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Study On
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In
Project Management

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Abstract

The construction industry is becoming increasingly complex due to rapid improvements in designs and the technology. Other factors like involvement of various interested parties, pressure applied by funding agencies and financial institutions and the tough competition prevalent have also contributed for this development. Thus, completing projects without time and cost overrun has become paramount importance.

The necessity for an efficient management system as far as the project management is concerned is essential and has become more urgent than ever before, because there are enough instances where projects have failed to accomplish the time and cost targets within the given parameters, resulting losses frustrating the interested parties. The new concept "Project Management" has emerged and the tools of project management are now being applied in order to make sure an efficient management system. The application of the project management software packages comes to the scene as far as the application of these modern sophisticated project management tools, especially in the main functional area such as planning, scheduling, monitoring, progress controlling, cost controlling and the document controlling are concerned. The demand for the computer application therefore have been increasing rapidly world over as the benefits offered by these so called project management software packages are enormous. This high demand, the benefits offered by these packages and my personnel interest on this area prompted me to carry out a research project to explore the application of project management packages in the Sri Lankan Construction Industry.

Objectives of the research project therefore were formulated in order to identify the latest project management tools which these dedicated project management software packages should be equipped with, identify the dedicated project management software packages available and used in the Sri Lankan Constriction Industry, identify the facilities available in these packages, explore the extent of their usage, ascertain the user satisfaction, find out the difficulties faced in the use of these packages and to study and find recommendations as to how the situation is to be improved.

Project management tools which the dedicated project management packages should be equipped with were studied and findings were gathered and compiled through the comprehensive literature review carried out as a part of the research. The industry research was carried out on a questionnaire based structured interviews and discussions and this survey enabled to gather industry experience in the use and application of dedicated project management packages in the project management activities in the Construction Industry. The study was mainly focused on the contracting firms covering the local firms and foreign contracting firms by giving the attention of it to the consultants and project management firms operating in Sri Lankan Construction Industry. Project management packages used in the Sri Lankan Construction Industry were researched and the findings have been analysed in

the chapter 4 of this project report. The existing situation regarding the application of project management packages in the industry was studied under five major functional areas, such as construction planning, scheduling, monitoring and controlling, cost controlling and document controlling. The research was also focussed on obtaining contractors' views on difficulties faced, benefits realised and future developments. The level of user satisfaction was also subjected in the research and the findings have been analysed and presented in chapter 4.

Lack of trained staff and the lack of interest amongst the technical people in application of project management software packages have been identified in this research as the main difficulties faced. As far as the user satisfaction is concerned, most of the firms expressed that they were satisfied with these packages even though the maximum benefits derived out of application of these packages are not fully known to them. Most of the people interviewed are not fully aware of the tools available in these packages and hence conducting awareness programmes in this regard is highlighted as almost all of them have future plan to improve this area especially by giving training to the technical staff and recruiting trained people. The need of formulating training sessions in this regard by universities, technical colleges and even by the ICTAD could be underlined as one of the important aspects found out in this research as some of the firms interviewed claimed that there are no sufficient institutes for them to get their employees trained in this regard. Further, the need of a comprehensive study on the productivity and the effectiveness of using computer packages for project management activities in construction industry, indicating the visible results and highlighting the fact that the benefits which could be obtained by using these packages could well compensate the cost of purchasing of even very sophisticated packages like P3 (Primavera) is of paramount importance.

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Further, I must thank all those who helped me during the research part, by dedicating their important time giving appointments and sharing their knowledge and the experience in this regard.

Declaration

This is to certify that this thesis;

1. embodies the results of my own course of study and research,
2. has been composed by myself,
3. has been seen by my supervisor before presentation

Signature of Candidate.....

Date: 26th July 2002

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List of Abbreviations

F	-	Foreign contractors
M1	-	M1 Contractors
M2	-	M2 Contractors
M3	-	M3 Contractors
M4	-	M4 Contractors
Con	-	Consultants
PM	-	Project Management Firms
ICTAD	-	Institute for Construction, Training and Development
DP	-	Data Processing
PERT	-	Program Evaluation Review Technique
MMI	-	Man/Machine Interface
AI	-	Artificial Intelligent
IKS	-	Intelligence Knowledge Based System
CPM	-	Critical Path Method
LOB	-	Line of Balance
BCWS	-	Budgeted Cost for Work Performed
ACWP	-	Actual Cost for Work Performed
BCWP	-	Budgeted Cost for Work Performed
P3	-	Primavera Project Planner
WBS	-	Work Breakdown Structure
CM	-	Construction Management
GUI	-	Graphical User Interface
PC	-	Personnel Computer
CAE	-	Computer Aided Estimating
BOQ	-	Bill of Quantity
GRN	-	Goods Received Notes

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01. Introduction

1.1 Background

1.1.1 Project management concept

"Computer Application in Project Management" may simply be described as five-step process as follows (Rosenau, 1992)

(1) Defining

Defining the project goals

(ii) Planning

Planning how the triple constraints, that are performance specification, time schedule and money budget are satisfied.

(iii) Leading

Providing managerial guidance to human resources, sub-contractors in order for them to carry their works effectively within the allowed time targets.

(iv) Monitoring

Monitoring the project work to find out how progress differs from the plan in time to initiate corrective actions. This often leads to re-planning, which may force the pre-determined goals to change with their resource requirements.

(v) Completion

Making sure that the job that is finally done conform to the current definition of what was to be done and wrapping up all the loose ends such as documents.

In brief, the whole process of Project Management can be defined as "the overall planning, controlling and co-ordination of a project from inception to completion aimed at satisfying client's requirements and ensuring completion on time, within cost and to required quality standards."

With the above concept, a new designation emerged in the construction industry called "project manager" or more specially client's project manager. However, the contractor on the other hand working under client's project manager or otherwise should carry out his project management activities or management of his construction to satisfy the client and also to secure his anticipated profits.

Also, the contractor's project manager should carry out his project management activities or management of the construction work to satisfy the client's requirements. Therefore, whenever the name "project manager" is mentioned in this study it is meant for the client's project manager, consultant's project manager or the contractor's project manager even though the definition the "project manager" is usually meant for client's project manager.

As far as the project management is concerned, planning, scheduling, monitoring and controlling play very important roles irrespective of whether the management functions concerned are carried out by the client's project manager, consultant's project manager and the contractor's project manager, in order to accomplish the five steps in the project management process as mentioned herein above.

Various project management tools ranging from simple techniques to very sophisticated techniques are available for project management activities so as to achieve above goals.

1.1.2 The need for computer application

Ever developing construction industry is becoming more and more complicated due to the following factors (Jayaweerasingham, 1996).

- Rapid technological development such as involvement of modern machinery, plants and sophisticated new construction methods;
- Invention and usage of new material, components and pre-fabricated components have tremendously increased;
- Involvement of various professionals in various disciplines has vastly increased;
- Today's clients are more and more concerned about the time and cost targets as any time overrun has to be compensated with the additional cost;
- Involvement and influence of various parties such as bankers, funding agencies and financial institutions have created a situation where time and cost targets have become more and more important;
- Due to the various new procurement methods and various type of contract, the management activities have become more and more complex.

All the above listed factors reinforce the fact that even though we have invented new construction materials, methods, equipment and various modern technologies considerably, completing a project within the set time and cost has become extremely difficult unless a good project management approach with regard to planning, scheduling, monitoring and controlling is adopted.

For this purpose, there are a lot of sophisticated project management tools available. These are: network analysis; PERT charts; Critical Path Method; and various other controlling schedules and cost control techniques.

However, the new information technology has opened the door for a new management approach where almost all management functions and activities can be easily and successfully carried out through computer packages.

Since the computer technology gives a lot of facilities such as quick data handling, filing and presenting data when needed, quick processing of data, ability to re-use data, ability to provide timely and accurate information to achieve business goals, it is clear that project management activities will become extremely easy, if a good computer software package is used. Because, in the project management activities (Gunesekara, 1996):

- The amounts of data to be handled are more.
- Time available to process data is very limited.
- Interconnection and link among data and information relevant to construction work is very complex.
- Inputs of various professionals have to be coordinated so as to make sure that the project's objectives are achieved.
- Involvement of various parties such as funding agencies, financial institutions and bankers who are very keen in constantly reviewing the project progress for which various reports are required within a very short time.
- Restrictions imposed by funding agencies such as on time and cost make it compulsory for the project managers to constantly review the progress and submit reports within very short time periods.
- Usage of new project management tools and techniques such as Network, PERT Chart, Critical Path Methods, Schedules and Cost controlling Techniques are very complex if handled manually.
- Also, a number of sophisticated software packages are readily available in the market, which gives almost all the project management tools described above.

So, computer application is very much necessary for project management activities.

The most important aspect is that by using computer software packages in the project management activities, answers could be found to most of the following questions in a very short period of time (Jayawardena, 1996):

- How long will the project take to complete?
- If a particular activity is delayed, will the project be delayed?
- Are enough resources available to complete the project on schedule?
- Could the job be completed within the budget?
- Will the work of a particular sub-contractor affect the progress of another contractor?

The ability to experiment with the plan and the facility for instant analysis of the project to provide the latest information is the other most important aspect which undoubtedly assists the project managers in decision making (Jayawardena and De Mel, 1994)

The manual analysis and reporting is a very tedious process and often abandoned after the first plan and the schedule without even going on to the controlling stage. Thus any investment on project management computer software packages is undoubtedly well worth and extremely helpful for project managers in project management activities and to survive in the competitive market. So, application of computer software packages in the project management activities has now become a necessity and thus any study on the computer application in project management activities will give a lot of benefits to all those who are engaged in the project management activities (Jayaweerasingham,1996).

1.2 Objectives

The main objectives of this research project are as follows.

01. To identify the project management tools which the project management software packages should be equipped with.

02. To identify the project management software packages currently used and to identify the facilities available in these packages with regard to planning, scheduling, monitoring and controlling activities including the document controlling in the project management activities

03. To ascertain the extent to which these packages are used and also to find out whether the facilities available are used to the maximum benefits in the Sri Lankan Construction Industry for project management activities.

04. To ascertain user satisfaction and explore the reasons attributed for satisfaction and dissatisfaction.

05. To find out difficulty faced by the industry in using Computer software packages.

1.3 Limitation

The topic "Computer Application in Project Management" has a very broad coverage as it covers all the computer applications in whatever means in the project management activities ranging from dedicated project management software packages to spread sheet applications, word processing applications, applications of database packages such as Microsoft Access, Dbase, Visual Basic and Visual Dbase.

In the process of project management, planning, scheduling, monitoring, and controlling are the most important activities because most of the other aspects are very much relevant to the human factors such as motivation and human resource management. Hence, this study is further limited to the application of dedicated project management software packages in planning, scheduling, monitoring and controlling aspects in the project management activities.

1.4 Methodology

This research study carried out can be classified mainly in to three categories.

1.4.1 Literature survey

Literature survey was carried out to acquire a broader knowledge in the areas relevant to this topic covering the following aspects.

* Identifying and studying all the sophisticated project management tools with regard to planning, scheduling, monitoring and controlling activities, which the project management software packages should be equipped with.

* Identifying and studying the project management packages available in Sri Lankan Construction Industry

* Identifying and studying the facilities available in some of the popular project management packages available in Sri Lankan Construction Industry.

1.4.2 Filed research

(I) Data collection

Data collection was carried out to gather industry experience in the use of computer software packages in project management activities. Data was collected through a detailed questionnaire survey and interviews conducted and also through discussions held with clients' project managers and project managers appointed on behalf of contractors and consultants to look after their interests, covering the following aspects.

* Identifying the project management packages, currently available in the Sri Lankan construction industry and also identifying the extent to which, these packages are used in the Sri Lankan Construction Industry.

* Identifying and studying the difficulties faced by the construction industry, in using these computer software packages in project management activities

(ii) Data analysis

The data collected from the industry research have been analysed in detail and are presented under "Analysis" in this report.

1.5 Main findings

1 Under the main functional areas of the project management, namely the planning, scheduling, monitoring, controlling including cost controlling and document controlling, it has been found out that the Critical Path Analysis, Bar/Gantt Chart, Networks such as Activity on Arrow Network and Activity On Node (Precedence) Network, Resource Histograms for Resource Planning, None Uniform Resource Requirements, Scheduling in respect of Bar Charts, Bar Chart Target Comparison, Progress Monitoring Reports, Cost Controlling Tools such as Actual vs. Target Cost Histograms, Earned Value Analysis, Cash Flow Histograms and Projected Cost Curves and Cash Flow Reports are the main project management tools which any dedicated project management software package should facilitate for. Facility for levelling resources, creating calendars, producing various reports and linking data with other common packages are the other requirements which any project management software package should be equipped with.

2. Under the main functional areas of planning, scheduling, monitoring, controlling including cost controlling and document controlling, there are a number of packages used in the Sri Lankan Construction Industry. Microsoft Project, Primavera Project Planner (P3), Total Project Manager/ Harward Total Project Manager (TPM/HTPM), Pert Master and Pert Master Advance, Time Line, Sure Track and Expedition by Primavera are the dedicated project management packages which are now available in the Sri Lankan Construction Industry.

3. It has been found that all the packages are equipped with the fundamental project management tools. As far as the P3 is concerned it has more advanced features such as cost controlling and cash flow forecasting facilities. The Expedition is somewhat different and it has features required for contract administration activities such as for document controlling.

4. The extent of the dedicated project management packages in the project management activities of construction projects was not satisfactory amongst the local constriction firms and consultants. It has been found that under main functional areas of planning,

scheduling, controlling, cost controlling and document controlling, the usage of the packages was not at a higher level. However, there is a trend of a improvement as now most of the contracting firms, consultants and project management firms have shown high interests in using project management software packages in project management activities.

5. Better controlling of activities, preparation of quality reports, increased company reputation, less repetitive works, turn over increase and the ability of better controlling of activities were identified as the benefits of using dedicated project management packages in project management activities of construction projects.

6. None availability of the trained staff, lack of interest amongst the professionals, lack of interest amongst the top management are the main difficulties encountered by the contracting firms in using the project management software packages. None availability of trained staff is one of the major difficulties faced by the consulting firms and project management firms. High cost is the other factor found as a difficulty faced in using these project management software packages.

7. All the foreign contractors and M1 contractors are satisfied with the available software packages. Most of the medium level local contracting firms are satisfied with the tools available in the project management software packages available in the Sri Lankan Construction Industry. Straight forward application and easy and quick execution of management and administration activities are the main attributing factors for this satisfaction. Lack of experienced professionals to use these software packages is the main contributing factor for dissatisfaction of most of the contracting, consulting and project management firms.

8. Most of the contracting, consulting and project management firms have future plans to develop the use of project management software packages in project management activities in the construction industry. Recruiting trained staff, streamlining the organisational procedures, are some of the steps which are going to be taken to improve the application of these packages in project management activities. Lack of institutes to provide training facilities is one of the main factors which hinders the increase of usage of the software package applications even though most of the firms are willing to give training to their employees. None availability of enough training programmes is also one of the main difficulties in the usage of these packages.

1.6 Guide to report

This research dissertation contains five chapters. Contents of the chapters are briefly as follows;

Chapter 1 This chapter gives the back ground, objectives, limitation, methodology, main findings and the guide to the project report.

Chapter 2 The literature review and the finding of it have been detailed in this chapter. Project management tools which the project management software packages to be equipped with, the packages available in the Sri Lankan Construction Industry and the facilities available in these packages in comparatively with the required tools to be equipped with, are detailed in this chapter. The extent of the usage of these packages based on the previous researches has also been discussed in this chapter.

Chapter 3 This chapter gives the details of data collection of the research project. Developments of the study for data collection, formulation of the interview questionnaire, have been detailed in this chapter. This chapter also gives the details of the pilot study, how the target groups were identified and how the data collection was carried out.

Chapter 4 This chapter details the analysis of the data collected. The analysis has been done in terms of computer usage in general, site based computer system, application of dedicated project management software packages in planning scheduling, monitoring and controlling including cost controlling and document controlling. The analysis of the data done under this chapter further shows the level of user satisfaction, future developments, difficulties faced and the benefits realised by the industry in using dedicated project management software packages in construction project management activities.

Chapter 5 Conclusion and recommendations based on the finding of the data collection are dealt with in this chapter. Conclusion on the findings relating to the objectives of the research project has been discussed in this chapter. This chapter also devotes to the areas such as future developments; future studies to be undertaken and the most importantly the recommendations for improving the level of usage of project management software packages in the construction project management activities.

02 Literature Review

2.1 Project Management tools which project management software packages should be equipped with

Before discussing the project management tools, it is worthy to understand how the project management process i.e. planning, scheduling, monitoring and controlling with corrective actions are carried out. The main objectives of any project are to complete a prescribed amount of work within a fixed duration at a previously estimated cost to the required quality. To achieve these objectives, project planning, scheduling, monitoring and controlling are necessarily required.

The three phases: planning, scheduling, monitoring and controlling is a cycle process as shown below (Jayawardena, 1995)

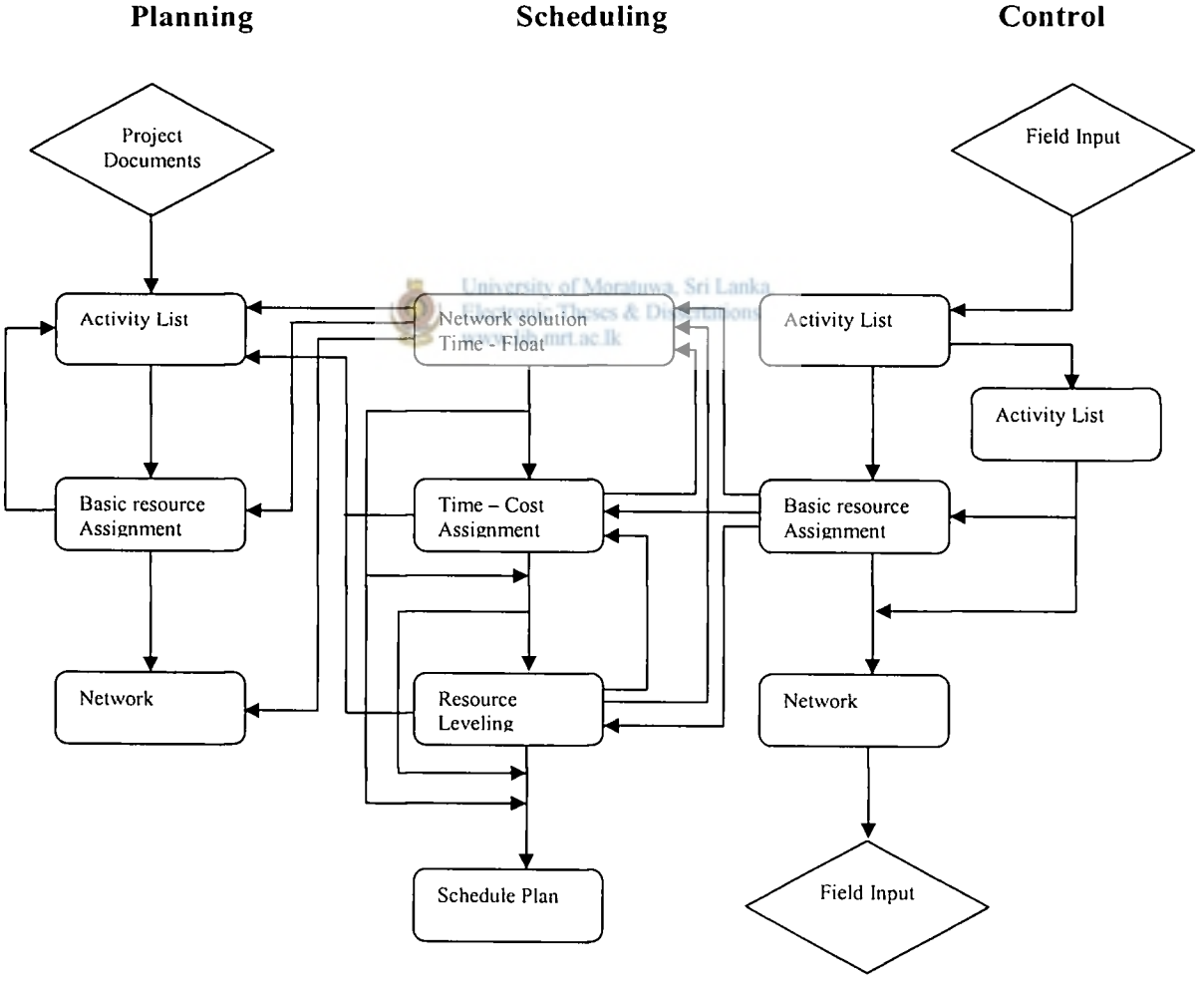


Figure 2.1 Project management process

There are various project management techniques and tools, which can be used for each of these phases depending upon the type and the size of the project. In case of planning, there are a considerable number of techniques such as Critical path Method (CPM), Bar Charts, Program Evaluation and Review Techniques (PERT), Linear Scheduling Method (LSM), Line of Balance (LOB), Work Study technique and operation techniques (Jayawardena, 1995)

Even though techniques such as Critical Path Method, Line of Balance and Linear Scheduling can be used in construction project management activities, the Critical method with it's associated tools for all three phases: planning, scheduling, monitoring and controlling is the most popular, effective and the efficient technique which is vastly used in project management activities specially in construction works (Jayawardena, 1995).

2.1.1 Why critical path method is so important?

The Critical Path Method is a powerful tool for planning and management of all type of projects. It provides a precise mathematical approach for planning, scheduling and control and allows ready evaluation and comparison of alternative work programmes, construction methods and types of equipment by changing individual activity durations, resources or relationships between activities (Jayawardena, 1995).

Further, network and it's associated tools provided by the Critical Path method help the project manager with precise information on the effect of each variation or delay in the adopted plan thus allowing identification of operations which needs remedial actions.

The use of CPM is well established in variety of industries and is very much established in the construction industry as stated above.

In addition to various other uses in variety of industries, the assessment of cost of hazards may be investigated. Also, a rational approach to problems in minimizing site risks, floods, inclement weather and similar hazards can be achieved through the CPM so that the cost of these risks may be assessed and incorporated in to the programme (Jayawardena, 1995)

Therefore, CPM is a very important and effective technique in the project management activities and hence should necessarily be incorporated in the project management software packages available for project management activities.

There are various project management tools based on critical path method. They are required at various stages of a project.

The first task, which has to be carried out in CPM, is to identify (Lock,1996)

- all the activities of the project
- all the resources required for each of this activity.
- interrelationship of these activities and;
- activity duration by considering all the constraints.

Once these tasks are finalized any project management software should be capable of accepting this information so that the project manager can effectively use for project management techniques which will be discussed below.

2.1.2 Networks

As we all are aware, network is a representation of the project plan by a schematic diagram that depicts the sequence and interrelationship of all the activities of the project. A fully developed network is a logical and mathematical model of the project based on single activity duration. This can be used to quickly establish the earliest start time, latest start time, earliest finish time, latest finish time, floats, critical path and the project duration of a project (Clough/ Sean, 1991)

Basically there are two types of networks;

(a) Activity on Arrow Network
(b) Activity on Node (Precedence) Network

As the names imply, in the activity on Arrow Network, Arrows represent the activities, whereas the activity on Node Network, the activities are represented by Nodes.

The precedence Network is more versatile in which lag and lead relationship of activities such as relationship between start to start, start to finish, finish to start and finish to finish of two or more activities can easily be represented with any lag if required. Due to these reasons, Precedence Network is becoming more and more popular and the most effective method. Further, fully developed network can be used as a plan, as a schedule and also as a controlling tool.

So, if a project management software package is used, alternative plans by changing duration, relationships, and resources etc., can be easily produced. Also, imposing milestones and project deadlines until you have an acceptable plan can be executed. Hence, any project management software package should facilitate for this very important project management tool.

2.1.3 Resource histograms for resource planning

As we are well aware, a project requires several resources such as skilled and non-skilled labourers, other personnel who are engaged in construction activities as required, plant and any other things as may be required. The problem that project managers or planners encounter is to find out when they need deferent type of resources during the project period, how many of each category is required at different times and whether available resources are sufficient. However, if they are not sufficient what action can be taken to overcome the problems could be easily thought of.

The resource requirement for each category of resources can be clearly seen in a resources histogram. Hence, any software package intended to be used for project management activities should have the facility to produce this type of resource histograms.

By analysing these resource histograms, we can easily find out whether the resources are sufficient to meet the demand within the maximum available resources. The maximum available limit too can be plotted in the same histogram.

Similarly, resource requirements of all resources should be able to be obtained and hence the software packages should provide the required facilities.

(i) Non uniform resource requirement

Generally, when resources are assigned to an activity, it assumes that the resource usage starts when the activity commences and continues until the activity finishes. However, there are situations where a particular resource is not required until the activity has been underway for a few days. It is also possible that the resource is not consumed at an even rate.

This is another challenge faced by the project managers. Incorporation of these problems in to the resources histograms is not an easy task. Therefore, any computer software package available for project management activities should necessarily facilitate for these requirements if maximum benefits are to be yielded in using computer software packages.

(ii) Levelling of resources

If the resource histogram indicates a lot of peaks and troughs or exceeds the resource ceiling, the non-critical activities should be moved within their floats using defined priority criteria to smooth the resources below the ceiling. If it is still impossible, the logic of the network will have to be re-arranged to accommodate resource demand.

This is in fact a very tedious process if carried out manually. So, any software package intended to be used for project management activities, should have the facilities to level resources according to a priority order against the availability to stay within the resource limit. Normally, resource levelling does not change the activity duration or resource requirements but it delays the scheduled dates. In this situation, two approaches can be made. The first is to move activities within floats or even delaying outside the floats to accommodate the demand of resources with the availability and checking the schedule to see whether it is acceptable. The second is to assign more resources during the peak periods (Jayawardena, 1995).

Therefore, any software package intended to be used for project management activities should necessarily have the facility to experiment by using deferent levels of availability or modify the network logic and then re-schedule to see the impact of alternative approaches (Jayawardena, 1995).

2.1.4 Calendars

The most important feature, which should be incorporated in computer packages developed for project management purposes, is the facility to create working calendars. Working calendars allow defining working and non working days and hours. The project schedules the activities to perform only during the working days and hours as specified. In addition to these base calendars, the software packages should be able to define resource calendars as well. The schedule considers that resources are available according to the calendars and the plan is adjusted to suit the availability (Jayawardena, 1995).

2.1.5 Scheduling

Once the project is planned using the critical path method including the resources, the planned data must be communicated in a schedule for execution. The schedule can be prepared in the form of a bar chart, histogram, table or a report. Therefore, any project management software package should have the facility to produce required schedules based on project management tools as herein described.

Given below are some of the common schedules, which are considered as paramount important for project management activities (Jayawardena, 1995).

(i) Bar charts

Bar Chart "Gantt Chart" is perhaps the most extensively used tool for scheduling. Its versatility arises from the simplicity of its preparation; it's use and its capacity to accommodate various forms for effective communications.

Therefore, any project management software should necessarily have the facility to produce bar charts. In addition, the facility to indicate how a particular resource / cost are allocated throughout the project by superimposing a resource / cost histogram on the bar chart is very important feature in the bar chart.

(ii) Reports

Producing various reports indicating detailed information of a project such as early start date, early finish date, late start date, late finish date, float and other information, which gives an immediate picture of which alternatives are most important in getting the project completed on time is extremely important. Hence, the project management software packages, which are intended to be used for project management activities specially, should be equipped with these tools to provide these reports whenever required.

2.1.6 Progress monitoring and control

Progress monitoring and control are very important in the project management, when a project is underway, to make sure that the project completes on schedule. Maximum benefits

of project planning and scheduling cannot to be obtained unless a proper monitoring and controlling is carried out. The important tools available for this purpose include bar charts and monitoring and controlling reports (Jayawardena, 1995)

(i) Bar chart target comparison

When a project is underway, the target plan (original schedule or base line plan) and the actual progress in the same bar chart indicate the actual position of the project. This will help to make sure that the activities are carried out as scheduled. The project manager will be able to identity from these bar charts where the delay is and then take appropriate actions to rectify the delay. Hence, project management software packages should be able to provide these kinds of bar charts in order to get the maximum benefits out of using computer software packages.

(ii) Progress monitoring reports

It should be able to compare the schedule plan (baseline plan) with the actual dates in a report. Then the potential problems can be flagged with LATE notice, and the schedule activities can be marked with OK.

Therefore, it is important for any project management software packages to give this kind of information in a report.

2.1.7 Cost controls

As we are aware, cost controlling is the most important aspect in project management. There are various techniques available for this purpose. Cost Histogram, Cash Flow reports, Cumulative Curves (S Curves) and cost control reports are the most important tools available for project management activities. It is clear, that each activity requires a mix of labour, materials, plant and other resources. The problem of the project manager is to track the actual cost for each resource, each activity and for the whole project with the budgeted cost and take necessary actions for controlling the cost in case it exceeds the budgeted cost (Jayawardena, 1995)

This process is very difficult task if carried out manually. Therefore, the project management software packages should support to produce these types of reports in project management activities, if the maximum benefits are to be obtained in using computer software packages.

Some of the tools, which the project management software packages, should facilitate for are as follows;

(i) Actual Vs target cost histograms

Actual Vs Target cost histogram is very useful in reviewing and evaluation of project spending. Also, the cumulative curves can be used to identity actual cost vs targeted cost up to date.

(ii) Earned value analysis

The performance can be determined using earned value, which calculates the value of work satisfactorily completed, based on a completed target plan. Measuring performance involves three key indicators: Budgeted Cost for Work Scheduled (**BCWS**), Budgeted Cost for Work Performed (**BCWP**) and the Actual Cost for Work Performed (**ACWP**). **BCWS** is the planned budget to date, **BCWP** is the budgeted value of work done to date and **ACWP** is the actual amount spent to date for the work performed.

The difference between the BCWS and the BCWP is the schedule variance. The difference between the ACWP and the earned value (BCWP) is the cost variance.

Therefore, any project management software having facilities to produce reports indicating above is very useful and gives maximum benefits to the project manager in project management activities throughout the entire project duration.

(iii) Cash flow histogram and projected cost curves

Projected cost histograms with cumulative cost curves indicate the cash pattern in the future. This will no doubt help the project manager in his decision making so as to make sure that the project will be completed within the targets.

(iv) Cash flow reports

A Cash flow report indicates all the cost for a specified account or resource. For instant monthly cash flow reports can be prepared indicating the monthly cash needs along with cumulative amounts based on earliest, latest and the targeted dates for project activities. The report can also be printed in a histogram and cumulative S Curve to indicate the spending pattern of a project (Jayawardena, 1995).

So, any software package having facilities to produce cash flow reports will no doubt bring a lot of benefits for the project management activities so as to achieve the project objectives.

(v) Cost reports

Cost reports indicating details such as budgeted cost, percentage completion, actual cost to date, estimate to complete and variance, are very advantageous in project management activities.

Therefore, project management computer software packages should have the facility to produce cost reports indicating above details.

2.1.8 Linking of data

Linking of data to third party application such as with other software packages covering spreadsheet applications, word processing applications and other compatible software packages is the most important feature, which should be incorporated in the project management software packages. Because, the facility to link with other software is necessarily required for project management activities, as a lot of analysis work and communication activities are involved in the project management activities (Jayawardena, 1995).

The other most important feature to be available in the project management software packages is the ability of providing any of these reports at any stage of the project in the required format covering only the information required by the user. For instance, the entire project should be able to expand or contract using the concept of sub project to reveal the required information in detail or in summary form.

Above are some of the most important project management tools available for various phases of project management activities, namely: planning; scheduling; monitoring and controlling (progress and the cost), which should be incorporated in the project management software packages, if maximum benefits are to be yielded in using computer software packages.

2.2 Extent of computer usage in project management.

As discussed in previous chapters, the definition of project management recognizes the need for professional judgement or management in addition to planning of time, cost and resources. The development of the information technology has opened the door for a new management approach where all management functions and activities can be easily, effectively and successfully carried out through computer software packages.

Even though there are a lot of dedicated project management software packages available in the market, very often, what is commonly referred to as project management software by software manufacturers and dealers, can be more precisely described as project planning and control software packages. No system currently available in the market, offers facilities to undertake all aspects of project management skills such as motivation, leadership etc which cannot in any way be computerized. All software packages claimed as dedicated project management software packages, support the management decision making process, i.e. they provide supporting tools.

The areas covered by most of these so-called project management software packages are as follows (Jayawardena and De Mel, 1994)

- Project planning and scheduling
- Resource management
- Progress monitoring and control
- Cost control and cash flow forecasting
- Presentation of information through various reports

In addition to above, now packages such as "expedition" in Primavera system are already available in the market for document controlling. This is a big boost for contract administration and project management activities. Computer application in the above areas, help the project manager to a great extent to carry out planning, controlling and co-ordination activities of a project to satisfy the client's requirements.

In addition to the dedicated software packages, general-purpose packages too can be used for certain aspect of project management activities.

Some of these packages are as follows (Jayaweerasingham, 1996):

1. Use of spreadsheet packages such as Lotus 1.2.3, Microsoft Excel for accounting, project planning and scheduling activities.

2. Use of data base packages such as Dbase111, MS Access and Visual Basic for managing and processing information on its own or by developing a management information system (MIS) to manage information required for project management.

3. Use of word-processing packages, drafting packages and business graphics for reports and desktop publishing.

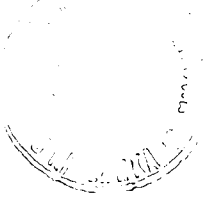
4. Use of purpose built packages developed using general-purpose languages such as Basic, Pascal, Visual dbase, Visual Base and Microsoft Access for specific project management applications.

There are more than 100 dedicated project planning and controlling packages available in the world. Capabilities and prices of these software packages vary depending upon the capabilities and facilities available in the packages (Jayawardena, 1995). Most of these packages have basic facilities with regard to planning, scheduling and controlling aspects of project management activities. A list of some project management software packages available in the world is given in the Appendix – B

2.3 Extent of the usage software packages in the project management in Sri Lanka (Koddikara and De Costa, 1993)

Before discussing the extent of computer software packages used for project management activities in Sri Lanka, it is worthy to have an idea about to what extent the computer software packages are generally applied in the construction activities.

This is simply demonstrated by a survey carried out by Koddikara and De Costa (1993) to investigate the use of computers in the Sri Lankan construction industry even though the results given are not relevant in the present situation as these results are from a research done fairly a long time ago.



The results are shown in the table below.

Table 2.1 Extent of computer usage in project management
(Koddikara and De Costa,1993)

Category	Usage in 1993 (%)	Future expectation (%)
Consultants	69	77
Large Contractors (Grade 1&2)	55	68
Small Contractor (Grade 3 & below)	00	11

Jayaweerasingham (1996) indicates that only 75% of Grade 1 contractors and 30% of Grade 2 Contractors who were interviewed and surveyed had used computer software packages for construction management activities. Also, 100% of the foreign contractors and 75% of the property developers who were interviewed and surveyed had used computer software packages for project management activities (Jayaweerasingham, 1996).

The survey was carried out on contractors and property developers only. The findings of this research also revealed that contractors were very reluctant to use computer software for net work planning and resource planning.

Further, usage of dedicated project management software packages among the contractors was also surveyed under the same research and the findings which can be described as somewhat unsatisfactory, is as follows:

Table 2.2 Type of software packages used in construction planning and control (Jayaweerasingham, 1996)

Type of Software	Percentage (%)				
	Network	Schedule	Resource	Progress	Cost Control
MS project	-	12	-	12	12
Time Line	-	16	-	16	8
Pert Master	-	4	-	4	-
HTPM	-	4	-	4	-

Even though no comprehensive research has been carried out on the computer software packages in project management, especially with regard to planning, scheduling, monitoring and controlling in the Sri Lanka Construction Industry, a few surveys, researches and studies in other relevant areas have been carried out.

The finding of these studies clearly indicates that the use of project management software packages by all parties is not up to a satisfactory level although a certain percentage of firms who do not use project management software packages have plans for future use.

The findings of these researches have also revealed that high cost of software packages, unavailability of certain software packages in the local market and the lack of after sales service have become negative incentives to purchase these software packages by average consultants or contractors. It has also been observed that the use of project management software packages by most of project managers in Sri Lanka is not up to the required level when these facilities are available in their organizations.

Most of project managers carry out co-ordination work, monitoring work and controlling activities through progress meetings and perhaps with a few project management tools available in the project management software packages.

However, the situation now have changed little bit as explained in next chapters in this report on the finding of the research done in this regard with the rapid development of the computer technology and information technology. Also now there is a growing tendency in the use of computers and the use of project management software packages for the project management activities. Most of the project managers whether he is appointed to look after the project management work on behalf of the client, consultants, and contractor, are very much concerned about the usage of computer software packages.

According to the previous researches and other literature available, it could be established that the dedicated project planning and control packages, which are used in Sri Lankan construction industry at present, are as follows;

(1) Microsoft Project
(2) Primavera Project Planner (P3)
(3) Total Project Manager / Harvard Total project manager (TPM / HTPM)
(4) Pert Master and Pert Master Advance
(5) Time Line
(6) Sure Track
(7) Expedition by Primavera

2.4 Facilities available in some of the project management software packages available in Sri Lanka.

Most of these software packages with their facilities will be discussed in brief in this section as follows. In discussing the facilities of the project management package, findings of the literature review carried out on text books, papers, thesis, study reports and articles written on this subject were used. My practical experience gained in practice using these packages have also been considered in this discussion.

2.4.1 Primavera Project Planner (P3)

This is one of the most powerful and user friendly graphical program software packages available in the world. It helps the users with planning tasks, allocation of resources, costing, tracking and powerful reporting. It is suitable for any project whether it be simple or most advanced and complicated.

It provides almost all the popular project management tools in the form of graphical screen displays called project forms. By using these forms to define project tasks and their relationship, a project can be well planned to reflect real world situation. By using Project Planner (P3), the management of a project can be effectively carried out in various ways such as for an instant, by managing project resources for a single project among multiple projects.

Assigning multiple calendars, resource allocation can be effectively done at uniform distribution, non-uniform distribution across an activity using 16 different resource distribution curves and also by defining resource lags.

P3 indicates any over allocated resources, which can be, corrected either manually or with automatic resource levelling facility available in the package.

The most important feature of the P3 is its ability to provide a lot of very useful monitoring tools and cost controlling tools. Also, a lot of reports can be produced to satisfy the user requirements and its report formats help the project manager in communicating the project details. Further, it also has the ability to link the data with other third party software applications facilitating smooth communication of information.

The following is a summary of all facilities available in the package (Primavera System, 1995)

Project Planning System Software Facility	
• Ability to create work breakdown structures	• **Available**
• Ability to create responsibility assignment matrix	• **Available**
Network Analysis	
• Maximum number of activities	• **Unlimited**
• Maximum number of activities per project	• **Unlimited**
• Network analysis convention	• **Arrow or Precedence**
• Sub Network	• **Capable**
• Maximum number of sub networks	• **Unlimited**
• Multiple Project Calendars	• **Available**
• Maximum number of calendar modules	• **Unlimited**
• Maximum number of total calendar modules	• **Unlimited**
• Resource Calendars	• **Available**
• User definable calendars	• **Available**
Other network facilities	
• It supports milestones, targets imposed ends, ability to support various activity relationships and assigning various constraints.	• **Available**
• Ability to store and re-use library of standard network	• **Available**

Resource Processing	
• Maximum number of resources	• **Unlimited**
• Method of activity allocation	• **Uniform, at start, at end, uneven, by using 16 different resource curves and defining resource lags**
Other resource processing capabilities	
• Resource levelling capability	• **Available**
• Resource histogram capability	• **Available**
• Facility to define limits on resource availability	• **Available**
• Ability to create resource comparison profile. This indicates what has happened and what is anticipated with multiple resources. In each case a curve shows the cumulative usage for the resource	• **Available**
• Ability to produce resource and activity matrix reports	• **Available**
Ability to produce other reports on resource such as resource sheets, resource graphs and resource views.	• **Available**

Cost Processing	
• Resource Costing and Cash flow facility	• **Available**
• Ability to produce billing by cost centre. This provides a cost based look at performance using concept of earned value. In simple language, it answers three key questions; what was budgeted?, what was accomplished? what was spent? based on this information P3 calculates variances to pinpoint problems and estimates cost at completion.	• **Available**

Tracking Progress	
• Ability in comparing the updated plan based on actual recording of works and cost as it is completed, with the base plan.	• **Available**
• Updating the project	• **Available**
• Ability to provide forecasting reports	• **Available**

Reports	
• Method of report	• **Via Screen and Printers**
• Degree of report flexibility	• **Available**
• Bar charts	• **Critical path with logic links, % completion and target dates**
• Graphical output capabilities	• **Available**
• Producing summaries of all the projects	• **Available**
• Producing Risk Analysis	• **Available**
• Producing risk analysis graphs. This will indicate the probability of achieving the schedule time and cost targets	• **Available**

Data Exchange and Security of Data	
• Import capability for Updating.	• **Available with compatible software packages. Microsoft Window application is compatible**
• Export ability	• **Available with compatible software packages. Microsoft Window application is compatible**
• Security of data	• **Access is limited, if required**

Figure 2.2 Facilities available in P3

2.4.2 Sure Track Project Manager 5.1, by Primavera System

This is also one of the most powerful and user-friendly graphical program software packages available in the world. It helps the usres with planning tasks, resources, costing, tracking and powerful reporting. It is suitable for any project whether it may be a simple or most advanced and complicated.

It provides almost all the popular project management tools in the form of graphical screen displays called project windows. By using these forms a project can be reflected in a real world situation. By using Sure Track Project Manager, the management of a project can be effectively carried out for a single project among multiple projects.

Assigning of multiple calendars and resource allocation can be effectively done at uniform distribution and non-uniform distribution with resource lags.

Sure Track indicates any over allocated resource which can be corrected either manually or with automatic resource levelling facility available in the package.

The most important feature of the Sure Track is its ability to provide a lot of very useful monitoring tools and cost controlling tools. Also, a lot of reports can be produced to satisfy the user requirement and its report formats help the project manager in communicating the project details. Further, it also has the ability to link the data with other third party software application facilitating smooth communication of information. However, the inability to provide Networks can be indicated as one of the shortcomings in the Sure Track Project Manager software package. Unfortunately one of the most important project management tools, network, which should be incorporated in to project management computer software packages is not available in this package.

The following is a summary of all the facilities available in the package (Primavera System, 1995)

Project Planning System Software Facility	
• Ability to create work breakdown structures • Ability to create responsibility assignment matrix Network Analysis **Gantt chart** • Maximum number of activities • Maximum number of activities per project • Sub Projects • Maximum number of sub projects • Multiple Project Calendars • Maximum number of calendar modules • Maximum number of total calendar modules • Resource Calendars • User definable calendars Other facilities • It supports milestone, targets imposed ends, ability to support various activity relationships and assigning various constraints. • Ability to store and re-use library of standard project Gantt Charts	• **Available** • **Limited** • **Unable** • **Unlimited** • **Unlimited** • **Capable** • **Unlimited** • **Available** • **30** • **Unlimited** • **Available** • **Available** • **Available** • **Available**

Resource Processing	
• Maximum number of resources • Method of activity allocation Other resource processing capabilities • Resource levelling capability • Resource histogram capability • Facility to define limits on resource availability • Ability to create resource comparison profile. This indicates what has happened and what is anticipated with multiple resources. In each case a curve shows the cumulative usage for the resource • Ability to produce resource and activity matrix reports • Ability to produce other reports on resource such as resource sheets, resource graphs and resource views.	• **Unlimited** • **Uniform, at start, at end, uneven with resource lags if any** • **Available** • **Available** • **Available** • **Available** • **Available** • **Available**

Cost Processing	
• Resource Costing and Cash flow facility • Ability to produce billing by cost centre. This provides a cost based look at performance using concept of earned value. In simple language, it answers three key questions; what was budgeted? what was accomplished? what was spent? based on this information P3 calculates variances to pinpoint problems and estimates cost at completion.	• **Available but limited in comparatively with P3** • **Available but limited in comparatively with P3**

Tracking Progress	
• Ability in comparing the updated plan based on actual recording of works and cost as it is completed, with the base plan. • Updating the project • Ability to provide forecasting reports	• **Available** • **Available** • **Available**

Reports	
• Method of report • Degree of report flexibility • Bar charts • Graphical output capabilities • Producing summaries of all the projects • Producing Risk Analysis • Producing risk analysis graphs. This will indicate the probability of achieving the schedule time and cost targets	• **Via Screen and Printers** • **Available** • **Critical path with logic links, % completion and target dates** • **Available** • **Available** • **Unable** • **Unable**

Data Exchange and Security of Data	
• Import capability for Updating.	• **Available with compatible software packages. Microsoft Window application is compatible**
• Export ability	• **Available with compatible software packages. Microsoft Window application is compatible**
• Security of data	• **Access is not limited.**

Figure 2.3 Facilities available in Sure Track Project Manager

2.4.3 Microsoft Project (98 version)

MS Project is a powerful and user friendly graphical program software package available in the world. It helps the users with planning tasks, allocation of resources, costing, tracking and powerful reporting. It is suitable for any project whether it be simple or most advanced and complicated one.

It provides almost all the popular project management tools in the form of graphical screen displays called project views. By using these views to define project tasks and their exact relationship, a project can be well planned to reflect real world situation. By using MS Project, the management of a project can be effectively carried out in various ways such as for a instant, by managing project resources for a single project among multiple projects.

A calendar is assigned for the entire project or assigning of multiple calendars for resources too is possible. The resource allocation can only be done at uniform distribution; non – uniform distribution is not available in the package.

MS Project shows any over allocated resources, which can be, corrected either manually or with automatic resource levelling facility which is available in the package.By using MS Project, it is easy to ascertain and see whether the project is progressing as planned. By using its project features in combination with views, exact information required can be indicated. Further, it also has the ability to link the data with other third party software applications facilitating smooth communication of information.

The MS Project includes a variety of report formats, which help the project managers in communicating the project details.

The following is a summary of all the facilities available in the package (PC Learning LAB, 1999):

Project Planning System Software Facility	
• Ability to create work breakdown structures	• **Unable**
• Ability to create responsibility assignment matrix	• **Unable**
Network Analysis	
• Maximum number of activities	• **Unlimited**
• Maximum number of activities per project	• **Unlimited**
• Network analysis convention	• **Arrow or Precedence**
• Sub Network	• **Capable**
• Maximum number of sub networks	• **Unlimited**
• Multiple Project Calendar holiday management	• **Available**
• User definable calendars	• **Available**
Other facilities	
• It supports milestone, targets imposed ends, ability to support various activity relationships and assigning various constraints.	• **Available**
• Ability to store and re-use library of standard network	• **Available**

Resource Processing	
• Maximum number of resources	• **Unlimited**
• Method of activity allocation	• **Uniform (Limitation)**
Other resource processing capabilities	
• Resource levelling capability	• **Available**
• Resource histogram capability	• **Available**
• Facility to define limits on resource availability	• **Available**
• Ability to create resource comparison profile. This indicates what has happened and what is anticipated with multiple resources. In each case a curve shows the cumulative usage for the resource	• **Unable**
• Capable in reducing other reports on resources such as resource sheets, resource graphs and resource usage.	• **Available**

Cost Processing	
• Resource Costing and Cash flow facility	• **Available but limited. No cost control techniques based on ACWP, BCWS, and BCWP.**

Tracking Progress	
• Ability in comparing the updated plan based on actual recording of works and cost as it is completed, with the base plan.	• **Available**
• Updating the project with actual information that is by entering the actual starts and finishes information and also entering the percent completion.	• **Available**
• Ability to provide forecasting reports	• **Limited**

Reports	
• Method of report	• **Via Screen and Printers**
• Degree of report flexibility	• **Available**
• Bar charts (Gantt Chart)	• **Critical path with logic links, % completion and target dates**
• Graphical output capabilities	• **Available**
• Producing summaries of all the projects	• **Available**
• Producing Risk Analysis	• **Unable**
• Producing risk analysis graphs. This will indicate the probability of achieving the schedule time and cost targets	• **Unable**

Data Exchange and Security of Data	
• Import capability. • Export ability • Security of data	• **Available with compatible software packages only.** • **Available with compatible software packages only.** • **Access is not limited.**

Figure 2.4 Facilities available in Microsoft Project (98 version)

2.4.4 Pert Master Advance

Pert Master Advance is one of the most powerful project planning, control and communication software packages designed to help project managers in achieving their goals in the project management. In its simple application, it calculates the length of time required for completing a project, once its tasks, relationships and resources are identified.

One of the most useful features of PMA is that it can quickly assess the impact of change on the project, i.e. what if, situation, allowing to quickly and easily construct and generate alternative plans and schedules to meet the project constraints.

Communication compatibility is another very usefully features of PMA. PMA can create variety of reports, tables and graphs that range from task assignments for individual worker, to full scale critical path diagrams and costing analysis, to provide specific information about the project.

Assigning of multiple calendar and resource allocation can be effectively done at uniform distribution, front and end and spread intervals. PMA indicates any over allocated resources which can be corrected either manually or with automatic resource levelling facility available in the package.Further, it also has the ability to link the data with other compatible third party software application facilitating smooth communication of information.

The following is a summary of all the facilities available in the package (Jayawardena, 1995)

Project Planning System Software Facility	
• Ability to create work breakdown structures • Ability to create responsibility assignment metrics Network Analysis	• **Unable** • **Unable**

• Maximum number of activities	• **Unlimited**
• Maximum number of activities per project	• **Unlimited**
• Network analysis convention	• **Arrow or Precedence**
• Sub Network	• **Capable**
• Maximum number of sub networks	• **Unlimited**
• Multiple project calendars	• **Available**
• Maximum number of calendar modules	• **Unlimited**
• Maximum number of total calendar modules	• **Unlimited**
• User definable calendars	• **Available**
Other facilities	
• It supports milestone, targets imposed ends, ability to support various activity relationships and assigning various constraints.	• **Available**
• Ability to store and re-use library of standard network.	• **Available**

Resource Processing

• Maximum number of resources	• **Unlimited**
• Method of activity resource allocation	• **Uniform, at start, at end and spread**
Other resource processing capabilities	
• Resource levelling capability	• **Available**
• Resource histogram capability	• **Available**
• Facility to define limits on resource availability	• **Available**
• Ability to produce other reports on resource such as resource sheets, resource graphs and resource views	• **Available**

Cost Processing

• Resource costing and cash flow facility	• **Available**
• Ability to produce billing by cost centre. This provides a cost based look at performance using concept of earned value. In simple language, it answers three key questions; what was budgeted? What was accomplished? What was spent? Based on this information P3 calculates variances to pinpoint problems and estimates cost at completion.	• **Unable**

Tracking Progress	
• Ability in comparing the updated plan based on actual recording of works and cost as it is completed, with the base plan.	• **Available**
• Updating the project	• **Available**

Reports	
• Method of report	• **Via Screen and Printers**
• Degree of report flexibility	• **Available**
• Bar charts	• **Critical path with logic links, % completion and target dates**
• Graphical output capabilities	• **Available**
• Producing summaries of all the projects	• **Available**

Data Exchange and Security of Data	
• Import capability.	• **Available with compatible software packages only.**
• Export ability	• **Available with compatible software packages only.**

Figure 2.5 Facilities available in Pert Master Advance

2.4.5 Harvard Total Project

Harvard Total manager is also one of the most powerful project planning, controlling and communication software packages designed to help project managers in achieving their goals in project management.

The following is a summary of all the facilities available in the package (Jayawardena 1995)

Project Planning System Software Facility	
• Ability to create work breakdown structures	• **Unable**
• Ability to create responsibility assignment matrix	• **Unable**
Network Analysis	
• Maximum number of activities	• **Unlimited**
• Maximum number of activities per project	• **Unlimited**
• Network analysis convention	• **Precedence**
• Sub Network	• **Capable**
• Maximum number of sub networks	• **Unlimited**
• Multiple project calendars	• **Available**
• Maximum number of calendar modules	• **Unlimited**
• Maximum number of total calendar modules	• **Unlimited**
• User definable calendars	• **Available**
Other facilities	
• It supports milestones, targets imposed ends, ability to support various activity relationships and assigning various constraints.	• **Available**
• Ability to store and re-use library of standard network.	• **Available**

Resource Processing	
• Maximum number of resources	• **Unlimited**
• Method of activity resource allocation	• **Uniform**
Other resource processing capabilities	
• Resource levelling capability	• **Available**
• Resource histogram capability	• **Available**
• Facility to define limits on resource availability	• **Available**
• Ability to produce other reports on resource such as resource sheets, resource graphs and resource views	• **Available**

Cost Processing	
• Resource Costing and Cash flow facility	• **Available**

Tracking Progress	
• Ability in comparing the updated plan based on actual recording of works and cost as it is completed, with the base plan.	• **Available**
• Updating the project	• **Available**

Reports	
• Method of report	• **Via Screen and Printers**
• Degree of report flexibility	• **Available**
• Bar charts	• **Critical path with logic links, % completion and target dates**
• Graphical output capabilities	• **Available**
• Producing summaries of all the projects	• **Available**

Data Exchange and Security of Data	
• Import capability for Updating.	• **Available with compatible software packages only.**
• Export ability	• **Available with compatible software packages only.**

Figure 2.6 Facilities available in Harward Total Project

2.4.6 Expedition

This is one of the most powerful contract control software packages available in the market. The Primavera System Software manufactures have designed this software package.

This software can help to streamline all administration works of construction projects. Therefore, not only the project manager, but everyone involved in the project management activities such as, sub contractors, consultants, specialist consultants and the client can also obtain a lot of benefit by using this software package.

Expedition by Primavera System can help the project manager in recording, storing, organising and reporting all administration works in the project management activities. (Jayaweerasingham, 1996)

The following is a summary of all the facilities available in the package (Primavera System, 2000)

Changes and Requests

- Customizable change management
- Workflow to meet your company standards
- Analysis of ripple effects of a change on several contracts
- Current status and latest cost estimate for a single change
- Requests for information and answers
- Proposed change orders, change order requests and requests for proposals
- Change orders and proceed orders
- Automatic generation and linking of multiple change documents
- Unit price and lump sum change documents
- Change log by contact
- Summary change order
- Graphical snapshot of total costs and documents status for all changes

Submittals

- Submittal items and packages
- Submittal status by package, drawing, ball-in-court, dates, multiple reviewers
- Days held, days elapsed, days overdue calculations
- Multiple reviewers and multiple item review cycles
- Ball-in-court tracking
- Automated transmittals and dunning letters
- Graphical submittal bar chart
- Submittal activity scheduling based on required lead time

Contracts and purchase orders

- Contract and purchase order documents with summary status of changes
- Lump sum and unit price documents
- Revised amounts and dates calculated by approved change orders
- Automatic link to materials delivery and submittals
- Insurance tracking with automated renewal notices

Requisitions for Payment

- Faster application and certification for payment
- Automatic retrieval of materials delivered and approved changes
- Industry standard AIA G702/ G703 forms
- Costs instantly calculated for this period based on project schedule

Budgets and costs

- Cost worksheet for complete financial picture
- Budgets, commitments and actuals
- Customizable worksheet headings
- Cost collection from multiple source documents
- Source document drill-down
- Automated posting of pending and approved revisions
- Customizable 20-character cost accounts
- Vendor invoices
- Currency and exchange rate can be specified per project
- Project trends analysis
- Project funding analysis

Contract Drawing Log

- Latest set of drawings with latest revisions created, distributed and tracked
- Drawing sets collected and easily sent to a distribution list
- Transmittal letters prepared automatically to all appropriate parties
- Production lists quickly assembled
- Accurate history of revisions to see who changed what and why
- Drawings tracked through Design Review to As Built

Information Links

- Hot-linked issues Log
- Document retrieval searches on key words
- Multiple linking across multiple issues
- Issue history reporting
- Unlimited classification codes to customize database
- Launch and attach word processing documents, spreadsheets, drawings and more
- Link cost information with your accounting system
- Remote access via Citrix Win Frame®

Communications Tools

- Action Item List Reports
- Automated letters of transmittal
- Contact directory with multiple contacts
- Documents sent via distribution lists
- Correspondence sent and received
- Letters in Rich Text Format
- E-mail Expedition documents and attachments to other Expedition users
- Punch list and notepad logs
- In-Basket by users
- Meeting minutes
- Daily reports

Reports and Documents

- InforMaker 5.0 custom report writer
- 150+ predefined reports and forms
- Multiple selection and sorting options
- Customizable forms and reports

Multi-user Security

- Security by system, project and user
- Restricted access by document type and modules: write, read only or no access
- Definable approval actions by user
- Controlled access to cost documents

System Requirements
• Windows® 95, Windows NT® or Novell Netware® • Pentium processor with 24MB of memory for client • Client/ server; Sybase® SQL Anywhere™ 5.5 database • Year 2000 compliant

Help Systems
• Complete on-line help system • Electronic documentation • Wizards to assist project administration tasks • Customisable spell-checker

Figure 2.7 Facilities available in Expedition

3.0 Data Collection

3.1.0 Development of study and data collection

3.1.1 Methodology

The data collection was done by conducting interviews and discussions with various personnel in the contracting organizations, consultants and project management firms, since this method was decided as the best method for this type of study due to the fact that interviews and discussions gives greater control over the respondents and provides opportunity directing questions to obtain detail explanations and justifications for various opinions and decisions, rather than obtaining details through posted questionnaires.

The data collection was done starting from the December 2000 to June 2001. It became a very difficult task to get appointments with the relevant people in this regard and hence the data collection was done amidst a lot of difficulties.

3.1.2 Limitation of study

As already explained under "Limitation" previously herein this report, this research was further focussed on contractors, consultants and project managers, as it was found appropriate to carry out a research on contractors' performance in dedicated project management software application in the construction industry, because of the need for effective management of construction projects in Sri Lanka.

Hence, the survey was carried out on ICTAD registered local contractors, foreign contractors operating in Sri Lanka, consultants and also on project management firms operating in Sri Lanka.

Due to the large number of contractors registered in ICTAD for building and civil engineering construction, in various categories, and the bulk of the works are normally undertaken by M1, M2, M3 and M4 contractors respectively, the attention of the research was focused on the above categories as far as the local contractors are concerned. Due to the limited number of foreign contractors, M1, M2 and M3 contractors, consultants and project management firms, rather than selecting samples, it was decided to cover all or most of the numbers in each category and present the data in order to get realistic results.

3.2.0 Formulation of interview questionnaire

It was identified that formulation of a questionnaire to obtain relevant information is one of the major tasks, which need careful planning, and considerable experience in computer application in construction management.

Hence, a questionnaire was formulated in order to gather industry experience in the use and application of dedicated project management computer packages in the project management and also in order to achieve the other objectives of this project. Further, as the professionals at managerial levels are busy in their business it was decided to prepare questions with proper sequence in order to collect all necessary information.

Discussion with four M1contractors, three consultants and two M2 contractors as well as one M3 Contractor who are using computers for project management was carried out prior to formulating the questionnaire. Further, the personnel experience in this field and the much needed guidance constantly given by the Managing Director of Lan Management Development Service, the supervisor for this project, was very much helpful in finalising the questionnaire which was done based on the information and extracted details from literature survey as well.

The following major sections were identified to be included in the interview questionnaire.

1. General organisational information.

(a) Type of organisation.
(b) Nature of respective works undertaken

2. Computer usage in general.

(a) Years of usage
(b) Reasons for using computer
(c) Whether a site based computer system is used, and if so why.

3. Usage of dedicated project management packages.

(a) Application of these packages in planning
(b) Extent of usage
(c) Application of these packages in scheduling
(d) Extent of usage
(e) Application of these packages in monitoring and controlling
(f) Extent of usage
(g) Application of these packages in cost controlling
(h) Extent of usage
(i) Application of these packages in document control (only if Primavera Expedition is used)

4. Level of user satisfaction

(a). User satisfaction with the packages, and if in the case of yes or no, so contributing factors.

(b) To ascertain the opinion as to effect of lack of computer application in project management specially in order to ascertain whether it curtail the performance of projects

5. Future development
6. Difficulties faced
7. Benefits realised

The Questionnaire used in the interviews consisted of ten pages of questions and one page of instruction and information. The questions have been formulated in such a way that answers were expected in the following ways.

7.1. Yes/No answers
7.2. Ticking on alternatives in ranking order
7.3. Word answers
7.4. Indicating answers on a X point scale, in ranking order.

The Questionnaire was designed to gather data in the following areas:

(i) Information about the company to establish the nature, size and characteristics of companies using computers.

(ii) To ascertain the type of packages used and the areas for which these packages are used. The information was gathered under five major functional areas namely, planning, scheduling, monitoring, cost controlling and document controlling.

(iii) To determine the level of user satisfaction and explore the reasons for satisfaction or dissatisfaction.

(iv) The benefits gained by the companies by using these dedicated project management packages.

(v) To ascertain the difficulties faced in this regard. Specially the practical difficulties in application of dedicated project management packages.

(vi) To explore the possibilities for the future development.

The Questionnaire was formulated in such a way that interviewees would be attracted into a friendly discussion, with possible answers also being proposed, in order to get genuine answers without any distortions. A copy of the blank Questionnaire is attached in Appendix C.

3.3.0 Pilot study

In order to make sure that sufficient and necessary data is collected through discussions to fulfil all the objectives of the study, a pilot survey was carried out amongst some contractors, and the data collected through this pilot survey was used to make necessary changes and improvements in the interview questionnaire.

3.4.0 Identification of target group

The target groups were identified as foreign contractors, local contractors in four categories, consultants and reputed project management firms.

The views of those who were interviewed in the research formed a major component of the report. The local construction firms were chosen on the basis of grading given by ICTAD as explained above, whereas the foreign contractors, consultants and project management firms were taken in to consideration in general basis.

Table 3.1 Survey sample

Type of Firms	Numbers	Percentage
Foreign Contractor	9	Nearly 90%
M1-Contractor	10	100%
M2-Contractor	13	93%
M3-Contractor	18	86%
M4-Contractor	17	27%
Consultancy	14	Nearly 90% (Major Firms)
Project Management	3	Covering all major firms
Total Number of Firms Interviewed	84	

3.5.0 Data collection

3.5.1 Information from literature survey

The data collection with regard the project management packages available and the tools available were comprehensively studied and discussed in details in a previous chapter under "Literature Review" and the knowledge obtained through the above process were used in the process of the data collection from the research specially when interviewing people.

3.5.2 Interviews and discussion through structured questionnaire

The data collection was commenced in December 2000 and successfully completed at the end of June 2001 amidst a lot of difficulties, as it was extremely difficult to get appointments with those who are at top positions as it was determined to get the information only from the top people.

Interviews and discussions were held with those people of 84 organisations, covering almost all the foreign contractors, all M1 contractors, 93% of M2 contractors, 86% of M3 Contractors, 27% of M4 contractors and nearly 90% of the major and reputed consultants and most of the project management firms. These percentages have been arrived on the number of firms interviewed and the number of total registered contractors under each category and consultants published by the ICTAD in 1999-2000.

4.0 Analysis

4.1.0 Introduction

The data as mentioned was collected according to a structured and detailed list. Information relevant to the study but not envisaged at the time of developing the list was recorded and taken into consideration during the analysis stage in order to interpret some findings and to arrive at some conclusions. The following analysis was carried out in the same order as described in the Questionnaire for easy interpretation. Information provided by the contractors for each question has been tabulated in a separate table to visualise each item of information more realistically.

4.2.0 Analysis

Two methods were basically adopted to present the data collected for analysis.

(i) Presentation of raw data

In certain circumstances it was found that raw data gives a real picture of the existing situation. In such situations every attempt was made to list raw data in descending order of importance based on the proportion of responded contractors either favourably or unfavourably.

(ii) Presentation of summarised data

In other cases, data was summarised after taking the whole picture into account and by giving due weightings to all comments and suggestions expressed by contractors. This method is more useful when presenting similar ideas given in various forms by different contractors.

4.2.1 Computer usage in general

Table 4.1 Computer usage

Type of organisation	Proportionate of computer usage
Foreign Contractors	100%
M1 Contractors	100%
M2 Contractors	100%
M3 Contractors	94%
M4 Contractors	94%
Consultants	100%
Project Management Firms	100%

1. As mentioned earlier, since the number of firms with regard to M1, M2, M3, foreign contractors, consultants and project management firms are smaller in comparison, our research was extended to such an extent that it covered more than 85% of each respective area specially with regard to the foreign contractors, M1, M2 contractors and consultants and project management firms. However, in regard to the M4 Contractors, the sample survey covered only 26% of the total population and hence, interpreting the data obtained in this category may not give a realistic picture whereas in the other categories it definitely gives correct picture about the real situation.

2. From the survey samples, 100% of M1 contractors, M2 contractors, 94% of M3 contractors and M4 contractors, 100% of foreign contractors and 100% of consultants and project management firms interviewed claimed that they were using computers in general. This is a remarkable increase when compared with the result of the survey done by Jeyaweerasinham (1996). The result of his research was that 100% foreign contractors, 75% of Grade 2 (equivalent to M1) and 30% of Grade 2(equivalent to M2) had used computer application in construction management activities. The results as indicated with regard to the foreign contractor, M1, M2 and M3 contractors, consultants and project management firms reflect the real situation as almost the total population was considered in the research. However, the results regarding the M4 contractors may defer from the actual situation as the total population was not considered in this research under this category.

4.2.1 (a) Reasons for using computers

During the research, the reasons for using computers in general were also surveyed and the survey was done in such a way that some common attributes for using computers, which were pre-determined on the findings obtained during the pilot survey, were incorporated in the Questionnaire and instructions had been given to rank these attributes according to their experience.

The attributes have been analysed, tabulated and presented in the Table No 4.2, in such a way that the result have been presented herein below in a marking scheme calculated on giving due weightings to the percentages of the ranking as such 60 marks, 50 marks, 40 marks, 30 marks, 20 marks and 10 marks have been considered for ranking 1, 2, 3, 4, 5 and 6 respectively.

Table 4.2 Reasons for using computers.

Attributes	Overall Preference	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
Standardising company formats	**19.8%**	235.8	21.2	47	21.5	37.5	44.6	34	30
Uniform administration	**25.22%**	300.4	26.6	32	44.5	43.9	55.8	42.6	55
Desire to keep up to date	**13.18%**	157	16.7	36	27.6	19.6	28.7	28.4	-
Forced in to computerisation	**3.95%**	47	6.7	8	9.3	-	13	10	-
To reduced cost	**18.71%**	222.9	42.2	21	36.1	33.8	31.4	33.4	25
Quick processing of data	**19.16%**	228.2	60	25	57.6	29.4	3.6	12.6	40

1. As per the summarised results of the opinions expressed by the interviewed firms is concerned, overall preferences of 25.22%, 19.80%, 19.16%, 18.71% has been given for attributes of uniform administration, standardising company formats, quick processing of data, and reduced cost respectively as the reasons for using computers in general.

4.2.2 Site based computer system

The extent of the computer application in general at site level was also subjected to the research and the attempts in order to ascertain reasons for using computers at site were also tried during this research. The reasons attributed by most of the people are same in common interpretation. Some of them are given below.

Table 4.3 Site based computer system

Type of organisation	Proportionate of computer usage
Foreign Contractors	100%
M1 Contractors	90%
M2 Contractors	46%
M3 Contractors	28%
M4 Contractors	6%
Consultants	29%
Project Management	100%

1. As indicated in the above table, all foreign contractors use computers at sites and 90%, 46%, 28 % and only 6% of local contractors of M1, M2, M3 and M4 use computers at sites. Further, 29% of the consultants and 100% of the project management firms use computers at sites.

2. This is again a remarkable increase in this respect, in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara. According to his finding, only foreign contractors and one local contractor had site based computer system, whereas in the present situation almost all the M1 contractors and a satisfactory number of M2 and M3 contractors use computers at sites.

3. The research revealed that most of M2 and M3 contractors in particular use computers at site either to fulfil contract requirements or to satisfy requests made by the consultants or project managers. However, the reasons for using computers at sites by M1 and all foreign contractors are the easiness of processing data and the facilities available for planning, scheduling, monitoring, controlling activities enabling them to execute these tasks at the site itself.

3. However, the common answers given by most of the contactors for not using computers at site are elaborated below whereas the high initial capital has been identified as the main factor for not using computers at sites for most of M3 and M4 contractors

4. Further, the top management of most of the local firms under M2, M3 and M4 contractors are not even aware of the productivity improvement, which can be directly and indirectly derived at, by using computers at site. The fact that the high productivity could easily compensate the initial capital cost which they categorise as high is not known to them.

The reasons expressed as to why most of the local contractors are reluctant in using site based computer system are given below.

(1) High cost
(2) Managing the construction projects from head office is preferred than a site based management.
(3) Site staff is not computer literate and training them will be a difficult task.
(4) Jobs are not available continuously to invest additionally on computer machines and staff.

4.2.3 Application of dedicated project management packages

The focal point of the research, the application of dedicated project management packages for project management, has been discussed in this section as per the details gathered during the research. The extent of the usage of dedicated Project Management Packages, in the five major functional areas such as planning, scheduling, monitoring and controlling, cost controlling and document controlling has been analysed, tabulated and presented in the following tables.

The following is the analysis of the survey samples as to the application of project management packages by the contractors, consultants and a few project management firms in the Sri Lankan Construction Industry.

Table 4.4 Application of dedicated project management packages in general

Name of the Package	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Microsoft Project	100	100	92	67	76	93	100
Primavera Project Planner	44	20	-	-	-	-	33
Sure Track (Primavera)	22	-	8	6	-	14	-
Expedition (Primavera)	-	-	-	-	-	-	33
Time Line	-	10	-	-	-	-	-
Havard Total Project Manager	-	10	-	-	-	-	-

Note: As far as the application of Time Line and Harvard Total Project Manager is concerned, only one contractor had used it previously. However, it has been noted here in percentages only for references.

1. As indicated in the above table, all the foreign contractors and local contractors of M1 category use project management packages for project management activities. As far as the packages are concerned, all of them use MS Projects and, 44% foreign contractors uses Primavera Project Planner. However, even though 20 % of the M1 contractors have purchased the Primavera Package, none of them uses it for project management activities. They have continued to use MS Project, while having a very sophisticated package like P3. Nevertheless, when inquiries were made in this regard, the firms interviewed gave various reasons, and the detailed analysis in this regard is given here in a separate section under "Difficulties Faced".

2. The research reveals that 22% of foreign contractors and 8% and 6% of the local contractors of M2 and M3 use the Sure Track (Primavera) package. As far as the application of Time Line and Harvard Total Project Manager is concerned, only one contractor had used it previously. However, it has been noted here in percentages only for references.

3 The situation in regard to packages like Expedition, is that most of the contractors are not even aware of this package and the fact is that the available facilities of this package have to be communicated and the people must be made aware of this, as now most of the firms are geared to adopt a lot of sophisticated methods.

4. Also, the situation in respect of M2 and M3 contractors is that only 92 % and 67% of them respectively use MS Project and 76% of the interviewed M4 contractors use it for project management activities. None of them uses any of the other project management packages.

5. As far as the consultants and project management firms are concerned, 93% of the consultants and 33% of the project management firms interviewed claimed that they used MS Project, while 33% of the project management firms (only one project management firm) claimed that they used P3 for project management activities.

6. However, the good thing to be underlined is that still there is a remarkable increase in this respect in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara. According to his findings, only a few contractors in addition to the foreign contractors were using project management packages for project management activities.

4.2.3.1(a) Application of these packages in planning

The extent of the application of these project management packages in planning was subjected to the research and the finding is as follows.

Table 4.5 Application of these packages in planning

Facility	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Net work Analysis	67	90	31	6	-	7	100
Critical Path Analysis	85	80	92	22	24	29	100
Bar Chart/Gantt Charts	100	100	92	61	71	79	100
Resource Planning	33	50	8	6	-	36	100

4.2.3.1 (b) Extent of usage

The extent of the usage of them in planning was subjected to the research and the finding is as follows.

Table 4.6 Extent of usage of these packages in planning

Extent of Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
For every project as a standard company format	100	50	54	28	-	79	100
For selected projects only, depending upon their nature	-	40	38	33	24	-	
For selected projects only, if requested by the consultants/client/project manager	-	10	8	39	47	-	
No usage					29	21	

Note: Please note that some of the interviewees did not answer some of the questions given in the questionnaire and hence the analysis was done out of the data gathered as shown in the table.

1. As indicated in the above table, the findings of the research shows that all foreign contractors, 100%, 92%, 61 % and only 71% of local contractors of M1, M2, M3 and M4 use these packages for planning at least in preparation of Bar/Gantt Charts. Further, it was revealed that 79% of the consultants uses it for at least preparation of Bar/Gantt Charts. In regard to Critical Path Analysis, Network Analysis, and Resource Planning, the analysis is that, they showed little interest as the result obtained in this regard are 29%, 7% and 36% respectively.

2. The situation in regard to project management firms is that all of them who were interviewed use these packages for planning in comprehensive manner in their level for each project. However, usage of these packages in Critical Path Analysis, Network analysis and Resource Planning is very poor, even amongst the top-level local contractors of M1, M2 and M3.

3. The results indicated in this regard are, 85% of the foreign contractors, 80%, 92%, 22% and 24% of the M1, M2, M3 and M4 contractors use them for Critical Path Analysis. 67% of the foreign contractors, 90%, 31%, 6% the M1, M2 and M3 contractors use them for Net work Analysis, while none of the M4 contractors interviewed uses them for Net work Analysis.

4. As it has been revealed in the research, in regard to the resource planning, only 33% of the foreign contractors, 50%, 8% and 6% of the local contractors of M1, M2 and M3 use them for resource planning while none of the contractors of M4 uses them in this regard. Foreign firms expressed that since most of the works they undertake are of management contracts, the need for using packages for resource planning does not arise unless for very special circumstances. However, they were in the opinion that obtaining technical staff which is competent in this area is extremely difficult in Sri Lanka.

6. Most of the local contractors accepted that lack of detail planning in the beginning of the project is one of the main reasons for them to neglect resource planning. Further, most of them expressed that lack of trained technical staff in this area is also a contributory factor for the poor implementation of resource planning.

7. The other important fact to be noted is that while all the foreign contractors attributed that they use these packages as a standard company format for each and every project, only 50%, 54% and 28% of local contractors of M1, M2 and M3 respectively have favoured in this regard.

8. However, 40%, 38%, 33% and 24% of local contractors of M1, M2, M3 and M4 have claimed that they use them for planning activities only for selected projects depending upon the nature and magnitude of projects. Only 10%, 8%, 39% and 47% of local contractors of M1, M2, M3 and M4 expressed that they use these packages for planning only if requested by the client, consultants or the project managers.

9. As far as the extent of the usage of these packages by the consultants and the project management firms, for planning activities is concerned, 79% of the consultants claimed that they use them for each and ever project as a standard company format while all the management firms interviewed claimed that they use them for each and every project as a standard company format.

10. Revelations made as to this poor indication and the difficulties faced together with the suggestions made in this regard during the interviews with this organisation, were too analysed and have been presented in relevant sections herein below. However, in brief various reasons were given by the contractors for not using these packages for detailed planning activities and analysis.

11. Most of them attributed that non-availability of trained staff, and the lack of awareness of the tools available in the packages for advanced analysis, are the main reasons for the poor result indicated above. However, the fact which no doubt brings some relief is that this is again a remarkable increase in this respect, in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara, and most of the firms are now ready to do improvements in this area. According to his finding, only foreign contractors and only a couple of local contractor were using these packages in planning.

4.2.3.2(a) Application of these packages in scheduling

The extent of the application of these project management packages in scheduling was subjected to the research and the finding is as follows.

Table 4.7 Application of these packages in scheduling

Facility	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Net work Analysis	67	80	31	-	-	7	100
Critical Path Analysis	85	80	38	-	-	29	100
Bar Chart/Gantt Charts	100	100	85	28	6	64	100
Resource Planning	33	50	8	-	-	14	100

4.2.3.2 (b) Extent of usage

The extent of the usage of them in scheduling was subjected to the research and the finding is as follows.

Table 4.8 Extent of usage of these packages scheduling

Extent of Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
For every project as a standard company format	100	50	54	28	-	64	100
For selected projects only, depending upon their nature	-	40	38	-	6	-	
For selected projects only, if requested by consultants/client/project Manager	-	10	8	-	-	-	
No usage				72	94	36	

Note: Please note that some of the interviewees did not answer some of the questions given in the questionnaire and hence the analysis was done out of the data gathered as shown in the table.

1. As indicated in the above table, the finding of the research shows that all foreign contractors and M1 contractors, 85% and 28% of local contractors of M2 and M3 use these packages for scheduling at least in preparation of schedules regarding Bar/Gantt Charts.

2. However, usage of these packages for preparation of schedules in respect of Critical Path Analysis, Network analysis and Resource Planning is very poor, even amongst the top-level local contractors of M1, M2 and M3. The results indicated in this regard are, 85% of the foreign contractors, 80% and 38% of local contractors of M1 and M2 contractors use them for scheduling in respect of Critical Path Analysis. Also, 67% of the foreign contractors, 80% and 31% of local contractor of M1 and M2 use these packages for scheduling in respect of Network Analysis.

3. As it has been revealed in the research, in regard to the scheduling in respect of resource planning, only 33% of the foreign contractors, 50% and 8% of the local contractors of M1 and M2 use them for scheduling. None of the contractors of M3 and M4 uses these packages for scheduling activities in respect of Resource Planning and Network Analysis. Most of the local contractors accepted that lack of detail planning in the beginning of the project is one of the main reasons for them to neglect resource planning. Further, most of them expressed that lack of trained technical staff in this area is also contributory factor for the poor implementation of resource planning.

4. Further, it was revealed that 64% of the consultants uses these packages for at least preparation schedules regarding Bar/Gantt Charts and for scheduling for other areas such as Critical Path Analysis, Network Analysis and the resources planning, they showed little interest as the result obtained in this regard are 29%, 7% and 14 respectively. The situation in regard to project management firms is that all of them who were interviewed use these packages for scheduling in comprehensive manner in their level for each project.

5. The other important fact to be noted is that while all the foreign contractors attributed that they use these packages for scheduling activities as a standard company format for each every project, only 50%, 54% and 28% of local contractors of M1, M2 and M3 respectively have favoured in this regard. However, 40%, 38% and 6% of local contractors of M1, M2 and M4 have claimed that they use them for scheduling activities only for selected projects depending upon the nature and magnitude of projects.

6. Only 10% and 8% of local contractors of M1 and M2 expressed that they use these packages for scheduling activities only if requested by the client, consultants or the project managers. As far as the extent of the usage of these packages by the consultants and the project management firms, for scheduling activities is concerned, 64% of the consultants claimed that they used them for each and ever project as a standard company format while all the project management firms interviewed claimed that they used them for each and every project as a standard company format.

7 Revelations made as to this poor indication and the difficulties faced together with the suggestions made in this regard, during the interviews with this organisation, were too analysed and have been presented in relevant sections herein below. However, in brief the contractors for not using these packages for detailed scheduling gave various reasons. Most of them attributed that non-availability of trained staff, and the lack of awareness of the tools available in the packages for advanced analysis, as the main reasons for the poor result indicated above. However, like in other areas the fact that there is a remarkable increase in this respect, in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara, is noteworthy. According to his finding, only foreign contractors and only a couple of local contractor were using these packages in planning.

8. Also, that fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to attention of training institutes and universities in order to cater for the future demand.

4.2.3.3(a) Application of these packages in monitoring and controlling

The extent of the application of these project management packages in monitoring and controlling was also subjected to the research and the finding is as follows.

Table 4.9 Application of these packages in monitoring and controlling

Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Critical Path Analysis	89	70	54	-	-	43	100
Bar Chart/Gantt Charts	100	90	85	61	35	57	100
Resource Planning	33	20	8	-	-	-	-

4.2.3.3 (b) Extent of usage

The extent of the usage of them in monitoring and controlling was subjected to the research and the finding is as follows.

Table 4.10 Extend of usage of these packages in monitoring and controlling.

Extent of Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
For every project as a standard company format	100	50	-	11	-	14	100
For selected projects only, depending upon their nature	-	30	62	6	12	79	-
For selected projects only, if requested by the Consultants/Clint/Project Manager	-	20	31	28	29	-	-
No usage			7	55	29	7	

Note: Please note that some of the interviewees did not answer some of the questions given in the questionnaire and hence the analysis was done out of the data gathered as shown in the table.

1. As indicated in the above table, the finding of the research shows that all foreign contractors, 70% and 54% of local contractors of M1 and M2 use these packages for monitoring and controlling in Critical Path Analysis. Also, all foreign contractors, 90%, 85%, 61% and 35% of local contractors of M1, M2, M3 and M4 respectively use these packages for monitoring and controlling in Bar Chart/Gantt Chart Analysis.

2. In regard to the monitoring in resource planning, only 33 % of the foreign contractors and 20% and 8% of local contractors of M1 and M2 use these packages for monitoring and controlling activities. The local contractors mostly of M3 and M4 category showed no firm interest in this area, except 61% and 35 % trend shown for controlling and monitoring activities in respect of Bar Chart/Gantt Chart Analyses.

3. Further, the research revealed that 43% and 100% of consultants and project management firms respectively use these packages for monitoring and controlling in Critical Path Analysis. In respect of Bar Chart/Gantt Chart Analysis, it indicated a result of 57% and 100%. The situation in regard to project management firms is that all of them who were interviewed use these packages for scheduling in comprehensive manner in their level for each project.

4. The other important fact to be noted is that while all the foreign contractors attributed that they use these packages for monitoring and controlling activities as a standard company format for each and every project, only 50% and 11% of local contractors of M1 and M3 respectively have favoured in this regard. However, 30%, 62%, 6% and 12% of local contractors of M1, M2, M3 and M4 have claimed that they use them for monitoring and controlling activities only for selected projects depending upon the nature and magnitude of projects.

5. Only 20%, 31%, 28% and 29% of local contractors of M1, M2, M3 and M4 categories of local contractors expressed that they use these packages for monitoring and controlling activities only if requested by the clients, consultants or the project managers.

6. As far as the extent of the usage of these packages by the consultants and the project management firms, for monitoring and controlling is concerned, 14% of the consultants claimed that they used them for each and every project as a standard company format and 79% for selected projects only depending upon the nature of the projects. All project management firms interviewed claimed that they used them for each and every project as a standard company format.

7. Revelations made as to this poor indication and the difficulties faced together with the suggestions made in this regard, during the interviews with these organisations, too were analysed and are presented in relevant section herein below. However, in brief the contractors for not using these packages for detailed monitoring and controlling activities gave various reasons. Most of them attributed that non-availability of trained staff, and the lack of awareness of the tools available in the packages for advanced analysis, as main reasons for the poor result indicated above

8. However, like in other areas the fact that there is a remarkable increase in this respect, in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara, is noteworthy. According to his finding, only foreign contractors and only a couple of local contractor were using these packages in monitoring and controlling, whereas now it has extended to M4 contractors as well.

9. Also, that fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to the attention of training institutes and universities in order to cater for the future demand.

4.2.3.4(a) Application of these packages in cost controlling

The extent of the application of these project management packages in cost controlling was also subjected to the research and the finding is as follows.

Table. 4.11 Application of these packages in cost controlling.

Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Using Earn Value Technique	44	-	-	-	-	-	33
Using Graphs	44	-	-	-	-	-	33

4.2.3.4 (b) Extent of usage

The extent of the usage of them in monitoring and controlling was subjected to the research and the finding is as follows.

Table 4.12 Extent of usage of these packages in cost controlling.

Extent of Usage	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
For every project as a standard company format	44	-	-	-	-	-	-
For selected projects only, depending upon their nature	-	-	-	-	-	-	-

Note: Please note that some of the interviewees did not answer some of the questions given in the questionnaire and hence the analysis was done out of the data gathered as shown in the table.

1. As indicated in the above table, the finding of the research shows that only the foreign contractors use the cost controlling tools of these packages. While 44% of them use these packages for cost cost-controlling activities by using Earn Value Technique and Graphs respectively and the extent of the usage for each and every project as a company format has been voted by 44% of them. None of the local Contractors claimed that they used these packages for cost controlling activities.

2. The reason for not using these packages for cost controlling activities, by most of the local contractors, as revealed during the research is that only the P3 package is equipped with cost controlling tools and hence those who are using MS Projects only have no choice in this regard.

3. However, as far as the local contractors of M1 category who are having P3 is concerned, the lack of trained technical people to implement these packages for project management could be attributed as the main reason for not using the packages for these activities. The situation in regard to project management firms is that only one of them who is having the P3 uses it for cost controlling activities in the project management.

4. However, as far as the cost controlling is concerned the fact that there is no improvement, when compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara, is noteworthy. According to his finding, only foreign contractors were using these packages in cost controlling activities.

5. Also, that fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to the attention of training institutes and universities in order to cater for the future demand.

4.2.3.5 Application of these packages in document controlling

The extent of the application of these project management packages in document controlling was also subjected to the research and the finding is that none of the foreign contractors or local contractors as well as consultants use document controlling project management packages.

1. Our inquiries in to this matter revealed that most of the local contractors are not even aware of the availability of project management packages specially designed for document control, such as Expedition (Primavera). Further, those who are aware of these packages attributed the lack of trained technical people in this regard as the main cause which prevents them from even investing money on these packages.

2. However, as far as the document controlling is concerned there is no improvement, when compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara. According to his finding, none of the contractors including foreign contractors had used these packages in document controlling activities.

3. Also, that fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to attention of training institutes and universities in order to cater for the future demand.

4.2.4 User satisfaction

4.2.4.1 (a) Level of user satisfaction.

The survey explored the level of satisfaction with the application of project management packages and how well they contribute in order to achieve overall company goals and objectives. The level of satisfaction is given below in the table. Determining the judgement as to the success of using project management packages appeared to be difficult for many respondents due to the fact that level of their expectations, were different from each other, in comparison with all the benefit available in these packages.

Table 4.13 Level of user satisfaction and dissatisfaction

Type of organisation	Satisfied (Proportionate)	Not Satisfied (Proportionate)
Foreign Contractors	100%	-
M1 Contractors	100%	-
M2 Contractors	90%	10%
M3 Contractors	67%	6%
M4 Contractors	53%	12%
Consultants	79%	7%
Project Management	100%	-

1. 100% of foreign contractors and local contractors of M1 category, 90%, 67% and 53% of local contractors of M2, M3 and M4 claimed that they were satisfied with these packages, while the result with regard to the consultants and project management firms is that 70% and 100% of them respectively, were satisfied with these packages.

2. The result in respect of "no satisfaction" is that 10% of the M2 contractors, 6% of the M3 contractors, 12% of the M4 contractors and only 7% of the consultants expressed that they were not satisfied with these packages. Reasons in addition to what has been given in the Questionnaire, attributed by them are that lack of tools especially in MS Project and the lack of experienced technical peoples to use them to get the benefits.

4.2.4.1.(b) Contributing factors for satisfaction in usage of packages .

During the research, the factors for satisfaction and dissatisfaction for using project management packages were researched and the answers were interpreted in line with some common attributes for satisfaction or dissatisfaction, which were pre-determined on the findings obtained during the pilot survey, and incorporated in the questionnaire. It was instructed to rank these attributes, according to their experience.

The attributes have been analysed, tabulated and presented in the Table No 4.14, in such a way that the results have been presented in a marking scheme calculated on giving due weightings to the percentages of the ranking as such 60 marks, 50 marks and 40 marks have been considered for ranking 1, 2 and 3 respectively.

Table 4.14 Contributing factors for satisfaction.

Attributes	Overall Preference	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
Straight forward Application	**47.97%**	283.4	50	43	44.8	31.6	27.1	36.9	50
Easy and quick execution of management and administration activities	**52.03%**	307.4	46	45	48.7	35.5	31.2	41	60

The summarised results of the opinions expressed by the interviewed firms indicates that, overall preferences of 52% and 47% has been attributed by most of the firms for their reasons for satisfaction, for easy and quick execution of works and straight forward application respectively.

Table 4.15 Contributing factors for dissatisfaction.

Attributes	Overall Preference	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
Comparably low return from software application	-	-	-	-	-	-	-	-	-
Available software does not fulfil the needs	-	-	-	-	-	-	-	-	-
Lack of experienced professionals to use the software	**100%**	19.6	-	6	-	6.6	7	-	-

1. However, the fact to be highlighted is that there are instances that some of them expressed dissatisfaction due to various reasons. The main reasons they attributed are lack of trained people to operate them obtaining maximum benefits and the lack of tools available in the commonly available software packages like MS Projects, especially in regard to cost controlling and resources planning.

2. This is again a remarkable increase in this respect, in compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara.

3. It was also revealed that some of the contractors expressed satisfaction on the packages, mealy due to the fact the these packages fulfil the basic requirements of preparing Bar Charts in respect of initial planning. But not knowing the productivity improvement, which can be directly and indirectly derived at, by using these packages.

4. Finally, the main contributory factors expressed by firms for dissatisfaction are: the available software packages do not fulfil the needs; and comparably low return from computer usage; and the lack of trained people to use these packages in order to get the maximum benefits.

4.2.4.2 Effect of lack of application of these packages on the performance.

The survey also extended to such an extent that it explored the opinion of the firms as to whether lack of project management packages really curtail the performance of projects. The results obtained have been tabulated in the following table.

Table 4.16 Opinion as to whether lack of software application curtail the performance of projects

Attributes	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Yes	78	30	61	67	29	7	67
Yes, to a certain extent	23	50	23	17	47	43	33
No	-	10	-	-	18	21	-

1. As elaborated in the above table, 78% of the foreign contractors, 30%, 61% and 67% of the local contractors of M1, M2 and M3 expressed that lack of application of these packages directly effect the performance of projects, while 23% of foreign contractors, 50%, 23% and 17% of the local contractors of M1, M2 and M3 were of the opinion that lack of application of theses packages may effect the performance of projects.

2. The position with regard to the consultants and the project management firms is that 7% and 67% of them respectively believe that lack of application of theses packages directly affect the performance of projects while 43% and 33% expressed that it may affect the performance.

3. However, the bottom line is that most of the firms interviewed were of the opinion that lack of application of theses packages in project management activities would either affect the performance of project directly or indirectly while only a small portion of them commented in the other way.

4. It was also revealed that a fair number of them expressed their comments not having a clear picture about the productivity improvement, which can be directly and indirectly derived at, by using these packages.

4.2.5 Future Development

The research was also concentrated on the future developments envisaged by the firms as it was identified as one of the other important areas to be analysed. The results obtained have been tabulated in the following table.

With regard to the steps for future development plan, opinion was obtained on common attributes in this regard, which were pre-determined on the findings obtained during the pilot survey and incorporated in the questionnaire. It was instructed to rank these attributes, according to the opinion of the interviewees.

The attributes have been analysed, tabulated and presented in the Table No 4.18, in such a way that the result have been presented herein below in a marking scheme calculated on giving due weightings to the percentages of the ranking as such 60 marks, 50 marks and 40 marks have been considered for ranking 1, 2 and 4 respectively

4.2.5.1 Future Development Plan

Table 4.17 Future development in the application of project management packages

Response for future development plans	Proportion (%)						
	F	M1	M2	M3	M4	Con	PM
Yes	100	100	100	100	100	100	100
No	-	-	-	-	-	-	-

4.2.5.2 Steps to be taken for improving the usage of project management packages

Table 4.18 Steps to be taken for improving the application of project management packages

Attributes	Overall Preference	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
Recruiting Trained Staff	**38.88%**	302.9	25.3	19	46.6	59.4	57.6	41.7	53.3
Providing Training Facilities	**43.13%**	336.0	23.1	52	49.8	48.1	49.9	56.4	56.7
Streamlining the Organisational Procedures	**11.67%**	90.9	-	35	-	-	-	29.1	26.8

1. As far as the summarised result of the opinion expressed by the firms interviewed is concerned, overall preference of 43% was given for providing training to the technical staff, 38.88% was received for in favour of recruiting trained staff and only 11.6% was received for streamlining the organisational procedures as a step to be taken in future in order to improve the application of these packages in project management activities. The abstract results with regard to the consultants and the project management firms is that they too have formulated some arrangements in this regard and the focal area which they too pointed out, is giving necessary trainings and recruiting trained peoples.

3. Further, the research also revealed that there is a shortage of institutes to provide training facilities in this area, and a lot of contractors say that even though they are willing to give training to their employees, lack of training programmes in this regard really hampers their programmes. However, the bottom line is that most of the firms interviewed were of the opinion that they really have some plan in their agendas in order to improve this area.

4.2.6 Difficulties faced

In order to cover one of the most important objectives of this research, that is to find out the difficulties faced in application of these project management packages, the research was focused on this area. Opinions of the interviewees were obtained on common attributes for difficulties faced in application of these project management packages. These common attributes, which were pre-determined on the findings obtained during the pilot survey, were incorporated in the questionnaire. It was instructed to rank these attributes, according to the experience of the interviewees.

The attributes have been analysed, tabulated and presented in the Table No 4.19, in such a way that the result have been presented herein below in a marking scheme calculated giving due weightings to the percentages of the ranking as such 60 marks, 50 marks, 40 marks and 30 marks have been considered for ranking 1, 2, 3 and 4 respectively

Table 4.19 Difficulties faced

Attributes	Overall Preference	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
High cost	**8.71%**	63	-	30	9.9	-	3.6	19.5	-
None availability of trained staff	**46.7%**	337.4	19.8	53	49.4	54.3	45.8	55.1	60
Lack of interest among the top management	**13.14%**	95	-	-	27.9	11.8	24.8	30.5	-
Lack of interest among the professional	**31.5%**	228	-	31	37	52.2	37.4	36.9	33.5

1. The summarised result of the opinion expressed by the firms interviewed in regard to the difficulties faced shows that an overall preference of 46% has been received for none availability of the trained staff, 31.5% has been given for in favour of lack of interest amongst the professionals and only 13.14% as the lack of interest amongst the top management. However, only 8.71% has been received for high cost factors as far as the difficulties faced are concerned.

2. The abstract results with regard to the consultants and the project management firms is that they too believe that none availability of trained staff and the lack of interest amongst the professional as major difficulties faced in this regard.

3. As elaborated in the above table, most of the firms expressed that none availability of trained people and lack of interest amongst the professional who are engaged in the project management activities are the main difficulties they are faced with.

4. The high cost and the lack of interest amongst the top management were also sighted by some of the firms as the difficulties in this regard. However, when further inquiries were made in regard to the high cost, it revealed that this is mainly due to the cost of purchasing of P3 and the cost of training of the staff in this regard. The fact that the real benefits derived by using sophisticated packages like P3 specially in respect of cost controlling, monitoring and controlling aspects and the productivity improvements in this regard was not known to them as they were not aware of the details of these packages.

5. However, the bottom line is that most of the firms interviewed were of the opinion that they were still faced with some difficulties in using these packages for project management activities.

4.2.7 Benefits realised.

In achieving one of the other most important objectives of this research, the benefits of using the project management packages were also subjected to the research.

The opinions of the firms interviewed were obtained on common attributes in respects of benefits which could be obtained by using these project management packages. These common attributes which were pre-determined on the findings obtained during the pilot survey were incorporated in the questionnaire. It was instructed to rank these attributes, according to their experience.

The attributes have been analysed, tabulated and presented in the Table No 4.20 in such a way that the result have been presented herein below in a marking scheme calculated giving due weightings to the percentages of the ranking as such 60 marks, 50 marks, 40 marks, 30 marks and 20 marks have been considered for ranking 1, 2, 3, 4 and 5 respectively

Table 4.20 Benefits realised

Attributes	**Overall Preference**	Weighting							
		Total	F	M1	M2	M3	M4	Con	PM
Better control of activities	**32.73%**	319.6	47.8	56	45.6	27.3	38.4	44.5	60
Increase the company reputation	**19.97%**	195	26.4	34	34	27.4	23.6	37.3	13.2
Preparation of quality reports	**29.61%**	289.2	60	36	48.7	37.4	32.5	38.3	36.3
Turn over increase	**6.65%**	64.90	-	-	23.1	9.9	12.9	9.1	9.9
Less repetitive works	**11.05**	107.9	37.9	25	-	16.8	28.2	-	-

1. The summarised result of the opinion expressed by the firms interviewed with regard to the benefits realised is concerned, overall preference of 32.73%, 29.61% and 19.97% has been received for better controlling of activities, preparation of quality reports and increased company reputation. However, 11.05% and 6.65% has been received in favour of less repetitive works and turn over increase.

2. As elaborated in the above table, it is evident that the primary benefit realised by the firms in using project management computer packages is the ability of better controlling of activities. Preparations of quality reports have also been ranked as a primary benefit and the increasing company reputation also have been identified by most of the firms as a benefit.

3. Generally, most of the firms do not believe that using project management computer packages, for project management activities, will increase the turn over of the organization.

4. However, the bottom line is that most of the firms interviewed were of the opinion that they still yield some benefits and the fact which should be underlined is that they believe that a lot of benefits is there, but due to various reasons as sighted herein this report they are not in position to yield the benefits available in those packages.

5.0 Conclusion

5.1 General

1. The study completed under the project "Computer Application in Project Management" was aimed at exploring the application of dedicated project management software packages in the Sri Lankan Construction Industry. The objectives of the research, as described in chapter 3, were set and the research was carried out concentrating on achieving these set objectives in a comprehensive literature survey and an industry research. The industry research was done focusing on 84 organisations consisting of 9 foreign contractors, all M1 contractors of the total of 10, 13 number of M2 contractors covering almost all of M2 contractors, 18 number of M3 contractors covering most of the M3 contractors, 17 number of M4 contractors and 14 number of consultants covering almost all the big reputed consultants and all reputed project management firms. This industry research was carried out through a questionnaire based structured interviews and discussions and it enabled to gather industry experience in the use and application of dedicated project management packages in the project management activities in the Construction Industry.

5.2 Computer software usage in general

1. Computer application in general together with the reasons for using computers and the latest status of computer usage at sites were also subjected in the research since it has a direct relevance to the subject area of the research. It has been revealed that 100% of M1 contractors, M2 contractors, 94% of M3 contractors and M4 contractors, 100% of foreign contractors and 100% of consultants and project management firms interviewed claimed that they were using computers in general. The fact that there is an interest growing amongst them is noteworthy. This is a remarkable increase in comparatively with the result of the survey done by Jeyaweerasinham (1996). The result of his research was that 100% foreign contractors, 75% of Grade 2 (equivalent to M1) and 30% of Grade 2 (equivalent to M2) had used computer application in construction management activities.

2. The results regarding the usage of site based computer systems show that all the foreign contractors, 90%, 46%, 28% and 6% of the local contractors of M1, M2, M3 and M4 use computers at sites. Further it was revealed that 29% of the consultants and all the project management firms interviewed use computers at site for their management activities. Reasons attributed by them for the difficulties in using computers at sites are: high cost; preference in managing the construction projects from head office than through a site based management system; lack of computer literacy by the site staff and the difficulty in training them and non availability of jobs continuously to invest additionally on computer machines and staff. The general conclusion which can be arrived at on the finding of the research is that most of the firms especially small scale contractors are reluctant in using computers as they are not aware of the fact that the high productivity could easily compensate the initial capital cost which they categorise as high.

5.3 Project management tools

1. In achieving the objectives of identifying the project management tools, which the project management packages should be equipped with, the conclusion arrived at is that under the main functional areas of planning, scheduling, controlling, cost controlling and document controlling, it has been found that the Critical Path Analysis, Bar/Gantt Chart, Networks such as Activity on Arrow Network and Activity On Node (Precedence) Network, Resource Histograms for Resource Planning, None Uniform Resource Requirements, Scheduling in respect of Bar Charts, Bar Chart Target Comparison, Progress Monitoring Reports, Cost Controlling Tools such as Actual vs. Target Cost Histograms, Earned Value Analysis, Cash Flow Histograms and Projected Cost Curves and Cash Flow Reports are the main project management tools which any dedicated project management software package should facilitate for. Facility for levelling resources, creating calendars, producing various reports and linking data with other common packages are the other requirements which any project management software package should be equipped with.

5.4 Project management packages available

1. It has been revealed from this study that under the main functional areas of planning, scheduling, controlling, cost controlling and document controlling, there are a number of packages used in the Sri Lankan Construction Industry. Microsoft Project, Primavera Project Planner (P3), Total Project Manager/ Harward Total Project Manager (TPM/HTPM), Pert Master and Pert Master Advance, Time Line, Sure Track and Expedition by Primavera are the dedicated project management packages which are now available in the Sri Lankan Construction Industry.

2. The tools available in theses packages have been identified and tabulated in the report under Chapter 2. It has been found that all the packages are equipped with the fundamental project management tools. As far as the P3 is concerned it has more advanced features such as cost controlling and cash flow forecasting facilities. The Expedition is somewhat different and it has features required for contract administration activities such as for document controlling. This conclusion is arrived at, achieving one of the objectives of the project, which is to find out the project management software packages used or available in Sri Lankan Construction industry and to identify project management tools available in these packages.

5.5 Application of dedicated project management packages in general

1. The extent of the usage of these project management packages in the Sri Lankan Construction Industry, as revealed during the research is that all of them use MS Projects and, 44% foreign contractors use Primavera Project Planer. However, it has been revealed that even though 20 % of the M1 contractors have purchased the

Primavera Package, none of them uses it for project management activities. They have continued to use MS Project while having a very sophisticated package like P3.

2. The results of the research show that 22% of foreign contractors and 8% and 6% of the local contractors of M2 and M3 use the Sure Track (Primavera) package. As far as the application of Time Line and Harvard Total Project Manager is concerned, it has been revealed that only one contractor had used it previously. The situation with regard to packages like Expedition is that most of the local contractors are not even aware of this package. The need of making the people aware of the facilities available in and the benefits which could be obtained from this package is underlined as one of the area to be focussed on, since most of the firms now are geared to adopt a lot of sophisticated method in this competitive era.

3. The results regarding M2 and M3 contractors show that only 92% and 67% of them respectively use MS Project and 76% of the interviewed M4 contractors use it for project management activities. None of them uses any of the other project management packages. 93% of the consultants and 33% of the project management firms interviewed claimed that they use MS Project, while 33% of the project management firms (only one project management firm) claimed that they use P3 for project management activities. The fact that there is an increase in the usage of these packages when compared with the findings of the survey done by Jeyaweerasinham (1996) is noteworthy. According to his findings, only a few contractors in addition to the foreign contractors were using project management packages for project management activities.

5.6 Application in Planning

1. Findings of the research indicate that all foreign contractors, 100%, 92%, 61 % and only 71% of local contractors of M1, M2, M3 and M4 use these packages for planning at least in preparation of Bar/Gantt Charts. Further, it was revealed that 79% of the consultants use it for at least preparation of Bar/Gantt Charts

2. Usage of these packages in Critical Path Analysis, Network analysis and Resource Planning is very poor, even amongst the top-level local contractors of M1, M2 and M3. The results indicated in this regard are; 85% of the foreign contractors; 80%, 92%; 22% and 24% of the M1, M2, M3 and M4 contractors use them for Critical Path Analysis. 67% of the foreign contractors, 90%, 31%, 6% of the M1, M2 and M3 contractors use them for Net Work Analysis, while none of the M4 contractors interviewed uses them for Net work Analysis. The usage of the packages by the consultants for planning in respect of Critical Path Analysis, Network Analysis, and Resource Planning, has been revealed as 29%, 7% and 36% respectively. All the project management firms interviewed use these packages for planning in comprehensive manner in their level for each project.

3. Only 33% of the foreign contractors, 50%, 8% and 6% of the local contractors of M1, M2 and M3 use them for resource planning while none of the contractors of M4 uses

these packages for this purpose. Foreign firms were of the opinion that the need for resource planning was not essential, unless for very special circumstances as most of the works they undertake in Sri Lanka are of management type contracts. Most of the local contractors accepted that lack of detailed planning in the beginning of the project is one of the main reasons for them to neglect resource planning. Lack of trained technical staff in this area was also sighted by most of them as a contributory factor for the poor implementation of resource planning

4. The other important fact to be noted is that while all the foreign contractors attributed that they use these packages for planning activities as a standard company format for each and every project, only 50%, 54% and 28% of local contractors of M1, M2 and M3 respectively have favoured in this regard. The results also show that 40%, 38%, 33% and 24% of local contractors of M1, M2, M3 and M4 have claimed that they use them for planning activities only for selected projects depending upon the nature and magnitude of projects. Further, only 10%, 8%, 39% and 47% of local contractors of M1, M2, M3 and M4 expressed that they use these packages for planning purposes only if requested by the client, consultants or the project managers. The usage of these packages for planning by the consultants and the project management firms for each and every project as a standard company format has been found to be of 79% and 100% respectively.

5. The fact that there is an increase in using project management software packages when compared with the findings of the survey done by Jeyaweerasinham (1996) for his masters under the supervision of Gunesekara is noteworthy. Most of the firms are now ready to do improvements in this area. According to his finding, only foreign contractors and a couple of local contractor were using these packages in planning.

5.7 Application in scheduling

1. The finding of the research shows that all foreign contractors, 100% and 85% of local contractors of M1 and M2 use these packages for scheduling at least in preparation of schedules regarding Bar/Gantt Charts. Usage of these packages for preparation of schedules in respect of Critical Path Analysis, Network analysis and Resource Planning is very poor, even amongst the top-level local contractors of M1, M2 and M3. The results indicate that 85% of the foreign contractors, 80% and 38% of local contractors of M1 and M2 contractors use them for scheduling in respect of Critical Path Analysis. Only 67% of the foreign contractors, 80% and 31% of local contractors under M1 and M2 category use these packages for scheduling in respect of Network Analysis.

2. The results of the research show that only 33% of the foreign contractors, 50% and 8% of the local contractors of M1 and M2 use these packages for scheduling of resource planning. None of the contractors of M3 and M4 use these packages for scheduling activities in respect of Resource Planning and Network Analysis. The results indicate that 64% of the consultants and 100% project management firms interviewed use these packages for preparation schedules regarding Bar/Gantt Charts.

Usage by consultant and project management firms for scheduling for other areas such as Critical Path Analysis, Network Analysis and the resources planning, has been found to be not satisfactory as the result indicates usage of 29%, 7% and 14% respectively. The situation with regard to project management firms is that all of them who were interviewed use these packages for scheduling in comprehensive manner in their level for each project.

3. The other important fact to be noted is that while all the foreign contractors attributed that they use these packages for scheduling activities as a standard company format for each and every project, only 50%, 54% and 28% of local contractors of M1, M2 and M3 respectively have favoured in this regard. The results show that, 40%, 38% and 6% of local contractors of M1, M2 and M4 have claimed that they use them for scheduling activities only for selected projects depending upon the nature and magnitude of projects. Only 10% and 8% of local contractors of M1 and M2 expressed that they use these packages for scheduling activities only if requested by the clients, consultants or the project managers. As far as the extent of the usage of these packages by the consultants and the project management firms, for scheduling activities is concerned, 64% of the consultants claimed that they use them for each and every project as a standard company format while all the management firms interviewed claimed that they use them for each and every project as a standard company format.

5.8 Application in monitoring and controlling

1. Achieving one of the objectives, the results of the research, as far as the extent of the application of these project management packages in monitoring and controlling is concerned, in conclusion shows that 100% of all foreign contractors, 70% and 54% of local contractors of M1 and M2 use these packages for monitoring and controlling in Critical Path Analysis. Usage of these packages for monitoring and controlling in Bar Chart/Gantt Chart Analysis has been revealed as 100%, 90%, 85%, 61% and 35% of foreign contractors and local contractors of M1, M2, M3 and M4 respectively.

2. Only 33 % of the foreign contractors and 20% and 8% of local contractors of M1 and M2 use these packages for monitoring and controlling activities of resource planning. Local contractors under M3 and M4 category showed no firm interest in this area, except 61% and 35 % trend shown for controlling and monitoring activities in respect of Bar Chart/Gantt Chart Analyses. The research also revealed that 43% and 100% of consultants and project management firms respectively use these packages for monitoring and controlling in Critical Path Analysis. And in respect of Bar Chart/Gantt Chart Analysis, it indicated a result of 57% and 100%. The usage of these packages by project management firms for monitoring and controlling activities is satisfactory as all of them who were interviewed had used these packages for scheduling in comprehensive manner in their level for each project.

3. All the foreign contractors attributed that they use these packages for monitoring and controlling activities as a standard company format for each and every project, whereas only 50% and 11% of local contractors of M1 and M3 respectively have favoured in this regard. The result indicates that 30%, 62%, 6% and 12% of local contractors of M1, M2, M3 and M4 have claimed that they use them for monitoring and controlling activities only for selected projects depending upon the nature and magnitude of projects. Only 20%, 31%, 28% and 29% of local contractors of M1, M2, M3 and M4 categories of local contractors expressed that they use these packages for monitoring and controlling activities only if requested by the clients, consultants or the project managers. The extent of the usage of these packages by the consultants and the project management firms, for monitoring and controlling have been found to be of 14% and 100% respectively for each and every project as a standard company format and 79% for selected projects only depending upon the nature of the projects, by the consulting firms. All project management firms interviewed claimed that they use them for each and every project as a standard company format. However, the fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to the attention of training institutes and universities in order to cater for the future demand.

5.9 Application in cost controlling

1. The findings of the research on the application of dedicated project management software packages in cost controlling in conclusion indicate that only foreign contractors use the cost controlling tools in the packages. It has been found that 44% of them use these packages for cost controlling activities by using Earn Value Technique and Graphs respectively and the extent of the usage for each and every project as a company format has been found to be of 44%. None of the local contractors and consultant claimed that they use these packages for cost controlling activities.

2. The reason for not using these packages for cost controlling activities, by most of the local contractors, as revealed during the research is that only the P3 package is equipped with cost controlling tools and hence those who are using MS Projects only have no choice in this regard. However, as far as the local contractors of M1 category who are having P3 is concerned, the lack of trained technical people to implement these packages for project management could be attributed as the main reason for not using the packages for these activities. The result indicates that only one project management firm having the P3 uses it for cost controlling activities to a limited extent in the project management activities. The fact that most of the firms are now ready to introduce rapid improvements in this area is noteworthy. This has to be brought to attention of training institutes and universities in order to cater for the future demand.

5.10 Application in document controlling

1 According to the finding of the research the following conclusion can be arrived at as far as the application of management packages in document controlling is concerned. The results of the research indicate that most of the local contractors are not even aware of the availability of project management packages specially designed for document control, such as Expedition (Primavera). Further, those who are aware of these packages attributed that lack of trained technical people in this regard really prevents them from even investing money on these packages. As far as the usage of document controlling is concerned there is no improvement, when compared with the findings of the survey done by Jeyaweerasinham (1996). According to his finding, none of the contractors including foreign contractors were using these packages in document controlling activities.

5.11 Difficulties faced

1. Achieving one of the objectives of the research to find the difficulties faced by the industry in application of project management computer packages in Sri Lankan Construction Industry, the research was concluded focussing on this area. The summarised result of the opinions expressed by the firms interviewed with regard to the difficulties faced is that an overall preference of 46% has been received for none availability of the trained staff, 31.5% has been given for in favour of lack of interest amongst the professionals, and only 13.14% as the lack of interest amongst the top management. However, only 8.71% has been received for high cost factor as the difficulties faced are concerned.

2. The results show that the consultants and the project management firms have identified that none availability of trained staff as the major difficulties faced giving weights as 55.1 and 61 respectively. The result with regard to the contracting firms is that preferences of 19.8, 53, 49.4, 54.3 and 45.8 in weights have been given by foreign contractors, M1, M2, M3 and M4 of local contractors for none availability of trained staff as the main difficulty faced. Lack of interest among the professional has been ranked second giving 31, 37, 52.2 and 37.4 weights as a difficulty faced by local firms under M1, M2, M3 and M4 respectively. Lack of interest among the top management has been given 27.9, 11.8 and 24.6 weights as a difficulty faced by local firms under M2, M3 and M4 respectively. No foreign contractor or M1 contractor has identified the lack of interest among the top management as a difficulty faced. Consulting firms have identified none availability of trained staff, lack of interest among the professional and lack of interest among the top management as the difficulties giving 55.1, 36.9 and 30.5 preference in weight. No project management firm have given preference to high cost and the lack of interest among the top management as a difficulty and, none availability of trained staff and lack of interest among the professional have been given preference of 60 and 33.5 in weights as a difficulty.

3. High cost has been identified with preference of 30, 9.9, 3.6 and 19.5 as a difficulty by local contracting firms of M1, M2 and M4 and consultancy firms. However, the reason for sighting the high cost as a difficulty was found to be the high cost of the P3 and the cost of training of the staff in this regard. The fact that the real benefits which could be obtained by using sophisticated packages like P3 specially in respect of cost controlling, monitoring and controlling aspects and the resultant productivity improvements in this regard was not known to them as they were not aware of the details of these packages.

4. The bottom line is that most of the firms interviewed were in the opinion that they were still faced with some difficulties in using these packages for project management activities. The reason for not using these packages for cost controlling activities, by most of the local contractors, as revealed during the research is that only the P3 package is equipped with cost controlling tools and hence those who are using MS Projects have no choice in this regard.

5.12 Benefits realised

1. Achieving another objective of the research regarding the benefits realised by the industry in using project management computer packages in the project management activities, the research was focussed on this area and the findings of the research were formulated and summarised accordingly. The summarised result of the opinion expressed by the firms interviewed in regard to the benefits realised is that an overall preference of 32.73%, 29.61% and 19.97% has been received for better controlling of activities, preparation of quality reports and increased company reputation. However, 11.05% and 6.65% has been received in favour of less repetitive works and turn over increase.

2. The primary benefit realised by the firms by using project management computer packages, as revealed in the research, is the ability of better controlling of activities. Preparations of quality reports have also been ranked as a primary benefit and the increasing of company reputation also have been identified by most of the firms as a benefit. Generally, most of the firms do not believe that using project management computer packages, for project management activities, will increase the turn over of the organization. The bottom line is that most of the firms interviewed were in the opinion that they still yield some benefits.

5.13 User satisfaction

1. Achieving another objective of finding the level of user satisfaction in using project management computer packages in the project management activities, the research was concluded focussing on this area. The findings of the research were formulated and summarised accordingly. The summarised result of the opinion expressed by the firms interviewed in this regard shows that 100% of foreign contractors and M1 contractors have expressed that they are satisfied with the available software packages. The result indicates that 90%, 67% and 53% of local contractors under M2,

M3 and M4 have expressed their satisfaction. Satisfactions of the consulting firms and project management firms have been expressed as 79% and 100%.

2. Contributing factors for satisfaction have been discovered with overall preference of 47.97% and 52.03% for the reasons of straight forward application and easy and quick execution of management and administration activities. Straight forward application has been given the preference by foreign contractors, M1, M2, M3 and M4 of local contractors, consulting firms and project management firms with weights of 50, 43, 44.8, 31.6, 27.1, 36.9 and 50 respectively. Preferences of 46, 45,48.7, 35.5, 31.2, 41 and 60 in weights have been given by foreign contractors, M1, M2, M3 and M4 of local contractors, consulting firms and project management firms respectively in favour of easy and quick execution of management and administration activities.

3. Contributing factors for dissatisfaction have been discovered with overall preference of 19.6, 6, 6.6 and 7 in weights for lack of experienced professionals to use these software packages by foreign contractors, M1, M2, M3 and M4 of local contractors respectively.

5.14 Future development

1. Achieving an objective of the research to find out the future development plans of the firms interviewed, the research was concluded focussing on this matter and the findings were summarised and compiled accordingly. The result shows a satisfactory trend as 100% of the firms subjected to the survey stated that they have got future plans to develop the use of project management software applications. It further reveals that an overall preference of 43% was given for providing training to the technical staff, 38.88% was received for in favour of recruiting trained staff and only 11.6% was received for streamlining the organisational procedures by the firms surveyed as the steps to be taken in future in order to improve the application of these packages in project management activities.

2. Recruiting trained staff has been given the preference as a step of future developments by foreign contractors, M1, M2, M3 and M4 of local contractors, consulting firms and project management firms with weights of 25.3, 19, 46.6, 59.4, 41.7 and 53.3 respectively. Preferences of 23.1, 52, 49.8, 48.1, 49.9, 56.4 and 56,7 in weights have been given by foreign contractors, M1, M2, M3 and M4 of local contractors, consulting firms and project management firms respectively in favour of providing training facilities as a step of development. 35, 29.1 and 26.8 of preference in weight have been given by M1 contractors, consulting firms and project management firms respectively in favour of streamlining the organisational procedures as a step of developing the application of project management software packages.

2. Further, the research also revealed that the numbers of institutes, which provide training facilities in this area are less, hindering the development of the software package applications as most of contractors stated that even though they are willing to

give training to their employees, it has become a difficulty due to non availability of enough training programmes in this regard. However, the bottom line is that most of the firms interviewed expressed that they really have some plan to improve application of project management software packages.

5.15 Recommendation

The following recommendations could be made on the findings gathered in the survey

1 The lack of top management commitments toward implementing application of project management software packages in project management has been identified in the research as a problem faced by the professionals in the industry. The lack of commitments and interests has impeded purchasing of sophisticated software packages like P3, Sure Track and Expedition and as well as spending money on training programmes in this connection. The reasons attributed for lack of interest, as per the opinion of some top officials in contracting firms interviewed, are: the lack of awareness of the sophisticated tools available in these so called project management software packages; lack of awareness of the benefits which could be realised by using these packages; lack of trained people for implementing the application of these software packages and lack of training programme in this regard. Therefore, in order to make the top management of contracting firms and consultants aware of the importance of using project management software packages and benefits which could be obtained, some awareness programmes should be conducted. The need of making them aware of the sophisticated methods and the benefits of using these software packages and communication of same down to the staff is of paramount importance. Hence, it is recommended that institutes like ICTAD, Institute of Project Management of Sri Lanka and Institute of Engineers of Sri Lanka to take the lead role in undertaking awareness programmes in this nature.

2. It has been identified in the reach that the lack of interests among professionals as a problem faced in the industry hindering implementation of software packages even though some firms are in the possession of sophisticated packages like P3 and Sure Track. The reasons attributed for lack of interest, as per the opinion of some of the top officials in contracting firms interviewed, are: the lack of awareness of the sophisticated tools available in these so called project management software packages, lack of awareness of the benefits which could be realised by using them; and lack of enough training programmes. Therefore, in order to make the technical staff of contracting firms and consulting firms aware of the importance of using project management software packages and benefits which could be obtained, some awareness programmes should be conducted. The need of making them aware of the sophisticated methods and the benefits of using these software packages is of paramount importance. Therefore, it is recommended that institutes like ICTAD, Institute of Project Management of Sri Lanka and Institute of Engineers of Sri Lanka should take the lead role in initiating training programmes regarding application of project management software packages. Also, it is recommended that top management of contracting firms and consulting firms should initiate to conduct

training programmes for their employees. Service of outside parties could be sought for these training programmes.

3 As a step of persuading the staff to implement application of the project management packages, it is recommended that a senior professional of each organisation be appointed as the management representative and the responsibilities of giving initiatives for training of the other professional have to be given to him. His responsibilities could be to act as a leader and set example for the other staff in using project management packages and pull them along the way toward fully computerised project management system.

4. In order to give a first hand awareness programme for the Engineers, Quantity Surveyors, and other professional including the technical staff in the Construction Industry, it is highly recommended that application of project management software packages should be included as a subject in university courses and in the courses conducted by technical collages.

5. It is recommended that, when recruiting staff, contracting firms, consulting firms and project management firms should give priority to those who have got the exposure in application of project management software packages and make an impression amongst the young engineers and other professional that the knowledge of project management software packages is important in career opportunities.

5.16 Further studies

As it has been found in the research, it is desirable to carry out further researches on following areas for the improvement of computer application in the construction industry.

1. It is advisable that a study is to be done in order to ascertain the effectiveness of using computer packages with a detailed analysis of productivity improvements in using project management packages in the project management activities. Case studies on application of project management software package by contracting firms could be carried out in order to explore the effectiveness and the productivity improvements in using these packages.

2. It is worth to give attention for further research in the involvement of personnel in the contracting firms and their attitude towards computer application in management of construction projects

3. A study is recommended to be carried out amongst the consultants and project management firms on their attitudes in using project management packages in the project management activities

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Appendix: A

National registration and grading of construction contractors

The National Registration and Grading of Construction Contractors are in implementation from January 01, 1989.

The Registration of Construction Contractors is considered under ten Categories on Financial Terms.

Grade	Limit (Rs. Million)				
M1			X	>	300
M2	300	>	X	>	150
M3	150	>	X	>	50
M4	50	>	X	>	20
M5	20	>	X	>	10
M6	10	>	X	>	5
M7	5	>	X	>	2
M8	2	>	X	>	1
M9	1	>	X	>	
M10	0.5	>	X	>	

The Contractors have been registered under the following fields of specialties.

1. Building Construction
2. Highway Construction
3. Bridge Construction
4. Water Supply & Drainage Construction
5. Irrigation & Land Drainage Construction
6. Dredging & Reclamation Construction
7. Other Heavy Construction (Specify)

Appendix: B

A List of Some Project Management Software Packages available in the world is given below.

System Name	Programme Description	Key Name
POWER PROJECT	Project planning with linked bar chart	ASTA
CA-SUPER PROJECT	Project planning and resource management	CA
PLOT VIEW	Tool to view network	CAMEL
GANTT	Gantt chart producer for S/W house	CAMEL
PANAROMA	Project planning with integrated Dbase	CHELTONIAN
HORNET 50001	Project planning & reporting	CLAREMONT
HORNET XK	Planning and control system	CLAREMONT
BARONET	Planning and control system	COMPLINE
PLANTRACK11	Planning and control system	COMPLINE
MARSBAR	CPM, linked to estimating	CONSTCOM
INTANET	Project planning package	CRCD
ACTION	Activity analysis system	CSSP
PORTLAND	Project management with integrated Dbase	CZPROF
INSTAPLAN	Outline base planning system	DEEPAK
PROVIMA	Planning and control system	DESIGN
FINEST HOUR	Planning and control system	FORGET TRACK
PRIMAVERA	Planning and control system	GORGET TRACK
SURE-TRACK	Document control system	=
EXPEDITION	Project management tool	=
MACPROJECT11	Small planning & control package	FRONTLINE
KEYPLAN	Project planning package	GOMARK
KERNAL	Planning and resource control	HARVEY
PMW	Project planning and control	HOSKYNS
FOCMAN	Network analysis, resource planning	INFORMBUILD
KORKUS DC	Network analysis, resource planning	K & HCS
KORKUS VAX	Planning & control system	K & HCS
CRESTA	Cost processing & time recording	K & HCS
COMCRAFT	Resource & cost processing system	KENTCOMP
MPMS	Cost/schedule control system	MAN SYSTEM
CASCADE	Planning and control with DBase	MANTIX
ARTEMIS RANGE	Planning and control system	METIER
MICROPLANNER	Planning and control system	MICRO PLAN
MICROPLANNER	General multisoft planning package	MICRO PLAN
X-PERT	Graphics report writer	
MS PROJECT	CPM to manage project information	MICROSOFT
GRANEDA	Small network analysis system	NETTRONIC
THE MONITOR	Network drawing/graphic information	ORGIN
PROJECT HELPER	Time, resource and cost control	PARKWAY
QEI	Resource and cost processing	PCF
	Project Planning and control package	

PERTMASTER ADV	Cost processing package	PERTMASTER
MICROPRISM	Network analysis and resource processing	PERTMEX
DNA	Network, resource and cost	PLANPTNRS
TIME MANAGER	Precedence network analysis	PROF APPLIC
TURBO CHART	Project planning and control system	PROTMAN
OWIKNET PROF	Network analysis programme	PSDI
QEDZ	Resource and cost processing	QUANTEC
PPOJECT MASTER	Small project planning system	RBA
TUXEDO	Project management presentation graphics	SECONDS
PROMIS 4	Planning output from network analysis	SIMCON
HARVARD DROT	Pre-production activities in planning	S/WARE PUB
MAN	Network analysis programme	
TIME LINE	Planning and control system	SYMANTEC
TRACKSTAR	Project control system	T & B
PREPROD	Planning and control system	TAYWOOD
PROJECT OUTLOOK	Project planning with integrated DBase	TEKWARE
PROT SCHED 4	Project planning with integrated DBase	TEKWARE
READNET	Project planning with integrated Dbase	TKT
KERNEL PMS	Planning and scheduling system	TRANSACT
OPEN PLAN	Planning and control system	WELCOM
OPEN PLAN MAC	Planning and control system	WELCOM
PRESTIGE		ZENTECH
PROJECT SCHEDULE		=
MICRO PLANNING		=
PROFESIONAL QUICKNET		=

Appendix: C

Questionnaire

SURVEY ON COMPUTER APPLICATION IN PROJECT MANAGEMENT

General Questionnaire for Contractors, Project Managers and Consultants

NOTE:

1. Please add remarks where useful to expand answers
2. Please attach separate sheets where necessary
3. The Questions have to be answered in the following ways

   (a) Yes / No Answers
   (b) Ticking on alternatives
   (c) Word Answers
   (d) Indicating Answers on a X point scale

4. Information obtained on this questionnaire will be used collectively with other responses

1. GENERAL ORGANIZATION INFORMATION

Name and Address : _____

_____

_____

_____

Type of Organization

Contractor ☐

Consultants ☐

Project Managers Appointed by the Client ☐

If a Contractor Organization, State the Grade of the Contractor M1, M2, M3 and M4 ☐

If a Foreign Contractor, Give Details ☐

Type of Organization

☐ Sole Proprietorship

☐ Partnership

☐ Public Limited Liability Co.

☐ Private Limited Liability Co.

Nature of respective works undertaken

☐ **Building constructions**

☐ **Civil engineering works such as road, bridges, water supply and irrigation works etc.,**

Name of Contacted person: _____

Designation: _____

Telephone Number: _____

2. COMPUTER USAGE IN GENERAL

2:1 How long you have been using computers Years ☐

2:2 Reasons for using Computer (If you can attribute more than one of the following, put them in priority order)

☐ Standardizing company formats

☐ Uniform administration, integration and discipline approach to repetitive tasks

☐ Desire to keep up to date with development

☐ Forced into computerization by competing forms and in project teams

☐ To reduce cost

☐ _____

2:3 Do you have a site based computer system.

☐ Yes

☐ No

2:4 If so Why

3. USAGE OF DEDICATED PROJECT MANAGEMENT SOFTWARE PACKAGES

MS Project	☐
Primavera Project Planner (P3)	☐
Sure Track (Primavera)	☐
Expedition (Primavera)	☐
Time Line	☐
Harvard Total Project Manager	☐
State if any Others	

3:1 Application of these packages in planning

Network analysis ☐

Critical path analysis ☐

Bar Charts/ Gantt Charts ☐

Resource Planning ☐

3:1:1 Extent of Usage

For Every Project as a standard company format ☐

For selected projects only depending upon their Nature as a Standard company policy ☐

If so, the limitations ☐

For selected projects only, if required by the client, Project manager and consultants ☐

3:2 Applications of these packages in scheduling

Network analysis schedule ☐

Critical path schedules ☐

Bar Charts/ Gantt Charts Schedules ☐

Resource schedules and histograms ☐

3:3 Applications of these packages in monitoring and controlling

Using Critical paths analysis ☐

Using Bar Charts/ Gantt Charts ☐

Using Resource Planning ☐

3:3:1 Extent of usage

For Every Project as a standard company format ☐

For selected projects only depending upon their Nature as a Standard company policy ☐

If so, the limitations

For selected projects only, if required by the client, Project manager and consultants ☐

If not at all, give reasons

3:4 Applications of these packages in cost controlling

Using Earn Value Techniques ☐

Using Graphs ☐

3:4:1 Extent of usage

For every project as a standard company format ☐

For selected projects only depending upon their nature as a standard company policy ☐

If so, the limitations

For selected projects only, if required by the client, project manager and consultants ☐

If not at all, give reasons

3:5 Applications of these packages in document control (Only if Primavera Expedition is used)

The extent of usage

4. LEVEL OF USER SATISFACTION

4:1 Are you satisfied with your project management software packages

☐ Yes ☐ No

4:2 If satisfied, contributing factors for satisfaction (If you can attribute more than one of the following, put them in priority order)

☐ Straightforward application

☐ Easy and quick execution of management and administration activities

4:3 If not satisfied, contributing factors for satisfaction (If you can attribute more than one of the following, put them in priority order)

☐ Comparably low return from software application

☐ Available software does not fulfill the needs

☐ Lack of experienced professionals to use the softwares

4:4 Does lack of computer application curtain the performance of projects

☐

5. FUTURE DEVELOPMENT

5:1 Is there any plan in expanding project management software application within your organization

☐ Yes ☐ No

5:2 If yes, how this can be achieved (If you can attribute more than one of the following, put them in priority order)

☐ Recruiting trained people

☐ Providing training facilities to the professional who are involved in administration activities.

☐ Streamlining the organizational procedures in order to make sure software application in project management activities is a must in every project.

State others, if any

6. DIFFICULTIES FACED

6:1 What are the difficulties faced when applying project management softwares. (If you can attribute more than one of the following, put them in priority order)

☐ High cost

☐ Non-availability of trained people

☐ Lack of interest among the top management

☐ Lack of interest among the professionals who are involved in project management activities

7. BENEFITS REALISED

7:1 What are the benefits gained by using project management softwares (If you can attribute more than one of the following, put them in priority order)

☐ Better control of activities and easy management and administration activities

☐ Increase company reputation

☐ Preparation of quality reports

☐ Turn over increase

State others, if any