome. That means the comparison, evaluation and analysis is possible.

The research problem must be reflected in project title. And project title should not contain any ambiguous theme. Even by reading the title of the project one having reasonable knowledge of the subject should be in position to make out the theme of the project. The title of the project should not be too short (which express the very wide area of knowledge) or too long (which covers every minute detail of the theme).

Title should be -

- Short but full
- Concise and clear
- Express the subject
- Focus the core area of the research undertaken
- Contain the period if specific
- If necessary reveal the name of the firm.

4. Literature review

Critical Review of Status Identifying Gaps (include references)

a. National Status Review

b. International Status Review

Literature survey is a background work that is made personally. It is based on books and academic publications. The topics of the literature surveys are selected so that they support the project. The main goal of a literature survey is to gather a basis for the practical work and to show that the student is familiar

with existing literature and research on the topic. It is not smart to re-invent the wheel, i.e., one has to know what has already been done. A literature Review is not simply a list of pertinent references, each considered in isolation. In addition to conveying an understanding of the topic, a good literature review critically evaluates key ideas and observations while making meaningful comparisons between the works of various authors. In reviewing the work that has been performed on a particular topic to date, it should be possible to identify knowledge gaps or inconsistencies, which may form the bias for future experimental work. Following are some of the key sources for conducting literature surveys:

1. Journal papers (Elsevier, Springer, Wiley, AICHE etc)

2. International conference papers

3. Academic reference books, encyclopedia

4. Patent search

5. Websites of core industries

a. Data sheets

b. Application notes

c. Videos

d. Software manuals

5. Introduction:

In introduction student is expected to give brief view of the subject. The focus here should be to create awareness about the subject in the mind of the reader. If Student is covering different dimensions of the subject all that must be explained briefly. The intention must be to give an overview of the subject. By going through it the reader must get an understanding that student is having sufficient theoretical knowledge of the subject and can explore something in depth. He should be introduced to the problem and the subject student intends to deal with. Here the student should start with wider perspective of the subject and should take the reader to the specific problem. The problem or issue should be explained/ introduced in brief.

6. Significance and Importance of the Study:

Student has to explain the importance of the subject here. Why in his opinion the subject is important is to be explained in brief. Importance of every subject is different, and it is always based on the place, location, firm, kind of firm, product etc. All these aspects are to be covered under this head. For example; if student wants to deal with the subject working capital, then he must explain the concept of working capital by quoting one or two definitions. Further he should explain how the efficient utilization of working capital is important for the said industry. And then he should discuss the important dimension of the subject in brief.

If student wants to deal with the subject Absenteeism, then he should explain the concept of absenteeism first and then why it is to be addressed in case of a particular industry. Significance of the subject changes with time. For example, Voluntary Retirement Schemes had significance 10 years ago. Now it has lost that relevance as the firms have already shaped themselves rightly and employees have also prepared themselves for such situations. Same is the case with all cost cutting programs or devices. So how the subject is significant in current situation is to be explained here. A peculiar dimension to the subject makes it significant, and that issue is to be dealt under this head. Significance of absenteeism is different from area to area unit to unit and industry to industry. Student should cover this aspect under this head. Student can give importance and significance of the subject in numerical form of sequence.

7. Objectives of the study:

Here objectives of the study undertaken are to be stated. At this level five to seven objectives are more than enough. Objectives are the answer to the question 'what aspects student wants to know by doing this project'? Objectives must address the various issues he is going to deal with in the said project.

8. Hypotheses:

Hypothesis is a principle instrument of research. It is main assumption made to study the subject. It can be defined as, “assumption or some supposition to be proved or disproved”. Hypothesis must encompass all the objectives of the study. The student through his project work attempts to verify or test the hypothesis. Thus it serves as a compass for the student. It can be called as a probability statement pertaining to some issue. The verification and testing of which is the purpose of the project. The student must formulate one or two sentences of assumptions as hypothesis which covers all the objectives of the study. So, hypotheses must be;

- Clear and precise
- Capable of being tested
- Limited in scope and must be specific
- Expressed in most simple way
- Must be consistent with known facts
- Amenable to testing within limited time
- Must be stating relationship between variables.

There is a backward linking between hypothesis and objectives. Hypothesis as sentence of assumption must cover or deal with all the objectives of the study. There is forwarding linking between hypothesis and Chapterization. The issues of various aspects raised by hypothesis must find place in Chapterization. In Chapterization there must be a chapter or heading with the sentence of assumption. Hypothesis can be positive or negative. So we can say that hypothesis states what student looks for and it is proposition which can be tested to determine its validity. Few examples of Hypothesis:

- Absenteeism in ABC Company limited is the indication of low morale and poor management initiative.
- ABC Company limited has improved its financial position during past 3 years, i.e. from 2012 to 2015.
- ABC Company has improved its market standing through its service in Mumbai city.
- Present Management Information system in ABC Insurance Ltd. is adequate and enables the top management in its decision making.
- ABC banks consumers are happy with the quality of the services rendered.

9. Research Methodology:

Under this head student is expected to disclose the way he is going to carry out the research. Here he should mention about

a. Sample

b. Sources of data collection

c. Method of processing the data collected

a. Sample: It is assumed that the student will explain how he has determined sample design or sample size. He must give logical explanation for sample size/design he chooses. In short there should be some plan for collection of data the research work needs how it will be obtained and why this sample size is taken. Further the student should give details about the sample selected and sample size. He is expected to give justification for the chosen sample. The sample size should be significant. He should try to reach to maximum respondents. Another aspect which he should deal with is the method used for sample designs. The sample designs are -

1. Deliberate sampling
2. Simple random sampling
3. Systematic sampling
4. Stratified sampling
5. Quota sampling
6. Cluster sampling and area sampling
7. Multi-stage sampling
8. Sequential sampling

Appropriate method of sampling is to be followed for the research/ project work. It is not possible to quote examples of all these methods, so for the sake of understanding a brief example is given.

For example:

If a bank under study is having 5000 customers at present. He should give brief account of his sample i.e. Sample size for this study is 1000 customers. i.e. 20% of total customers It comprises 500 men below 60 years of age 200 senior citizens (of which 25% women) 100 Working women below 60 years of age 100 College students 100 House wives

b. Sources of data collection: Which source whether primary or secondary source of data collection the student is going to explore for his study is essentially be mentioned. Mentioning the titles of the documents he is referring is a welcome gesture, but if not, it doesn't matters at all at this level.

For example:

For data collection questionnaire will be served to 1000customers as primary source of information. The student will conduct unstructured interviews of 50 customers. As he himself is working there will be get chance to observe the customers too. Hence Questionnaire method, observation method and interview method will be uses to collect the data. If he is using annual reports newspaper cuttings of the bank for the some information.

It should be Annual reports and financial statements of the bank will also be used for the study as secondary source of data collection.

OR

Primary source of data collection –

- Questionnaire to 1000 customers
- Unstructured interviews of 50 customers
- Observation method

Secondary source of data collection-

- Audited annual reports for 3 years
- Bank periodicals of last 3 years.

c. Method of data processing: Here it is expected that student will give brief idea of data processing. The econometric tools or statistical tools and techniques, the student intends to use need to be mentioned. In nutshell student is expected to give the process he will follow, tools and techniques he will use to reach to the conclusion or to test his hypothesis.

10. Work Plan

Phase-wise plan of action up-to post project activities detailing time schedule Milestones may clearly be indicated. PERT chart may be attached.

11. Chapterization:

It is scheme of chapters. Sequential and logical arrangement of the chapter's student proposes for the study. Student has full freedom to design the Chapterization. Chapterization should

- cover all the related issues
- not have too many chapters
- maintain the flow of the subject and have logical sequence
- not be overlapping
- have sufficient number of subheadings
- be clear and concise

12. Expected Contribution:

Here the student is expected to discuss how his project will enhance the present level of knowledge. In which way it is going to help the organization under study. What contribution will it make in the field of study? How the industry, customer, a business unit will be benefited or improve as a result of this project is to be expressed here. In other words expected contribution means practical use or benefit the society may enjoy due to his efforts is to be expressed here.

13. Expected Outcome in Physical Terms

a. New/ Upgraded Product

b. New/ Up-scaled Process

c. New/ Upgraded System

d. Services (including Software)

e. Feasibility Analysis

f. Any other

14. Challenge & Constraints

Please identify strengths and weaknesses of the implementer's vis-à-vis current project in terms of technical expertise, team building, past record etc. Also list the perceived opportunities and threats and describe how PI/Organization proposes to capitalize on them or avert them.

15. Quality of student projects

a. Initiative and Implementations

- Encouraging and facilitating more in-house projects to be done by students in the campus facilities under the guidance of faculty members.
- Encouraging and facilitating students to do projects for specific industry leading to the use of completed projects to be used by the industry for a larger social cause.
- Establishing projects supporting programmes on institute level.
- Installing the completed projects in the Departmental Labs for possible further work by next set of students and demonstration to visitors.
- Encouraging and facilitating the students to publish papers in national and international conferences on the projects completed.
- Awarding the 'best student project' to one student in each Alumni Meet.
- Encouragement to take up mini projects of social relevance where in innovation is an integral part and offering financial assistance for the successful completion of these types of project works.

b. Project Quality Aspects

- Technical Quality, as measured by Defect Counts and positive counts or indicators.
- Perception of Quality, a subjective factor that can be measured by such indicators as Student Involvement and Stakeholder Satisfaction

c. Indicators of Quality

- Engagement Measures: Internal Customer involvement in key project activities; expected vs. actual.
- Planned vs. actual cumulative review count
- Assessment Measures: Customer satisfaction surveys; stakeholder expectations evaluation.

d. Project Groups Competencies

- Using tools interactively (use language, symbols and texts interactively, use knowledge and information interactively, use technology interactively);
- Interacting in heterogeneous groups (relates well to others, co-operate, work in teams, manage and resolve conflicts);
- Acting autonomously (acts within the big picture, form and conducts life plans and personal projects, defends and asserts rights, interests, limits and needs).

CONCLUSION:

The project having the characteristic is unique and temporary. In any case, it is necessary to consider the nature of the potential project, characteristics of different projects, advantages and disadvantages of every organizational form, different preferences in the culture of the home organization, as well as to reach the best possible compromise. It is generally considered that the functional model would be the best choice for projects where the major focus is oriented on the qualitative technology application. Thus by following the above said framework project outcome concludes ability to;

- Acquire the thinking pattern which explores wide range of topics for innovation
- Learn the technique of analysis, classification and then selection of appropriate literature.
- Learn the methodology to apply the problem solving approaches
- Learn to communicate effectively with others to discuss technical, social needs and find an engineering solution.
- Learn the methodology to apply the problem solving approaches.
- Communicate effectively with others to discuss technical, social needs and find an engineering solution.
- Learn practicing to maintain and prepare a project report / synopsis, report of the work done as an evidence of an ability to work independently and in a group for the given task
- Prove themselves with performance with emphasis on effort, organization, creativity and initiative.

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