A Study on Optimization and Allocation of Requirements during the Software Development Life Cycle in Digital Align Private Limited

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ABSTRACT

Purpose: *In order to face the challenge of optimization and allocation of necessary requirements to complete a project with in the allocated time period, the project manager must be efficient in applying different technical skills and managerial strategies to the project management process. In order to develop a software and RPA product, a company schedules different process as per the specified order and uniquerequirements. As the history of project management reminds that most of the industries startedto implement this concept by observing the success of mega engineering projects because of the effective utilization of project management concept.*

Objective: *This work is carried to understand the concepts of project management in software firms. To investigate the implementation and importance of these concepts and to know the role of project manager in managing the process in software development.*

Methodology: *Digital Align Private Limited, Mangalore, provides excellent and state-of-the-art customized software and hardware solutions as per the necessities of customers. In order to manage the project activities CEO, CFO and CTO all together acts as project manager. The software development project management process starts by identifying needs and recommending solutions, which can be delivered to value its stakeholders. At the second phase the actual development will begin and the developed software will be tested according to customer requirements.*

Findings/Results: *Budgeting, cost management, finance planning etc., represented by CPM and PERT charts by using Microsoft Project and Atlassian JIRA project management software. The project resources, which are used to manage the project and allocation of technical staff are represented by histogram. With the help of Gantt Chart software development project schedule of 5 month are shown.*

Conclusion: *To manage Digital Align business in an effective and gainful manner, the company managed overall internal and external risks of the project. By using the project managementsoftware, the company condensed the project manager's efforts and human errors to managemultiple projects.*

Paper Type: *Case study-based Research Analysis*

Keywords: Project Management, Software Development Life Cycle, Process, Software Company, Requirement Specification.

1. INTRODUCTION :

Software Industry or Information Technology Industry deals with software and hardware development [1]. Maintaining business includes trading, manufacturing, servicing activities. The software industry started since 1953 and first software provider is computer Usage Company in 1955, IBM and UNIVAC are the commercial computer dears in 1960s. In 1959 computer sciences corporation was founded and helped to develop advanced computer technology and automatic processing technology. Now the world-wide size of software industry estimated as USD$ 429.9 billion [2]. The Project Management is the management activities of initiating, planning, organizing, controlling and closing the assigned project work by satisfying the requirements and manage cost benefit of the project within assigned time period [3]. The word Project is any activity undertaken which involves research design and proper planning with set of interrelated activities to be executed by an individual or by a team to achieve particular purpose over a fixed cost and time frame, the activities of Project Management is managed by the Project Manager. The Project Manager is a key person who manages the project and overall responsibilities of the success of project by effectively managing the project management activities. It includes project initiation to project closure, technical and non-technical skills to manage a project. The duties of project manager are decision making, developing schedules, project cost management, risk management, project team management, documentation and reporting, contacting with vendors, quality control, etc. [4].

Project Cost Management is the activity which does cost-benefit analysis of the project [5]. It is the method to manage the overall cost of project which helps to generate profit, this activity deals with cost budgeting using historical data and complete the project within budgeted cost, which will include project development cost, labor cost, material costs and to manage risk of the project like inflation, natural disasters, unexpected costs. Project management process is which the general development stages of a project [6].

2. OBJECTIVES OF THE STUDY :

(1)To study and understand the project management concept in software development companies.
(2)To analyze the implementation and importance of project management concept in software development companies.
(3)To analyze the role and importance project manager in order to manage the software development process.
(4)To evaluate the impacts and challenges involved in project management to software development companies.

3. METHODOLOGY:

The study is based on data collected from primary sources and secondary sources as shown below:

- The primary sources of data are collected by direct interviewing the CEO and Managing Director, departmental heads, and employees of Digital Align Private Limited.
- The secondary sources of data are collected by referring few textbooks related to project management concepts, articles, websites, and literature reviews related to project management and software project management concepts, referring to finance and cost data of Digital Align Private Limited.

4. LITERATURE REVIEW:

Project Management regarded as a high priority as all organizations involved in implementing new undertakings, innovation and challenges. Project may be individually diverse, however over a time, some tools, management techniques and problem-solving techniques results in bringing project to a successful end (Gonovski, V. 2017) [7]. Software project management is a key idea about the planning, monitoring and control of software projects. Projects to produce software are worthwhile only if the satisfy real needs and examine how it can identify stakeholders in a project and their objectives (Cotterell, M., and Hughes, B. 1995) [8]. Project management is the combination of project scope management, project cost management, project time management, project quality management, project human resource management, project risk management, project communication management (Aanbari, F. T., and Kwak, Y. H. 2018) [9]. Project management deals with the pre-determined cost,

quality and pre-determined schedule of a project, and is managed by systematic way and the final result should be accepted by others is called success of a project (Almaamari, G., Williams, N., and Atkinson, R. 2017) [10].

There are differences in practicing project management concept with each industry, the maturity of repeated work project is low and the project involving research expansion activity is very high (Korte, R., Smith, K. A., and Li, C. Q. 2018) [11]. Project manager should aware of the project risk involved to complete the project successfully, to manage that he can predict and control the risks by taking reference from similar projects which will save the investment and time (Sanz-Llopis, J., and Ostermann, M. 2020) [12].

Project management office which headed by project manager is team which manages whole activities of project management and they are responsible for project failure, project success and that is the result ofcoordination between them and execution team (Petersen, K. W. 2020) [13]. Project risk management is the process of identification of risk factor, assessing the risk effects, developing strategic solutions, implementing solutions, control the risk factors, managing the crisis, recover from the crisis related to project management (Arashpour, M., Abbasi, B., Arashpour, M., Hosseini, M. R., and Yang, R. 2017) [14]. The Project will successful when there is coordination in the management team and executing team, the team coordination and communication should be there with each member to build a project towards the objective (Korte, R., Smith, K. A., and Li, C. Q. 2018) [15].

5. INDUSTRY OVERVIEW :

Digital Align Private Limited

Digital Align Private Limited is located in Mangalore, the company known for providingexcellent and innovative customized software and hardware solutions as per the requirements of customers. The company deals with trading, manufacturing and services which they incorporated to provide e-commerce, technical and project training, website and Digital Assistant for customers using AlignXcel, software and hardware solutions, electronic and electrical product manufacturing.

The company was founded in the year 2015, by Rajesh Patil.

2021: Rajesh Patil Belgaum made the firm Digital Align as Digital Align India Pvt Ltd, a project development center and to provide technical training. The objective was to build a FinTech product and providing software development and automation services to banks in US.

2021: Digital Align registered and incorporated as a company, Digital Align Private Limited under government of India ministry of corporate affairs,.

2022: The company started evolving as a product based company initiative of AlignXcel. By the end of 2022 introduce digital assistants and software products such as GenieOCR, App and DASmartlog API.

Vision: Engineering Ideas

Mission: An Innovative Technology Company That Creates FinTech Products for local banks and credit union companies.

5.1 Organization Structure:

Digital Align Private Limited Company follows functional organizational structure with constructive management policy with democratic leadership style, where the organizational structure follows all tasks should be allocated by and reported to Managing Director, where management policy follows that the top management will consult each teams before taking any major decisions regarding the company, whereas leadership style allows all team members and employees to participate in decisionmaking and exchange their ideas. So, the organizational structure helps them to lead towards success by taking careful decisions, proper work allocation based on employee specialized area of operation and proper supervision for quality management.

- **Chairman, Director:** Rajesh Patil Belgaum is present Chairman and Director of Digital Align Software Private Limited, the company has two Directors, he is top management of thecompany who takes part in major decisions in Annual General Meetings.
- **Director**: Mahantesh Patil is present Director of Digital Align Private Limited and he isthe top management of the company who takes part in major decisions of the company.
- **Vice President, Sales & Business Development**: Kevin Murphy is Vice President who manages

Sales and Business Development.

- **Managing Director:** Athul Kakathkar is presentManaging Director of Digital Align Private Limited and he is the top management and manages middle level management, his activity consist decision making, coordination, strategic management, marketing and human resource management of the company.
- **Chief Finance Officer (CFO): Lakshmi Parameshwaran,** Chief Finance Officer manages the finance, accounting and banking related issues and helps to maintain proper books of accounts and guides to manage thefund and cost of the company.
- **Web Developing Engineer:** Web developers who develop the websites and web applications.
- **RPA and Software application Developing Engineer:** Software and App developers develops the personal computer and mobile applications.

5.2 Information about day-to-day organization activity:

(1) Engineers who are in to Web, software and mobile application designers are works under the supervision of chief technological officer of the company.
(2) The work allocation, salary payment and increments for employees being done on the basis of performance analysis report prepared by chief technological officer.
(3) Employees also provides technical training and project development training for students and learning individuals and engaged with research and development activities.

5.3 Products and Services:

(A) Products:

- **Digital Assistants**: Fintech Assistants which helps staffs of various credit unions, local banks manual, mundane, boring, tedious work.
- **DASmartLogs**: Using Elastic search technology, to store daily status log files and to retrieve logs using DASmartLogs API. This API also helps in providing business insights, ROI for the company.
- **Genie OCR**: Intelligent OCR Application which involves Human in the loop where Data extracted from huge Pdf is displayed using Genie OCR App to verify and review the extracted information.
- **Apprasial App:** An Web Application which helps to manage Appraiser Process and supports Loan Officer to review the Appraisal Process.
- **AlignXcel Marketplace, Process Portal:** This is a marketplace where users can buy new digital assistant products, request for new products and view bot performance all in single app.
- **Web-app for On-demand Process:** An web application to trigger On Demand Process by providing some inputs required to run the process for the clients.

(B) Services:

- **Software development:** Software designing consist of development, designing, maintaining, redesigning of personal computer applications like Appraisal App and digital solutions and software as per the requirements of customers.
- **Web development and hosting:** Web development consist of website development, web application development which the company designs, develops, maintains and redesigns as per the requirements of their customer.

6. SWOC ANALYSIS :

SWOC (Strength, Weakness, Opportunities, and Challenges) analysis is used frequently to analyze organizational internal capabilities [16-19]. Here, the strength and weakness are analysed as internal attributes and Opportunities and challenges are analysed as external attributes:

6.1 Internal Attributes:

Strength:

- Strong impact of AlignXcel as brand name, DASmartLogs, GenieOCR Process Portal are some of trusted brands in the market.
- Innovativeness Digital Assistants like P1FCU Mortgage, Skyone , OCR Web, Web App
- Highly skilled and trained employees.
- Low cost manufacturing techniques of the company.

- Top clients like Toyota Financial Savings Bank, P1FCU Credit Union, SkyOne Credit Union, Gesa Credit Union Companies.

Weakness:

- Company has small market share
- Less number of workers, so that they cannot take more projects at a time
- Less financial support

6.2 External Attributes:

Opportunities:

- Market share growth opportunities
- Digital India support from government
- Increasing market demand for digitalization
- Growing market for artificial intelligence and robotics
- Increasing demand for online facilities and mobile application facilities
- Increasing demand for innovative products and services
- Research and Development activities
- Future development and demand for e- commerce

Challenges:

- Increasing competition from competitors in the market Digital Align Private Limited has well-established infrastructure facilities, the functions of company are operated from the Mangalore head office. The competitors of Digital Align Private Limited are in the software solution providers situated in Mangalore region as follows:
  (i) Robosoft technologies, Mangalore
  (ii) Cognizant technology solutions, Mangalore
  (iii) Invenger technologies, Mangalore
  (iv) Diya Systems, Mangalore
- Research and Development activities to develop existing products
- Expanding manpower in order to intake more valuable projects and to improve quality work
- Explore social problems using engineering and innovative ideas
- Expanding RPA and Salesforce business through more electronics and digital products
- Developing more innovative, unique products and patent available to the market
- Developing Human Resource & finance departments
- Reaching education institutions through incubation centers in nearby districts

7. DATA ANALYSIS AND INTERPRETATION :

Software companies and information system companies are mainly dealing with inventing, updating and developing software and hardware technologies. It involves hardware products, computersoftware designing, mobile application designing, web-designing, which the work involved, developing or creating these products or services for their business purpose and developing for customer requirements is called a project. In order to manage these projects, the concept of project management is required, it is shown in the following figure 1.

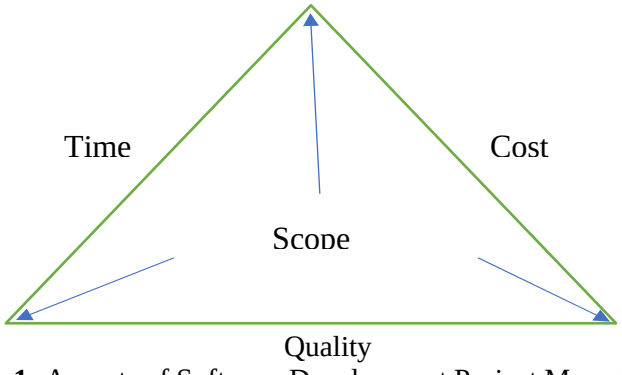

Fig. 1: Aspects of Software Development Project Management

- Projects have starting time and finishing time, project management is required to complete the project and complete each process with in scheduled time in the software development projects.
- Project management is required to fulfill the requirement and bring all process and team together to reach the objective and manage the scope of software development project.
- Project management also required to manage the quality of software which they develop, the organizing and controlling each process will result in increasing the performance of the team which will resulting in better quality.
- Projects have limited budget that is project management is required to manage the financial and cost aspects and complete the project with in the estimated budget and to utilize the resources at maximum possible way.

7.1 Project Management in Software Development Process:

Software development process will be applied on projects in a software company in order to develop a software based on the requirements. These large-scale companies appoint a project manager, whereas small and medium scale companies appoint chief technical officer and some companies assign to the department heads.

Software development, mobile application development and web development has a similar process in every company that the process involves analysis, designing, development, implementation, monitoring and evaluation and the project manager has to manage all requirements of these projects. The process is depicted in the following figure 2.

Software Development Project Management in General Sense:

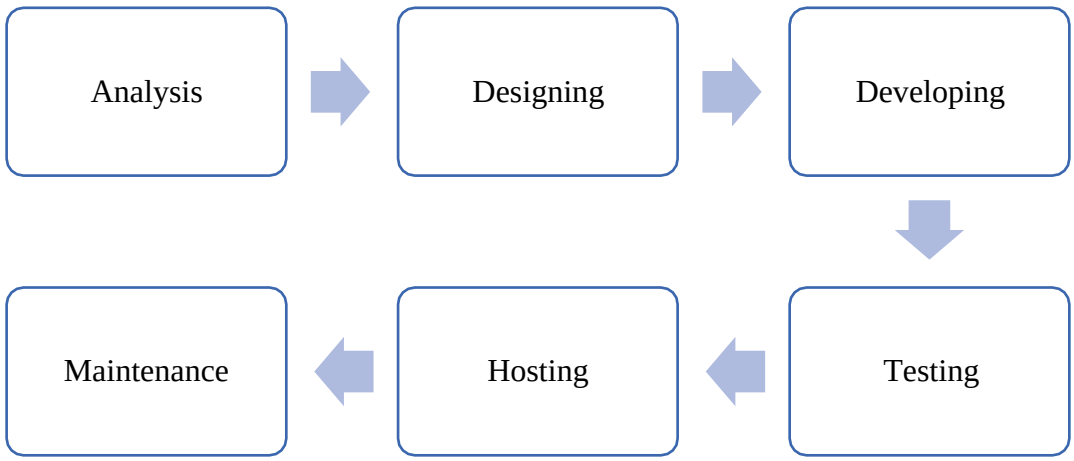

Fig. 2: Software development process in general sense

7.2 Analysis:

The project begins with the end user of that product and objectives include:

- Software invented or developed for company's personal use
- Software invented or developed for target market
- Software invented or developed for customer requirement

While developing a project there will be a certain requirement it may be for company or for market or for customer. The marketing team will analyze the market and brings customer and presents customer requirements to the company.

7.3 Designing:

In designing stage project manager does the planning and organizing activities. If the project is with innovative concept they have to invest more on research and development activities and they need professional team to development or otherwise they can only invest more on development activities and they need regular employees. The designing team will be formed and communicated them regarding the requirements of the customer and their time schedule. Design of the project based on therequirement includes resources required and number of employees required, activity schedule user interface,

programming language selection, tools and data base selection, etc.

7.4 Developing:

Project manager controls activities and communicate the objectives the teams and provides resources.It is important to provide the time frame to complete the work, here developer does user interface design in order to produce desired output and does programming or coding using different programming languages based on specifications of the software. The important programming languages and operating systems used in the market are as follows:

- SQL (Sequel)
- Uipath
- C# programming
- Salesforce
- PHP
- VB
- iOS
- Python

Here, primary testing and validation will be carried out.

7.5 Testing:

In this stage project manager will appoint software tester, who analyzes the performance and each function of the developed software and web applications by using selenium software test and the tester approves the software to hosting, if the further changes required by the failure of developing stage or further major changes required by customer has to be cleared before hosting stage.

7.6 Hosting:

After successful testing the software company should assure the server for hosting the software or web application with the server which is managed by server engineer. Here, project manager gets actual cost and can compare the budgeted cost by that he can know profitability of the project and he can utilize the same technique for their upcoming projects.

7.7 Maintenance:

The company have to maintain the software or web application and availability with server, customer can further ask for changes in any time for that company should provide services and charge separately which will be extra income for the company.

Software Development Project Management in Digital Align Limited:

Digital Align Private Limited is a small-scale software company. It attracts projects from business, service lenders, online shopping, companies and government clients. As the company deal with small software projects with the time period of one to five months, they do not appoint separate project manager in order to manage the project activities but CEO, CFO and CTO all together acts as project manager. The software development project management process depicted in the figure 3.

The company not only deals with software development projects but also web development projects, mobile application development projects and also hardware product development projects but software development is the core business of this company and major part of revenue is generated from this business.

1. Software and web application development project:
- Designing and developing computer software based on customer requirement
- Time period is one to five months

2. Mobile application development project:
- Designing and developing mobile application and access to web application
- Time period is one to five months

3. Hardware product development project:

- Company research and development activities to solve social problems & develop existing technology, time period is based on research completion.

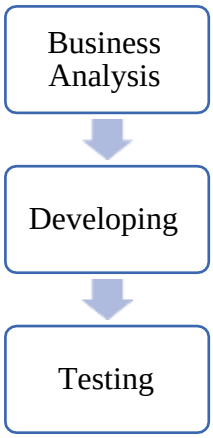

Fig. 3: Software development process in Digital Align Limited

7.8 Business Analysis:

The company gets clients through CEO and he lists the customer requirements, analyzes the possibility of performance, suggest the changes and availability of services to the customer and prepares business documentation. Then CFO analyses and prepares budgeted cost and fixes the primary price to the project and collects the advance payment, the CTO of the company makes necessary resource arrangements and plan for user interface selection, programming, tools and data base to perform the project. Once the customer accepts the company requirement to perform the project, company signs an agreement with them begins the developing work.

7.9 Developing:

The developer designs the software project as customer requirement, the developing team is managed by CTO. Once the designing is completed then they divide the work within the team, developing process includes user interface design, programming or coding using programming languages, then for safety measures the does primary testing and validation process once it gets passed then communicate to the customer and makes necessary changes required.

7.10 Testing:

In testing process the developer test the web application using selenium software test to check whether the software and its functions works properly or not? Then final changes are to be done the product will get approved by CTO. The company rent the server service from GoDaddy as they do not own server and does the hosting or publishes the product to customer use, the CEO issues safety and security certificate to the customer. The CFO analyzes the budgeted cost and actual cost then generates the invoice and collect the final payments. If, the customer requires further changes company charges separately as hourly work rate but the server maintenance charges are included in project cost.

7.11 Levels of Software Project Management:

Levels of software project management is the measurement of work complexity involved in the project based on this the software development process will be decided and changes in general development process are to be made. The Requisite organization and stratified system theory by Dr. Elliot Jaquez explain about classification of project based on project complexity, time schedule and output of the project to manage project work, resource plan, project tasks and process. The levels of project are as follows:

Level 1:

Time frame is within three months and work is repetitive in nature, improvement in completed medium project are involved in this level.

Level 2:
Time frame is three months to one year and work is repetitive and semi- repetitive in nature, small scale project development and improvement in medium and large project are involved in this level.
Level 3:
Time frame is one to two years and work are semi- repetitive in nature, medium scale project development and improving completed big scale project are involved in this level.
Level 4:
Time frame is 2 to 5 years and work are semi- repetitive and research and development in nature, medium scale and large-scale project development and improvement in functional system are involved in this level.
Level 5:
Time frame is 5 to 10 years and work are research and development, large scale project and improving group of functional systems are involved in this level.
Level 6:
Time frame is 10 to 20 years and work are research and development, large scale projects, improving a value chain of the company are involved in this level.
Level 7:
Time frame is 20 to 50 years and work are research and development, large scale projects, improving multiple value chain of the company are involved in this level.

7.12 Project Management Software:

The digitalization era of project management is project management software, it is technological tool to estimation, planning, decision making, organizing and controlling of project activities used by project manager and project team.
The project management software comes with different types like personal, single user, computer software, mobile software, web based, multiple users and visual. It is helpful to maintain accuracy, control errors, less time consuming and also as evidence.

7.13 Functions of project management software:

- Cost budgeting, comparative analysis of budgeted cost with actual cost, cost control
- Project schedule estimation
- Project schedule division for each process and time management
- Project resource estimation
- Activity cost accounting
- Comparative analysis with historical data
- Project portfolio management Project Management software:

Some common project management software as follows:

- Microsoft Project
- Atlassian JIRA
- Confluence
- Wrike
- Trello
- Liquid Planner

Table-1 below depicts a number table represent or of required resource for managing the project, which is used for planning and allocating the technical staff based on schedule to the project.

Table 1: Resource allocating in general project management.

Month	1	2	3	4	5
Resource					
Designer	3	2	2	1	1
Developer	0	2	4	2	1

Tester	0	0	0	1	2
Total	3	4	6	4	4

Resource histogram is generated for the designer, developer and the tester is represented in a bar chart in figure 4.

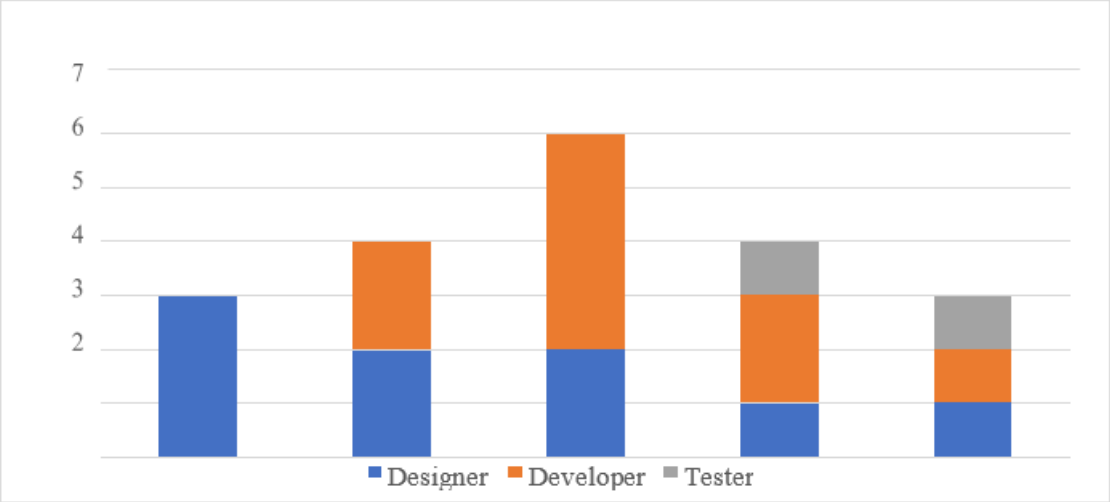

Fig. 4: Resource allocation for managing general project

In software projects the human resource is allocated based on that company's software development process.
The above resource histogram shows a five-month small project resource allocation in general as the company follows general software development process.
Apart from these employees there will be project manager or management team and also some non-technical employees.
The following Table 2 represents resource allocation in Digital Align development project.

Table 2: Resource allocation at Digital Align for 5 months project.

Month	1	2	3	4	5
Resource					
Analyst	3	0	0	0	0
Developer	0	2	3	3	1
Tester	0	0	0	1	2
Total	3	2	3	4	3

The histogram shows the 5-months resource histogram of Digital Align Private Limited based on their software development process.

- The company need Analyst as there is no project manager but there is project management team and they act as analysts.
- There is no requirement of separate designer because the developer himself act as designer and the number of requirements for designer is more but most of the companies prefer to hire a designer but when you see it from employee cost the Digital Align is doing good.
- Here the analysts are from project management team, developers and testers are from executive team but as it is seen in general resource allocation, designers, developers and testers all are from executive team only. The below depicted table-3 lists required resources.

Resource allocation histogram chart for five months project at Digital Align shown in figure 5.

Fig. 5: Resource allotment for five months project at Digital Align

Table 3: Resource utilization for one month project.

Weeks	1	2	3	4
Resource				
Analyst	1	0	0	0
Developer	0	1	1	2
Tester	0	0	0	1
Total	1	1	1	3

- The projects like small scale functioning software development like ERP software for small shops and upgradation of any research and development project.
- Research and development projects in large scale companies takes long time schedule like 10 months to two years. Table-4 below shows the statistics of resource histogram for R&D projectsof 10 months, it generally requires more skilled employees and non-repetitive job.

Table 4: Project resource management for R&D software development projects

Month	1	2	3	4	5	6	7	8	9	10
Resource										
R&D	3	3	1	0	0	0	0	0	0	0
Analyst	2	2	3	0	0	0	0	0	0	0
Designer	0	0	0	3	1	0	0	0	0	0
Developer	0	0	0	0	5	5	5	3	3	0
Tester	0	0	0	0	0	0	0	1	1	3
Total	5	5	4	3	6	5	5	4	4	3

- Here in addition to designer, developer, and tester the research and development team and analysts arealso given high importance as it involves huge resource management and high employee cost.

7.14 Software Development Project Schedule Management:

The project management major objective is to manage project schedule that will be from the time of acceptance to hosting the software project by managing and completing individual activities and bringing together to complete the project with in the scheduled time period. The main two techniques apart from project management software are Project evaluation and review technique and Critical path method and these methods are mainly supported with variance analysis of project schedule and Gantt

chart and how it changes based on the software development process is given in the figure-6 below.

Month	1	2	3	4	5
Activities					
1. Analysis					
2. Design					
3. Development					
4. Testing					
5. Hosting					

Fig 6: Gantt Chart for Software Development Project Schedule of 5 Months

- The figure shows that for a five-month schedule project how a company can divide their total time in to individual activity schedules and the management team allocates minimum and maximum time that an individual activity can use that will impact on their project completion time period, PERT and CPM also depends on this schedule.
- Figure-7 below represents the Gantt chart of Software development 1-month project at Digital Align Private Limited and also this can be followed by all companies for small scale software development projects which does not involves research activity.

Month	1	2	3	4
Activities				
1. Analysis				
2. Design				
3. Development				
4. Testing				
5. Hosting				

Fig 7: Gantt Chart for Software Development Project Schedule of 5 Month

- These projects will help to fill the extra time which they were getting while developing the 5- month scheduled projects and helps to provide daily work and improve the skills of their employees.
- This type of projects generally does not require project management software support and it can manage manually as the work complexity is very less and the designing and testing work will be very less and it involves more analysis and development activity.
- There will be less work in the begging of the project schedule and increase at the end of the projectas shown in below figure-8, which should be highly monitored by the project management team.

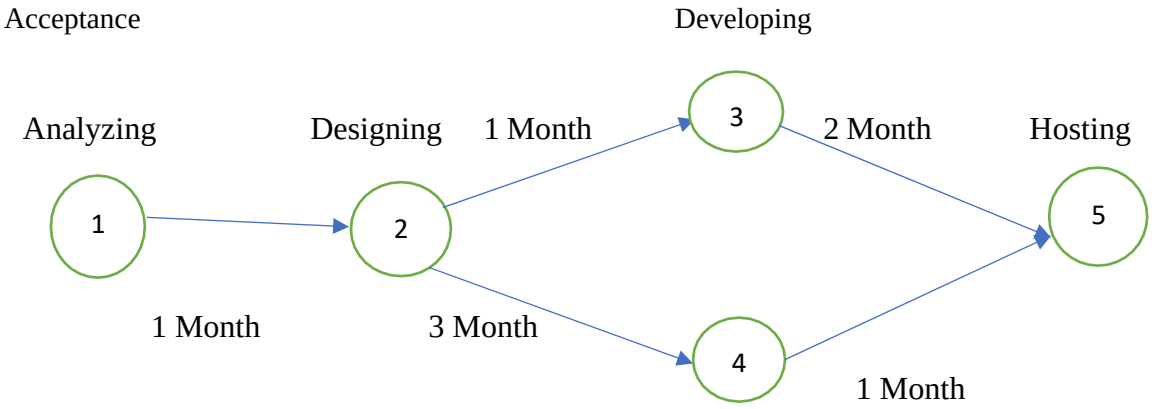

Fig. 8: Monitoring Project Management

7.15 Testing:

- Activity 1 represents the software development project acceptance and analysis as according to the development process, from activity 1 to activity 2 it takes maximum 1 month.

- Activity 2 represents the designing process of software development process and after 1-month activity 3 begins and after 3 moth activity 4 begins and these are closely interconnected activities.
- Activity 3 represents developing stage which is done along with activity 4 and after 2 months it is ready for activity 5.
- Activity 4 represents testing stage which the quality of activity 3 is to be measured and after 1 month it is ready for activity 5.
- Activity 5 represents the hosting stage and it is the completion of software development process.
- 1 to 2= 1 month
- 2 to 3= 1 month
- 2 to 4= 3 month
- 3 to 5= 2 month
- 4 to 5= 1 month
- This will help to know critical path to complete the project shortest way and we can say that 1-2-3-5is shortest than 1-2-4-5. So, 1-2-3-5 is the critical path of this software development project. This is shown in the following table-5.

Table 5: Estimation of project duration and its relationship

Task Name	Duration in months			Relationship
	Optimistic	Most Likely	Pessimistic	
1	0.5	1	1.5	Start, 1 month
2	0.5	1	1.5	after task 1, 1 month
3	1	2	3	after task 2, 2 months
4	0.25	0.5	1	after task 3, 0.5 month
5	0.25	0.5	1	After task 4, End, 0.5 month

- Variance= ((Pessimistic Time- Optimistic Time)/6)^2.
- The optimistic time, most likely time and pessimistic time are derived from Gantt chart and PERT and CPM together and the task represents each stage in the software development process.
- The variance calculation mainly required for risk management in project schedule management, that is CPM will help to identify shortest way to complete the project effectively and variance help to identify the variability in project duration, by this a project manager can identify the schedule risk and take preventive measures in designing project schedule.
- The project manager estimates the optimistic time, most likely time and pessimistic time in order to manage the overall time by managing individuals time taken for a task, so that he can prevent the delay in completing the project is depicted below in table-6.

Table 6: Expected task duration and its variance

TaskName	Duration in months			Expected task duration	Variance
	Optimistic	Most Likely	Pessimistic		
1	0.5	1	1.5	1	0.029
2	0.5	1	1.5	1	0.029
3	1	2	3	2	0.11
4	0.25	0.5	1	0.5	0.016
5	0.25	0.5	1	0.5	0.016

7.16 Software Development Project Cost Management:

Cost management is one of the major objectives of software development project management and it is the major responsibility of project manager or project management team. The cost management concept

includes cost estimation and budgeting, cost control, cost reduction, pricing decision, profitability management, cost risk management, cost recording.

7.17 Methods of Software Development Project Cost Management:

- The general software development project cost budgeting in small scale and medium scale companies are made on historical cost basis, only special projects which involves more research and development activities are done through zero based cost budgeting.
- The COCOMO model or constructive cost model is developed mainly for software development project management using regression formula which requires historical cost data, it is most preferable cost budgeting model in the industry.

7.18 Estimated Cost Data for a Software Development Project:

Table-7 showing estimated cost and income records for medium scale project in a small company (5-month work with worth INR Rs. 10 Lakhs).

Table 7: Estimated cost in completing a project

Particulars	**Amount in INR Lakhs**
TOTAL PROJECT WORTH	**10.00**
(LESS) EXPENSES:	
Employee Cost	04.50
Telephone and Internet Charges	0.10
Electricity Charges	0.10
Server Charges	0.05
Maintenance Charges	0.75
Transportation Charges	0.05
Stationary Charges	0.05
System Maintenance Charges	0.25
Miscellaneous Expenses	0.25
Marketing Expenses	0.10
PROJECT INCOME	**3.80**

- If a small company take up a five-month work with INR Rs. 10 lakh worth project which is generally a semi-repetitive work project without any research and development activity they can make INR Rs. 3.80 lakh income excluding office maintenance expenses, interest, taxes which theycan get overall 35% as net profit.
- The above data estimated on historical data of the small-scale software development company same as Digital Align Private Limited software development projects are repetitive and semi- repetitive projects.
- The biggest cost for every software development company is employee cost and high attrition rates which could maximize the overall employee cost per year, outsourcing and automation will be the solution for this problem.
- The 1-month schedule project cost and income vary based on their functions it might be only 30,000 INR Rupees if it involves only upgradation and maintenance work but also company can get up to 2.00 INR Lakhs Rupees if it is a full-fledged project involving more work.
- This type of project will help to generate more income along with medium scale projects as it requires less resources the developing cost will be less and company can earn more by taking more small projects.
- It helps the company to manage their fixed cost and for this type projects there will be time and work basis payment system which the salary payment for the employees will be on hourly basis and some companies follows commission on number of small projects they complete within a month.
- When it compared with 5-month scheduled project and research and development project it will cost very less and earn more as the company can complete more projects.

8. FINDINGS :

8.1 Methods of software development projects:

The software development project management is the key functioning area of any software development company, the management style of software development projects differs with the small scale and large-scale companies and the size of the project and target customers. The software development projects in large scale companies are generally involve huge investment, high research and development activities, long term time period and large resources and it involves more of non-repetitive jobs. The software development projects in small scale and medium scale companies involve small investments, small term time period, less resources, minimum research and development activities and it involves more repetitive jobs. All new software development projects are accepted only after doing the feasibility test which is also called as business analysis or evaluation of possibility of the performance which involves financial feasibility, resource feasibility, cost feasibility, time feasibility and market feasibility. The project management methodologies are the basis for managing the projects and the project management structure is designed on the basis of the underlying methodology.

8.2 Software development project manager:

- There is no compulsion to appoint a project manager, in small scale companies' departmental heads all together acts as project manager and works in a team but it works only because they are getting lessprojects or small projects compared to large scale companies, in large scale companies there should bea project manager in order to reduce the complexity in project management.
- The importance of project manager in big project management is too high that, he should manage all the functioning areas of project and he have to be connected with all key persons of the project, activities like project team management, project cost management, project schedule management, project report recording, customer requirement management, project communication management, project risk management.

8.3 Project complexity management:

- Project complexity arises due to risks in the project management like inflation or cost risk, employee risk, project completion or schedule risk, resource risk, communication risk, market, and competitor risk, these should be analyzed and managed by project manager or management team.
- Present days most of the companies uses project management software which is easy to access and includes most of all functioning areas of project management like budgeting, cost management, finance planning, schedule management, PERT, CPM, internal communication which will reduce the complexity of the project management team.

Table-8 displaying the comparative cost and income records for medium scale project in a small company (5 month schedule small project):

Table 8: Cost analysis of a small company

Particulars	**Amount in INR Lakhs**	**Amount in INR Lakhs**	**Amount in INR Lakhs**
TOTAL PROJECT WORTH	**10.00**	**15.00**	**20.00**
(LESS) EXPENSES:			
Employee Cost	4.50	4.50	4.50
Telephone and Internet Charges	0.10	0.15	0.20
Electricity Charges	0.10	0.15	0.20
Server Charges	0.05	0.05	0.05
Maintenance Charges	0.75	1.50	2.25
Transportation Charges	0.05	0.10	0.15
Stationary Charges	0.05	0.10	0.15
System Maintenance Charges	0.25	0.50	1.00
Miscellaneous Expenses	0.25	0.50	1.00
Marketing Expenses	0.10	0.20	0.30
PROJECT INCOME	**3.80**	**7.25**	**14.70**

- The above comparative cost-income statement shows how a small-scale software company plansto maximize their income and profitability of the business by increasing the number of project intake there by increasing the sales.
- This method will help the company to design the target and effective utilization of resources and provide the service for better price to the customer.
- The challenge is employee cost which fixed per month in order to overcome this and make huge profit the company should increase their sales and taking more projects also requires time each project should be completed within a time frame and sometimes it needs overtime work and extra payment.

9. SUGGESTIONS AND CONCLUSION :

The company develops its business by implementing the concept of project management and project manager supported with modern project management software support, which will help the company to better result of managing time, resource, cost, performance, quality altogether a good value to the customer.

(1) Appointing a Project Manager:

- Software development companies who do not appoint a project manager will divide the samework with all departmental heads by thinking it might increase overall employee cost
- If the company can appoint a project manager who handles all process and multiple projects, the departmental heads can concentrate more on their departmental activities which will automatically increases the performance of the business and help to manage multiple projects, quality of each project, business portfolio management, better communication with all department employees and to maintain good relation with customers and to run the business in a systematical way.

(2) Utilizing the Project Management Software:

- The software development companies can utilize the project management software in order to manage the multiple projects and manage individual projects efficiently.
- Plan the activities of project in systematical way will increases the performance and quality ofthe work.
- Design the schedule and resources in each stage of development and record employee cost willhelp to time and employee management.
- Small companies can get better results even though they do not appoint project manager.

The analysis, interpretation and findings of this study convey that by adopting project management system the software development company can manage the business in an efficient and profitable manner. As the history of project management reminds that most of the industries started to implement this concept by observing the success of mega engineering projects because of the effective utilization of project management concepts.

The project management will help to finish the project within time by managing time schedule, run the business profitably by managing cost effectiveness of the project, increase the performance by maintaining good communication flow within the company and with customer and best utilization of resources to get good quality product, to manage overall internal and external risks of the project of any type of software development projects.

The large-scale software development companies care efficiently using the project management concept and it helps them to manage mega projects and multiple projects. In medium scale and small-scale software development companies all departmental heads together work as project manager but itwill lead conflicts between departments and there will be less effective communication which will lead to decrease in the overall performance. In unstructured small-scale software development companies who are getting small and less projects they do not go for project management but they do only cost and time management and that will affect the quality of the product.

Hence, in the modern days, the companies want to reduce the number of employees and they also want to reduce the human efforts and human errors by adopting robotics and artificial intelligence technology. Project management software actually reduces the project manager’s efforts and human errors to manage multiple projects currently large-scale companies are utilizing this technology but in medium and small-scale software companies it removes the presence of project managers where the

employees themselves utilize the technology and manage the project as they were getting less number and small projects compared to large scale companies.

REFERENCES :

[1] Das, K., & Sagara, H. (2017). State and the IT Industry in India. *Economic & Political Weekly*, *52*(41), 57-64. Google Scholar↗

[2] Gökgöz, F., & Güvercin, M. T. (2018). Investigating the total factor productivity changes in the top ICT companies worldwide. *Electronic Commerce Research*, *18*(4), 791-811. Google Scholar↗

[3] Jiang, J. J., Klein, G., & Fernandez, W. D. (2018). From project management to program management: an invitation to investigate programs where IT plays a significant role. *Journal of the Association for Information Systems*, *19*(1), 1-9. Google Scholar↗

[4] Demirkesen, S., & Ozorhon, B. (2017). Impact of integration management on construction project management performance. *International Journal of Project Management*, *35*(8), 1639-1654. Google Scholar↗

[5] Taks, Marijke, Kesenne, Stefan, Chalip, Laurence, & Green, B. Christine. (2011). Economic Impact Analysis versus Cost Benefit Analysis: The Case of a Medium-Sized Sport Event. *International Journal of Sport Finance*, *6*(3), 187-203. Google Scholar↗

[6] Hochdörffer, J., Buergin, J., Vlachou, E., Zogopoulos, V., Lanza, G., & Mourtzis, D. (2018). Holistic approach for integrating customers in the design, planning, and control of global production networks. *CIRP Journal of Manufacturing Science and Technology*, *23*(1), 98-107. Google Scholar↗

[7] Gonovski, V. (2017). Risk Management in Project Management–Basics. *Knowledge International Journal*, *16*(3), 995-1000. Google Scholar↗

[8] Cotterell, M., & Hughes, B. (1995). Software project management, *International Thomson Computer Press.* 1-293. Google Scholar↗

[9] Aanbari, F. T., & Young Hoon Kwak, P. F. T. A. (2008). Impact on Project Management of Allied Disciplines: *Trends and Future of Project Management Practices and Research*, *5*(2), 324-331. Google Scholar↗

[10] Almaamari, G., Williams, N., & Atkinson, R. (2017). Stakeholders' trust and power dynamic in tourism resort projects in a developing country, *International Journal of Recent Technology and Engineering*, *8*(4), 77-89. Google Scholar↗

[11] Korte, R., Smith, K. A., & Li, C. Q. (2018). The Role of Empathy in Entrepreneurship: A Core Competency of the Entrepreneurial Mindset. *Advances in Engineering Education*, *7*(1), 1-7. Google Scholar↗

[12] Sanz-Llopis, J., & Ostermann, M. (2020). Innovation in project management through framing and challenge redefinition. *International journal of managing projects in business*, *5*(1), 234-239. Google Scholar↗

[13] Petersen, K. W. (2020). Project Management Office Performance Variables that InfluenceProject Success: A Correlational Study, *Dissertation of Capella University*, 121-135. Google Scholar↗

[14] Arashpour, M., Abbasi, B., Arashpour, M., Hosseini, M. R., & Yang, R. (2017). Integrated management of on-site, coordination and off-site uncertainty: Theorizing risk analysis within a hybrid project setting. *International Journal of Project Management*, *35*(4), 647-655. Google Scholar↗

[15] Korte, R., Smith, K. A., & Li, C. Q. (2018). The Role of Empathy in Entrepreneurship: A Core Competency of the Entrepreneurial Mindset. *Advances in Engineering Education*, *7*(1), 1-12. Google Scholar↗

[16] Holla, R. (2017). A Study on SWOC Analysis of Reliance Jio. *International Journal of Engineering Research and Modern Education (IJERME)*, *2*(1), 42-47. Google Scholar↗

[17] Aithal, P. S., & Kumar, P. M. (2015). Applying SWOC analysis to an institution of higher education. *International Journal of Management, IT and Engineering*, *5*(7), 231-247. Google Scholar↗

[18] Vijayakumar, S., & Nethravathi, P. S. (2021). The Mega Conglomerate of India-Success Story of Growth of Reliance Industries: A Case Study. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, *5*(1), 143-154. Google Scholar↗

[19] Puneeth, B. R., & Nethravathi, P. S. (2021). Paytm's Journey towards Digital Payment in India–A Case Study. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*, *5*(2), 125-141. Google Scholar↗

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