K-CHART: A TOOL FOR RESEARCH PLANNING AND MONITORING

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ABSTRACT

The importance of planning and monitoring in any activities, more particularly researches can never be over-emphasized. Inadequate research planning and monitoring leads to delayed delivery of results, inefficient use of resources and increased cost. There are various research tools available and being used to assist in research planning and monitoring. An efficient tool should address the issues under study, the methodologies used, the expected results in sufficient details, the timelines, and monitoring features. However, there is arguably no existing tool that can support all the features individually. In this paper, a new research planning and monitoring tool, K-chart is proposed. K-chart provides all the features mentioned above and presents them in a simple way. This paper elaborates on the construction of K-chart and its advantages.

Keywords: Research methodology; K-chart; planning and monitoring tool

ABSTRAK

Peri-pentingnya perancangan dan pemantauan di dalam sebarang aktiviti, lebih-lebih lagi penyelidikan tidak dapat disangkal lagi. Kelemahan perancangan dan pemantauan penyelidikan boleh mengakibatkan kelewatan mencapai hasil penyelidikan, penggunaan sumber yang kurang berkesan dan peningkatan kos. Justeru itu, terdapat pelbagai alat penyelidikan yang boleh digunakan untuk membantu dalam perancangan dan pemantauan aktiviti penyelidikan. Suatu alat perancangan dan pemantauan yang berkesan seharusnya mempunyai ciri-ciri yang meliputi isu kajian, metodologi yang diguna pakai, hasil yang dijangkakan secara terperinci, garis-masa dan pemantauan. Walau bagaimanapun, sehingga kini, belum ada suatu alat yang mempunyai kesemua ciri-ciri yang dinyatakan secara sekaligus. Di dalam makalah ini, satu alat perancangan dan pemantauan penyelidikan yang baru iaitu Carta K adalah dicadangkan. Carta K mempunyai semua ciri-ciri yang dinyatakan dan dipersembahkan dalam bentuk yang mudah. Makalah ini juga memperincikan proses dalam pembangunan Carta K dan kelebihan-kelebihannya.

Kata kunci: Metodologi penyelidikan; Carta K; alat perancangan dan pemantauan

1. Introduction

Planning sets the first phase of a research activity. It involves identifying of problems and topics, setting the objectives, identifying the deliverables and milestones and placing the timeline. Clarity in planning will lead to smooth progress of research, even in cases when parts of the research objectives need to be changed. A good planning tool should be able to facilitate the change smoothly.

In general, there are several basic features that are considered necessary for a comprehensive research planning and monitoring tool. This includes a clear presentation and designation of issues under study; the methodologies adopted in the research, the expected results, the timelines and the progress indicators. The issues under study should be clearly presented in a way that the dissection from the general issues to the more specific ones is

apparent. This is important so that the scope of study (depth and width) can be clearly identified. The dissection process of the issues is also strongly related to the level of assumptions made in the study. A good tool should be able to indicate the level of assumptions made. Subsequently, for each of the specific issues under study, the methodologies adopted should be identified. This should be clearly and easily presented by the planning tool.

Results are considered the most important part of research. Based on them, the success of a research project can be gauged. Thus a planning tool should be able to clearly present the list of the expected results; the performance parameters (dependent variables) together with the corresponding design parameters (independent variables). The designation of the results based on their importance is another feature that is normally very useful to researchers. For example, knowing which of the results are expected to have some novelties is particularly beneficial for prioritization purposes. A good research planning and monitoring tool will also include the information on the timelines; when each of the activities is expected to begin and when to stop. However, the timelines lack the ability to indicate the research progress status. This monitoring information (in the form of percentage of completion) is a very important part of research planning.

Research planning and monitoring tools which support all the features mentioned above are highly desirable. Unfortunately, authors' literature survey reveals that none of the existing tools is capable of supporting all of them individually. Rather, various tools need to be utilized in order to develop a comprehensive research plan. Cause and Effect diagram, also known as Fishbone diagram or Ishikawa diagram (Madu 2005; Nur Riza *et al.* 2000) is useful to identify the parameters under study and their relationships. Pareto chart (Madu 2005; Salleh *et al.*1999) helps in identifying the relative degree of influence of the factors affecting the performance of the systems under study, while flow-charts are very useful for depicting the sequence of a process. However, all the tools are rather too specific in their functions. For example, all of them (Ishikawa diagram, Pareto chart and Flow chart) do not clearly show the designation of issues, and the methodologies used. They also do not accommodate sufficient monitoring abilities. Another tool which is perhaps the most widely used planning tool is Gantt chart (Pritchard 2004; Wilson 2003; Pyzdek 2003). It provides the activities involved and the time line. Thus, Gantt chart is useful for monitoring purposes as well. However Gantt chart lacks the clear designation of issues under study, and the specific results to be obtained. So, the clear scope of works; the depth and width of research are not conveniently presented.

This paper proposes a new tool developed to assist in planning for a research project activity. The tool, known as K-Chart attempts to integrate the elements of issues, methodologies, results and monitoring.

2. Content and Construction of K-chart

K-chart is presented in the form of a Tree diagram as illustrated in Figure 1. A K-chart consists of Issues, Methodologies, Results and Time line. A K-chart basically organizes the issues from the broad ones to the specific ones within the area under study. The broader issues are placed at the higher branches of the Tree diagram, and dissected into various specific issues (sub-issues) underneath it. The issues are then designated into general, complementary and focused issues. The issues under focus are distinguished by the thicker (or colored) lines. These are the issues that will be the main study, while other issues are meant for literature reviews only (General issues). However, as the layer of issues gets deeper and more specific, the issues for literature reviews also become more in-depth (these are referred to as Complementary issues). The number of layers in dissecting the issues into more specific ones

indicates the degree of assumptions made to the issues under study. The more specific the issues under study, the less the assumptions are made. This is important, as assumptions made must all be valid in order for the eventual results to be meaningful.

After the Issue layer (or band of layers), the methodologies are specified.Generally, methodologies can be designated into various types such as theory, simulation, experiment and survey. These are essentially methods used in obtaining data and in analyzing them. Again the methods with thicker (or colored) line indicate the ones, which will be principally adopted by the researcher. The layer of Results will then follow, and appears as branches underneath each of the methodologies. Results basically list the parameters under study which are divided into two main categories; Performance Parameters (PP), and Design Parameters (DP). PP represents the effects or outputs (dependent variables) of the systems under study while DP the inputs or causes (independent variables). The number of results expected will be the total number of DPs. In Figure 1, there will be as many as five results expected, three for PP1 and two for PP2.Moreover, the results which are expected to be of higher priorities, for example, due to their novelties are represented by dotted (or colored) perimeters.
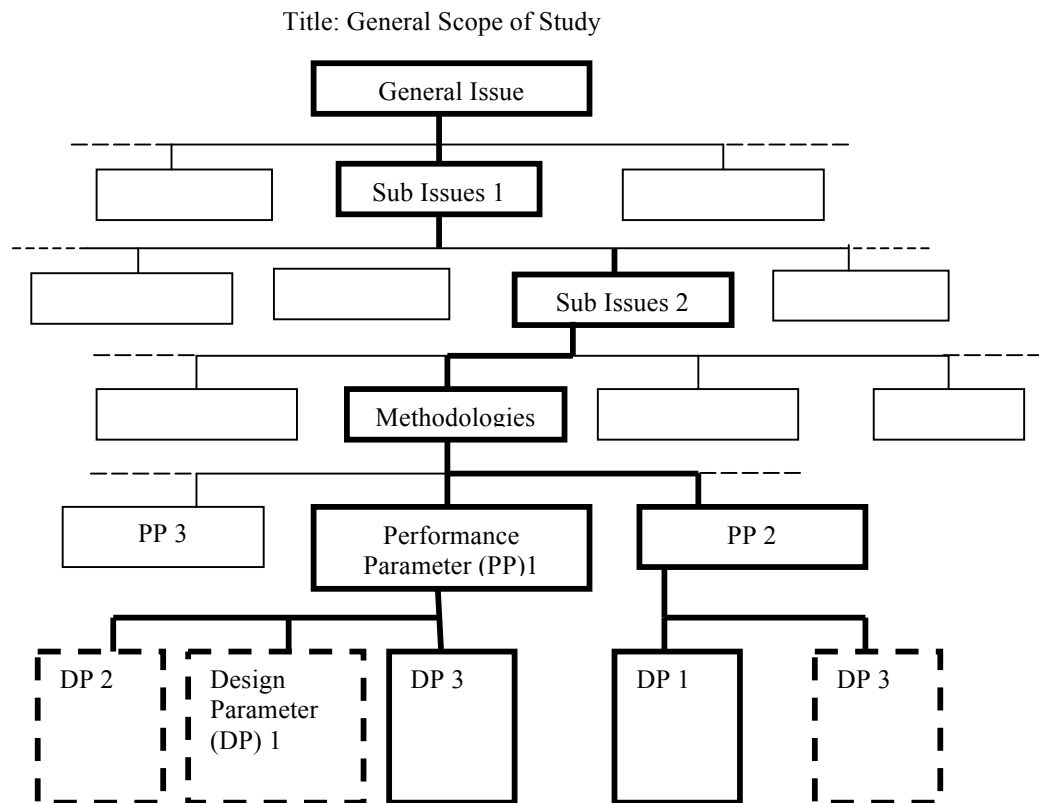
Title: General Scope of Study

Figure 1: Structure of a K-chart

Finally, the timelines are constructed to correspond with each of the DPs. Thus, DPs will appear horizontally while the timelines vertically, in contrast to Gantt chart which normally arranges the activities vertically and the timelines horizontally. This is illustrated in Figure 2.

3. Monitoring Capability of K-Chart

The monitoring element of the existing tools is primarily represented by the timelines. However, timelines only depict the expected completion dates (and the corresponding

periods). They do not clearly present the current progress of research. The information on how much and what percentage has been currently achieved, cannot be clearly shown by the timelines, and has not been provided in the existing tools.

K-chart facilitates this need by use of the level of shading inside the DP boxes. The shading indicates the current progress for the particular result in percentage. The corresponding dates can also be marked by the side of the DP box if required.
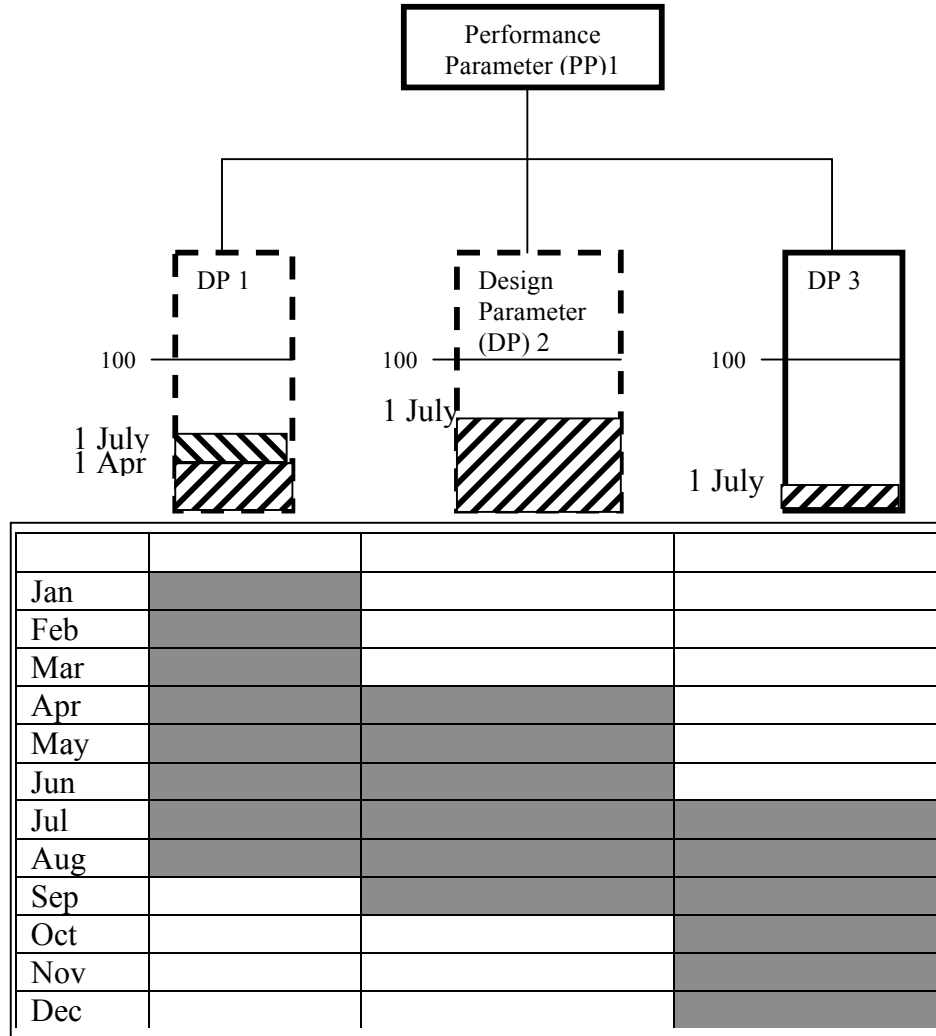
Figure 2: DP boxes' color coding and horizontal lines to provide monitoring capabilities of K-chart

In Figure 2, the timelines show that the experiments will begin in January, April and July for DP1, DP2, and DP3 respectively. They also show that each of the DPs will be completed at the end of August, September and December respectively. These, however, are the planned timelines. The monitoring on the 1st of April, as shown by the pattern shading of the DP boxes shows that DP 1 has achieved about 30% completion, while works on DP2, and DP3 have not begun. All of this corresponds well with the planned timelines for all the results.

Next monitoring on the 1st of July shows that DP1 has achieved about 50% completion which is somewhat delayed from the targeted timeline. According to the timeline, DP1 should have about 75% completion. The progress of the second result, DP2 shows that it is about 70% completion which is very much within the targeted timeline. DP 3 also has an acceptable

progress. Thus, K-chart provides a simple way to follow the progress of a research project while at the same time maintaining a good overview of the whole project's scope.
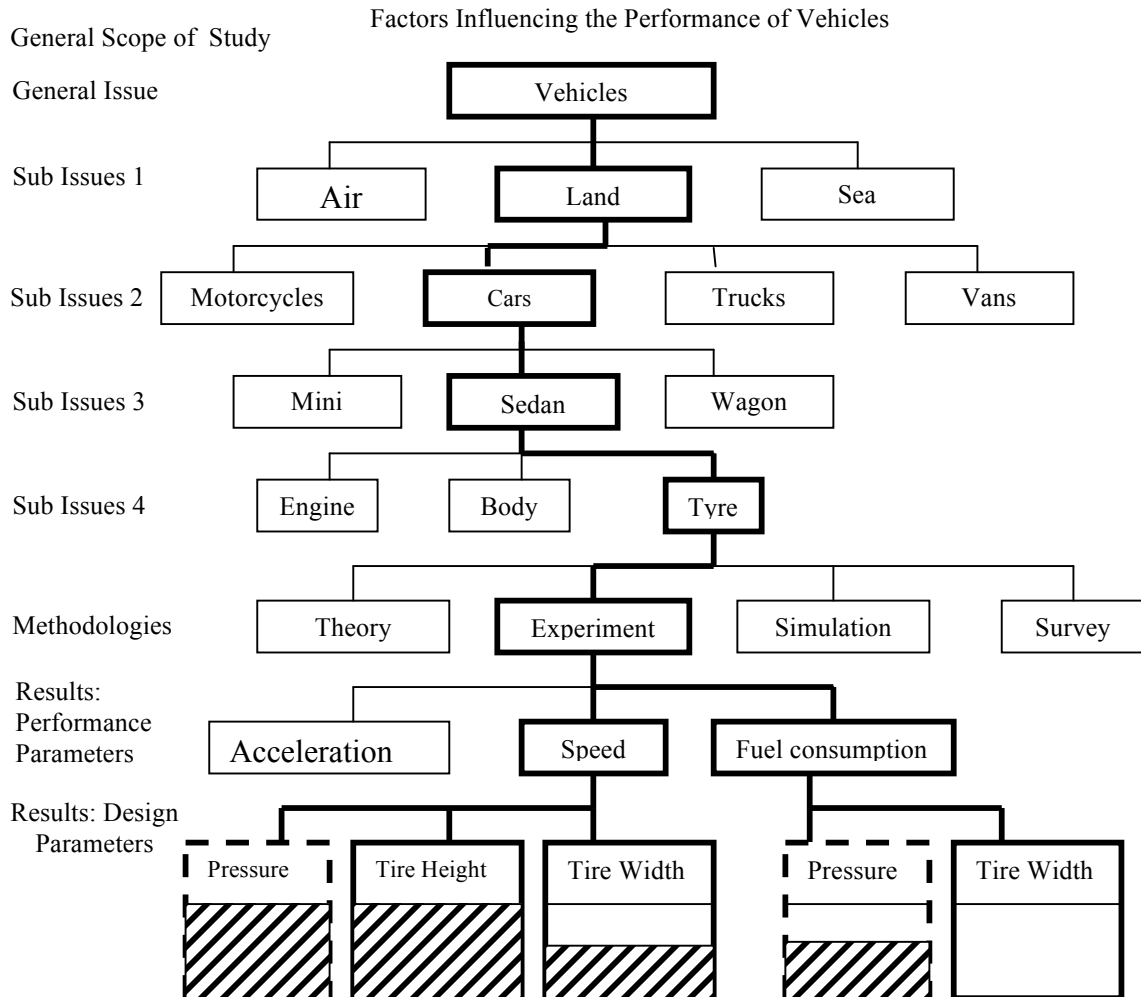
Figure 3: An example of a complete K-chart, showing the project status as of 1st March, 2nd year

An example of a complete K-chart for a generic project on studies of the factors influencing the performance of vehicles is presented in Figure 3, with a progress monitoring done on the 1st of July. The project focuses on the effects of tire conditions on the performance of vehicles. The specific vehicle under study is chosen to be sedan size cars. Thus, an assumption could be made as to how the results can be applied to other types of land vehicles. Since tire conditions are used as the design parameters, it is obvious that the results are not applicable for non-land vehicles.

The study can also be easily expanded to include the effects of the car's body and engine conditions on its performance. The methodology chosen is through experimentation, and the performance parameters under study are speed and fuel consumption. All the three tire conditions are tested for the speed, whereas only tire pressure and tire width are tested for their effects on fuel consumption. The results on the effects of tire pressure are of higher priority as some novelties are expected.

The timelines depict that the whole project will take two years, ending in Dec. of the second year. The K-chart clearly shows that, as of 1st March, the second year, the study on the car's speed is completed as far as tire pressure and tire height are concerned. This is consistent with the timelines. However, the study on the effect of tire width on the speed is lagging behind schedule. By 1st March, 2nd year, this study should have been completed. The pattern shading indicates that it has only completed about 60% of the target. On the other hand, the chart also shows that the progress of the study on the effect of tire pressure on the car's fuel consumption is well ahead of schedule. It is about 60% complete whereas the schedule expects it to achieve only about 25% by the 1st of March. The dotted line of the tire pressure box represents the importance of the result, thus the change in the implementation to focus more on this aspect. The chart also shows that the experiment on the effect of tire size on the car's fuel consumption is not yet started. This is consistent with the planned timeline.

4. Conclusion

The need for an efficient and simple tool for research planning is obvious. The existing tools, although have been helpful thus far, are not sufficient to provide the various information required in research planning and monitoring. K-chart is described here to clearly show its encompassing capabilities including clear organization and designation of issues under study, the methodologies adopted, the detail results expected and the timelines for each of the results, as well as the monitoring features. All these are presented in a simple way by use of a tree diagram. The chart is easily constructed and also friendly in use.

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