Project Scope Management

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Abstract- *When a construction site is being built, the constructor raises a fence on the site defining the boundaries of the construction. This process of building a fence is called scoping. Scope management is the process of defining what work is required and then making sure all of that work – and only that work – is done. Scope management plan should include the detailed process of scope determination, its management, and its control. This needs to be planned in advance. The project manager must seek formal approval on a well-defined and clearly articulated scope. To identify scope, requirements must be gathered from all stakeholders. Gathering requirements from only a few stakeholders or only the sponsor might lead to the incorrect definition of scope.The project scope is the work the project will do to deliver the product of the project (i.e. the product scope). In the software application development example, the project scope is the work that is to be done to develop the software application. This work includes the planning, coordination, and management activities (such as meetings and reports) that ensure the product scope is achieved. These efforts are a part of the project management plan and are further a part of the scope management plan. At the end of the project or the phase, the completed work is compared against the scope baseline in the project management plan to determine if the scope has been successfully completed*

Keywords- Project scope management, etc.

I. INTRODUCTION

Planning has long been a subject of discussion in the building industry. Many guides have been developed and much knowledge resides with experienced practitioners (Griffin 1972; Pena 1987; Billings 1993; Preiser 1993; Haviland 1996; Cherry 1999; ASCE 2000). However, early planning in many cases is not performed well in the building industry. Consequently, the building sector suffers from poor or incomplete scope definition, frequently experiencing considerable changes that result in significant cost and schedule overruns (Gibson et al. 1997; Cho et al. 1999; Cho 2000). Because of these problems, there existed a need for a better method of assisting in defining project scope. The building industry is different from the industrial sector in various ways, such as the approach of planning, design, and construction of facilities; the owner's perspective; the architectural focus; and so on. Nonetheless, there are many similarities. Like the industrial sector, the building industry suffers from poor or incomplete preproject planning. As in the industrial sector, planning in the building industry is a process that needs to have input from a wide variety of individuals and must have significant owner involvement. However, at the time of this study, a quantitative understanding of scope definition issues for buildings had not been well-studied and no tool existed to help with scope definition. As developed, the PDRI for Building Projects is a user friendly checklist that identifies and precisely describes each critical element in a project scope definition package to assist project managers in understanding the scope of work. It provides a means for an individual or team to evaluate the status of a building project during preproject planning with a score corresponding to project's overall level of definition. The PDRI helps stakeholders of a project quickly analyse the scope definition package and predict factors that may impact project risk specifically in regard to buildings. (CII 1999; Cho 2000) As illustrated in Fig. 1, the PDRI for building projects is designed for use at varying times during the project's lifecycle prior to detailed design and development of construction documents.

Preproject planning is the project phase encompassing all the tasks between project initiation to detailed design. Over the past nine years, the Construction Industry Institute (CII) has funded several research projects focused on Preproject planning. Findings from these investigations have dramatically changed the awareness of project management professionals within CII toward the importance of the process and the benefits of early project planning. Research results have shown that greater Preproject planning efforts lead to improved performance on industrial projects in the areas of cost, schedule, and operational characteristics (Gibson and Hamilton 1994; CII 1995; Griffith and Gibson 1995; Griffith et al. 1998). Synthesizing these efforts was the development of the Project Definition Rating Index (PDRI) for industrial projects, a scope definition tool that is widely used by planners in the industrial projects sector. One of the major subprocesses of the Preproject planning process is the development of the project scope definition package. Project scope definition is the process by which projects are defined and prepared for execution. It is at this crucial stage where risks associated with the project are analyzed and the specific project execution approach is

defined. Success during the detailed design, construction, and start-up phases of a project is highly dependent on the level of effort expended during this scope definition phase (Gibson and Hamilton 1994).

A more recent CII research study focused on developing a useful tool for measuring the level of project definition at the time the project is authorized for final funding. This new tool, the PDRI for Industrial Projects, is a project management tool that assists in calculating a total score representing the level of project definition. Developed specifically for industrial projects such as refineries, chemical plants, power plants, and heavy manufacturing, the PDRI provides project team members with a structured approach for developing a good scope definition package. The PDRI for Industrial Projects consists of 70 scope definition elements in a weighted checklist format. The 70 elements are divided into three main sections and 15 categories (Gibson and Dumont 1996; Dumont et al. 1997). The project team assessing the level of definition of each of the 70 elements and a score is calculated; the lower the score, the more well defined the project. A score of 200 points or below using this tool was shown to statistically increase the predictability of project outcome. A sample of 40 projects using the industrial version of the PDRI indicated that those projects scoring below 200 versus those scoring above 200 had:

• Average cost savings of 19% versus estimated for design and construction
• Schedule reduction by 13% versus estimated for design and construction
• Fewer project changes
• Increased predictability of operational performance

With the success of the PDRI for industrial projects, many building industry planners wanted a similar tool to address scope development of buildings. CII constituted a team and funded a research effort to facilitate this development effort. The rest of this paper will introduce the PDRI for building projects. The primary structure and format of the PDRI and its development will be explained. This will be followed by a brief synopsis of its validation on 33 completed building projects and its use on 20 ongoing projects. The paper will conclude by describing the potential uses of the PDRI and summarizing its benefits to building construction practitioners.

1.2 WHAT IS SCOPE

The scope of a project can be be defined in terms of the functionality which the project is intended to provide, attain, or span. A project scope statement defines, in writing, drawings and price figures, the intended span of work expected and to be provided for in plans for a new facility. The scope statement should also spell out expectations about any eventual extensions, and should include a contingency policy as well. The scope statement should be a clear communication of the extent and functionality of the facility, between the proposers, sponsors, designers, constructors and the users or purchasers. In order to be explicit as to the meaning or extent of various systems, scope may be further described in terms of cost budget figures. Such budget figures need to be expressed in enough detail to provide the basis for a cost control system and for evaluating any subsequent changes to that scope. According to Frederick,a technical scope document is what describes the project's physical characteristics, establishes the design basis, and provides input to civil-structural, architectural, plant design, mechanical, electrical, and control systems disciplines. Elements usually employed to produce this definition include P&IDs4 , single line diagrams, facility layout sketches, an equipment and instrument list, bulk take offs of mechanical/electrical quantity items, an engineering procurement, instrumentation and construction master schedule, a written controls philosophy, and repair standards expected. Minimum results expected from the production of a project scope statement include a broad description of what is to be covered in the works. The scope of a project can conceptualized to be as shown in Figure 1-1 .The overall scope of the project can be thought of as a composition of scope of units which in turn are composed of scope of subunits and so on. The functionality of sub-units determine the functionality of the unit and similarly the combined functionality of the units determine the overall functionality.

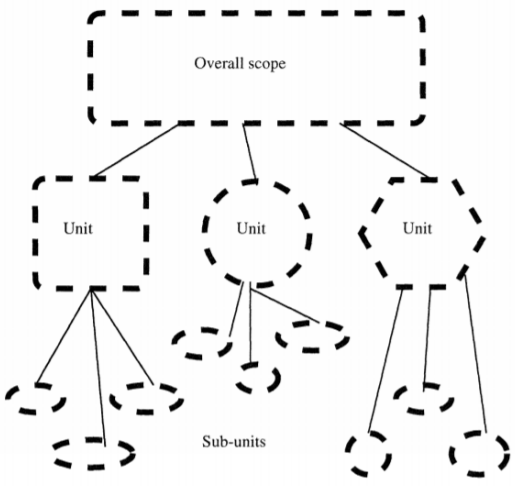

Fig1.1: Scope Definition

From Figure 1-1 coverage of scope can be considered in two directions; Horizontal and Vertical. Horizontal scope can be thought as the cumulative coverage of units or subunits

at the same level of detail whereas vertical scope is the completeness of scope of the respective units and subunits. Horizontal scope is said to be well defined if all units are defined and similarly vertical scope is well defined when all the subunits and detail of their components are well defined. The purpose of this distinction as we shall see in chapter 3 and 4 is to determine which type of change has more impact and which is more frequent, which shall help us to determine how deal with them and where to focus our attention at a specific stage in the project.

1.2.1 SCOPE CHANGES

Any change, at any stage, in the functionality of the project or facility is termed a scope change. All other changes which result from design errors and omissions, acts of god, or changed conditions are classified as refinements or alterations. Overruns resulting from alterations, refinements and cost escaltions are independent of scope changes. The change in functionality can be of three types and can be in the horizontal or vertical direction as described in section

1) Change in the capacity of functionality
2) Change in the quality of functionality
3) Complete change in the functionality
1) Change in the capacity of functionality

This kind of a change can be either addition or subtraction in the span of work. The examples are increase or decrease in the length or width of the road with other specifications remaining the same, or the increase or decrease in the number of standardized housing units to be constructed.

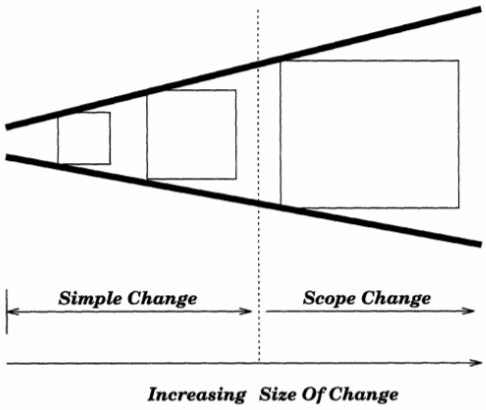

Figure 1-2: Increasing Size Of Change

2) Change in the quality of functionality

This kind of a change is an addition or subtraction of a functionality to the span of work, so as to change the overall functionality. The examples are providing or deleting dividers, toll booths, extra-markings and guard-rails in a road design or providing or deleting facing in a building etc.

3) Complete change in the functionality

This kind of a change is a complete change in the original functionality of a project or facility. The examples of such a change are changing the design of a flexible pavement to a rigid pavement, or changing the design of a building from reinforced concrete to structural steel. There are a variety of reasons why scope changes takes place and what factors might force such changes.

1.3 INCREASING SIZE OF CHANGE

Sometimes if the the capacity or size of a item, activity or portion of a project is changed the functionality of that item, activity or portion does not change. But if the size is increased to such an extent that a change in functionality occurs, then it can result in scope modification. To understand this, consider for example, that a tunnel is being constructed which also has utility lines passing through it. If it so happens that there is a change in the design sizes of the utility lines. Up to a certain extent we might be able to adjust them in the same dimensions of the tunnel, but if the change is large enough the dimensions of the tunnel might have to be changed. Such a change might itself be a scope change or cause a change in scope for example, the ventilation system might need relocation and redesign, and the new design might be functionally different from the previous one. Figure 1-2 depicts such increasing size of change, the dotted line is the critical point where the change becomes a change in functionality and hence a change in scope. In some cases the reverse of this might also be true, that is with a decrease in size the functionality might change. The importance of this discussion is that this type of change in functionality can happen unintentionally with incremental approval of increase in the size of an item, with the assumption that it would not cause a scope change. Such a scope change might be due to the activity itself or due to its disruptive or radiating effect on other dependent or related activities. So it is important to watch out for this kind of changes that do not appear to be a scope change in the beginning, but can become a cause of one. It is important to keep track of the border line point, whence the change becomes effectively a change in the functionality and consequently a change in the scope. It should also be noted that the border line point is different for different items and also unique for different cases.

1.4 DEVELOPMENT OF PDRI FOR BUILDING PROJECTS

Initial development work on the PDRI for building projects began in June 1997 at the University of Texas using the PDRI for Industrial Projects as a basis. This effort included input and review from approximately 30 industry experts, as well as extensive use of literature sources for terminology and key scope element refinement (O'Reilly 1997). The 12 member, CII PDRI for Buildings Research Team, constituted in February 1998, refined and streamlined the list of PDRI elements and their descriptions, starting with the draft of 71 elements to the final draft in December 1998. A complete list of the PDRI's three sections, 11 categories, and 64 elements is given in Fig. 2. The 64 elements in the PDRI for Building Projects are arranged in a score sheet format and supported by 38 pages of detailed descriptions and checklists. The score sheet is given in Appendix I and will be described in more detail later in this paper. A representative example description for element G1, Equipment List, is given in Fig. 3. Due to limitations of space, the entire list of detailed element descriptions are not included in this document.

1.5 OBJECTIVE OF STUDY

- To identify the scope of residential building by refreing PMBOK
- To study factors affecting the project scope management.
- To implement WBS for satisying the project scope.
- To develop WBS programme using tool MSP
- To check effectiveness of MSP programme for satisfying the project scope using questionnaires survey

II. METHODOLOGY

Flow Chart

2.1 PROJECT SCOPE MANAGEMENT: WHAT IT IS AND WHY IT'S IMPORTANT:

Project Scope Management refers to the set of processes that ensure a project's scope is accurately defined and mapped. Scope Management techniques enable project managers and supervisors to allocate just the right amount of work necessary to successfully complete a project—concerned primarily with controlling what is and what is not part of the project's scope.

2.1.1 WHAT IS PROJECT SCOPE?

Scope refers to the detailed set of deliverables or features of a project. These deliverables are derived from a project's requirements. PMBOK defines Project Scope as the "The work that needs to be accomplished to deliver a product, service, or result with the specified features and functions." There are three processes of Project Scope Management planning, controlling, and closing.

2.1.2 PLANNING

The planning process is when an attempt is made to capture and define the work that needs to be done.

2.1.3 CONTROLLING

The controlling and monitoring processes focus on documenting tracking, scope creep, tracking, and disapproving/approving project changes.

2.1.4 CLOSING

The final process, closing includes an audit of the project deliverables and an assessment of the outcomes against the original plan.

2.1.5 THE SCOPE STATEMENT

The scope of a project is the clear identification of the work that is required to successfully complete or deliver a project. One of the project manager's responsibilities is to ensure that only the required work (the scope) will be performed and that each of the deliverables can be completed in the allotted time and within budget. The documentation of the scope of the project will explain the boundaries of the project, establish the responsibilities of each member of the team, and set up procedures for how work that is completed will be verified and approved. This documentation may be referred to as the scope statement, the statement of work, or the terms of reference.

2.2 STEPS INVOLVED IN PROJECT SCOPE MANAGEMENT

As a project manager, you'll need to define project scope no matter what methodology you choose to use. Here's one example of a systematic process to capture, define, and monitor scope.

STEP 1—DEFINE PROJECT NEEDS

Defining the needs of the project is the first step toward the establishment of a project timeline, allocation of project resources and setting project goals. Only with these steps defined will you be able to understand the work that needs to be done – in other words, the scope of the project needs to be defined. Once that is done, team members can be allocated tasks, and provided direction to deliver a project in the given time and budget.

STEP 2—UNDERSTAND THE PROJECT OBJECTIVES

To define the project scope, it is important to first establish the objectives of the project, which may include a new product, creating a new service within the organization, or developing a new piece of software. There are a number of objectives that could be central to a project; the project manager ensures the team delivers results according to the specified features or functions. Define the project scope The resources and work that goes into the creation of a product or service is essentially what defines the scope of the project. The scope generally outlines the goals that will be met in order to achieve a satisfactory result.

STEPS FOR DEFINING THE SCOPE OF A PROJECT

To define the scope of the project, identify the following:• Project objectives

- Goals
- Sub-phases
- Tasks
- Resources
- Budget
- Schedule

Once these parameters are established, the limitations of the project need to be clarified and the aspects that are not to be included in the project identified. By doing this, the project scope will make clear to stakeholders, senior management, and team members what will and will not be included in the final product or service. Additionally, the scope of the project must have a tangible objective for the organization that is undertaking the project. This is integral for the scope of the project, since it will play a vital role in how project methodologies are applied to complete it.

2.3 PROJECT SCOPE MANAGEMENT PROCESSES

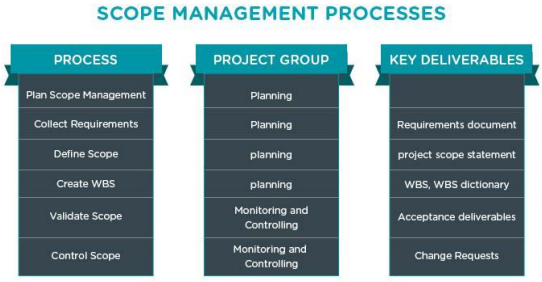

Fig 2.1 Scope Management Process

2.4 PLAN SCOPE MANAGEMENT

This is the first process in the Project Scope management process. The PMBOK® Guide, Fifth Edition, added several processes to separate the initial planning activities from other activities. This process creates the scope management plan. The scope management plan describes the project scope and documents how it will be further defined, validated, and controlled. The table below shows the Inputs, Tools and Techniques, and Outputs of the Plan Scope Management Process.

Fig 2.1 Scope Management Plan

The Scope management plan covers how the scope will be defined, validated, and controlled. It also includes information on preventing or dealing with scope creep, handling change requests, the escalation path for any disagreement on the scope elements between stakeholders, the process for the creation of the scope statement, the WBS, and how the deliverables will be accepted.

2.5 COLLECT REQUIREMENTS

This process involves documenting stakeholders' needs with the stated intent of meeting the project's objectives. In this process, managers use several techniques and tools for collecting project requirements from stakeholders. The process attempts to leave no stone unturned, resulting in an in-depth list of project requirements. If this

process is performed thoroughly and correctly, it can greatly reduce the possibility of unpleasant surprises as the project moves toward completion. The table below shows the Inputs, Tools and Techniques, and Outputs of the Collect Requirements process.

COLLECT REQUIREMENTS PROCESS

INPUTS	TOOLS & TECHNIQUES	OUTPUTS
Project charter	Interviews	Requirements documentation
Stakeholder register	Focus groups	Requirements management plan
	Facilitated workshops	Requirements traceability matrix
	Group creativity techniques	
	Questionaires and surveys	
	Observations	
	Prototypes	
	Group decision-making techniques	

2.5.1 DEFINE SCOPE

This process involves the preparation of a detailed description of the project and its major deliverables. The scope clearly states what the project is supposed to achieve and what it cannot accomplish. The supporting documents are reviewed to ensure that the project will deliver work in line with the stated goals. The scope that results states the stakeholders' needs and communicates expectations for project performance. The table below shows the Inputs, Tools and Techniques, and Outputs of the Define Scope process.

COLLECT REQUIREMENTS PROCESS

INPUTS	TOOLS & TECHNIQUES	OUTPUTS
Project charter	Interviews	Requirements documentation
Stakeholder register	Focus groups	Requirements management plan
	Facilitated workshops	Requirements traceability matrix
	Group creativity techniques	
	Questionaires and surveys	
	Observations	
	Prototypes	
	Group decision-making techniques	

2.5.2 CREATE WORK BREAKDOWN STRUCTURE (WBS)

The Work Breakdown Structure (WBS) is an important element of the Scope management process and the PMI® places great emphasis on this aspect—many project managers often skip this step, leading to inaccurate plans. The WBS provides the project manager and the team with the opportunity to break down a high level scope statement into smaller, better manageable units of work, called work packages. The resulting WBS should provide a complete list of all work packages required to complete the project The table below shows the Inputs, Tools and Techniques, and Outputs of the Create Work Breakdown Structure process.

CREATE WBS PROCESS

INPUTS	TOOLS & TECHNIQUES	OUTPUTS
Project Scope Statement	Decomposition	WBS
Requirements documentation		WBS dictionary
Organizational process assets		Scope baseline
		Project document updates

2.5.3 VALIDATE SCOPE

The Validate Scope process focuses mainly on customer acceptance. It is when the project customer formally accepts all the project deliverables. This process occurs at the end of each phase. During the process, the customer gives their feedback on the work that was performed. The table below shows the Inputs, Tools and Techniques, and Outputs of the Validate Scope process.

VALIDATE SCOPE PROCESS

INPUTS	TOOLS & TECHNIQUES	OUTPUTS
Project management plan	Inspection	Accepted Deliverables
Requirements documentation		Change requests
Requirements traceability matrix		Project document updates
Validated deliverables		

2.5.4 CONTROL SCOPE

The Control Scope process involves monitoring the status of the project and managing changes to the scope. The table below shows the Inputs, Tools and Techniques, and Outputs of the Scope Control process

CONTROL SCOPE PROCESS

INPUTS	TOOLS & TECHNIQUES	OUTPUTS
Project management plan	Variance analysis	Work performance measurements
Requirements documentation		Change requests
Requirements traceability matrix		Project management plan updates
Organizational process assets		Organizational process assets updates
Work performance information		Project document updates

This process involves assessing additional requirements from the customer or proactively overlooking the project scope. Managers measure the work product against the scope baseline to ensure that the project stays on track, helping to prevent any unnecessary changes.

2.5.5 PROJECT SCOPE MANAGEMENT TIPS

Often, when performing Scope Management, project managers bump into issues along the way. The problems that may arise when defining and documenting Project Scope are Some common issues with performing scope management can lead to problems once the project has begun. We recommend reviewing all scope management documentation with an eye toward:

- Ambiguity: Ambiguity in scope often leads to unnecessary work and confusion. To avoid this, the scope needs to be clearly defined and to the point.
- Incomplete definition: Incomplete scopes lead to schedule slips which lead to cost overruns. To avoid this, the scope needs to be complete and accurate.
- Transience: Transient scopes lead to scope creep—the primary cause of late deliveries and "never-ending" projects. To avoid this, the scope document needs to be finalized and remain unaltered for the duration of the project.
- Uncollaborative scope: A scope that is not collaboratively prepared causes misinterpretations in requirements and design. To avoid this, the scope document should be shared with all stakeholders at every step of the scope definition process.

2.5.6 WHY PROJECT MANAGERS NEED SCOPE MANAGEMENT

Effective scope management requires clear communication, to ensure that stakeholders and team members alike understand the scope of the project while agreeing on how the project goals will be met. Scope management helps avoid the challenges that a project might face with bloating scope and an unruly requirements list. Project scope clearly sets out what is or is not included in the project, and controls what gets added or removed as the project is executed. Scope management establishes control mechanisms to address factors that may result in changes during the project lifecycle.

Without defining project scope, the cost or time that the project will take cannot be estimated. At times, due to a lack of communication, scope may need to change. This directly affects the cost and disturbs the schedule of the project, causing losses. Scope management is not difficult to implement; however, it does require effort, time, and patience. It's well worth the investment—with proper scope management, you can specify a clear scope and deliver the project with minimal overruns. If you're studying for your PMP exam, consider online project management training from Simply learn. We offer a wide variety of project management courses taught by certified faculty with at least 10 years of industry experience.

III. CASE STUDY

Fig 3.1 eye view of actual site

3.1 SITE DETAILS

- Scope of Project: The builder wants to take competitive advantage using environmental factor. The major goal is to minimize the temperature naturally inside building
- Factors affecting scope: Materials, Architectural planning and orientation.
- Name of site : Cool homes
- Location of site : Cool homes, Ring road, behind Gajanan Maharaj Mandir, Bhusawal, Jalgaon.
- A G+4 proposed building of 24 flats and of 4 shops is taken for case study location is in Bhusawal.
- Design Team : Apex consultant
- Owner and Developer :Shivaji Patil
- Architect :Sneha Nichat
- Cost of project : 2.4 cr.
- Structural Engineer : Navneet Patil and Prashant Patil
- Builder :Praj Infra Solutions pvt.ltd.
- Area : 6400 sq.feet
- Residential building having 24 flats and 4 commercial road front shops.
- This Project is based on sustainable structure
- Present condition of the project : Excavation is done, now working on centre Lining of foundation.
- This project using heat resisting theme building project. (In bhusawal the temperature in summer rises up to 48-49 degree celc.
- Total 24 flats and 4 shops.
    i. 16 flats – 2 bhk
    ii. 8 flats – 1 bhk
    iii. 4 shops – commercial road front shops.

3.2 CENTRE LINE PLAN

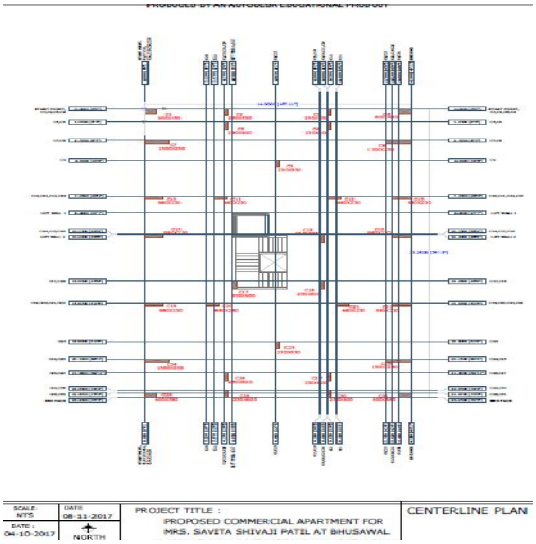

Fig 3.2 Setting Out Plan

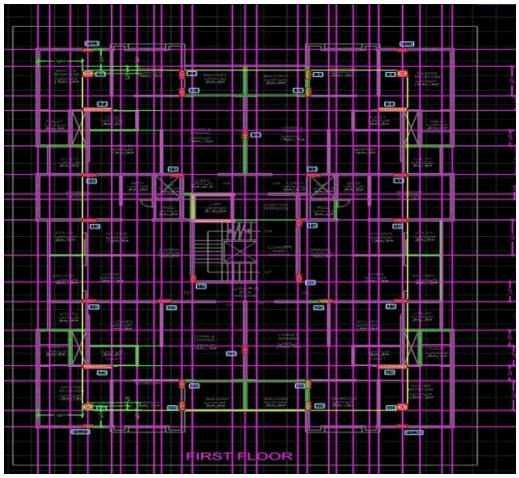

Fig no. 3.3: Centre Line Plan

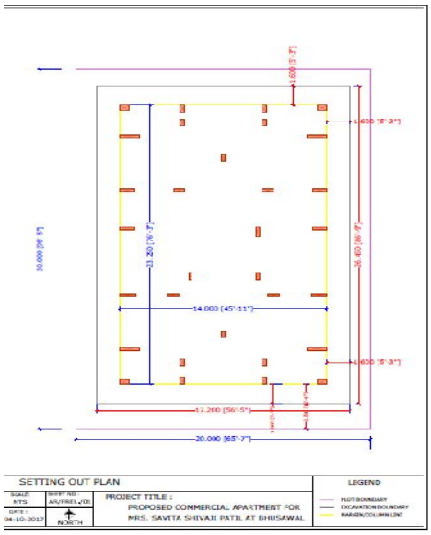

Fig 3.4: First Floor Centre Line Plan

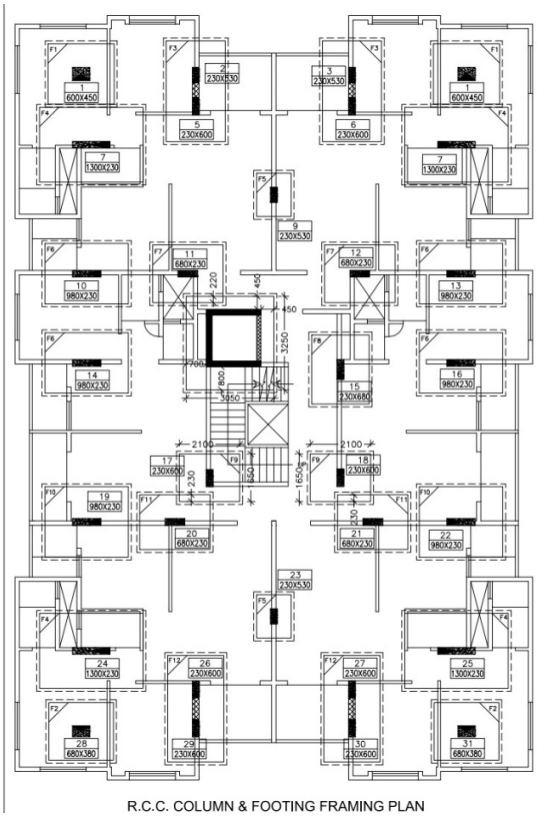

Fig 3.5R.C.C. COLUMN & FOOTING FRAMING PLAN

IV. CONCLUSION

1) The study investigated project scope management practices among organizations in the construction sector in Cool homes and examined the determinant factors for the choice of project scope management practices employed in the organizations

2) The study revealed that major project scope management practices employed by construction firms were define project scope, create work breakdown structure, verify scope, and control scope.

3) The factors shown to significantly influence the choice of project scope management practices were competitive advantage, organizational process assets, complex activity list, complex project scope statement, limited resources, fast tracking, and expert judgment.

4) The studies further revealed that the key significant impact of project scope management practices on project success were customer expectation, customer satisfaction, resource allocation and project duration.

5) The adoption of project scope management practices by construction organizations in Cool homes are majorly affected by 'Competitive advantage', 'Complex project scope statement', 'Client demand' and 'Return on investment'. This will eventually ensure profitability, better return on investment and continued market share.

REFERENCES

[1] Shweta Kasnale' ANALYZING PROJECT SCOPE DEFINITION COMPLETENESS BY USING PDRI FOR AN INFRASTRUCTURE PROJECT' ISSN: 2277-9655

[2] Maja-MarijaNahod' Scope Control Through Managing Changes in Construction Projects'

[3] Robert T. Hans' WORK BREAKDOWN STRUCTURE: A TOOL FOR SOFTWARE PROJECT SCOPE VERIFICATION'Vol.4, No.4, July 2013

[4] Davy B. 'Technical Report CS-2014-22 Multi-Agent Based Simulation in Software Project Management: Scope Management Representation and Visualization'

[5] Pierre-Majorique Léger1' Scope Management: A Core Information System Implementation Project Pedagogy' ISSN 1913-9020 E-ISSN 1913-9039

[6] A. O. Ogunberu' Factors Affecting the Choice of Project Scope ManagementPractices among Construction Organizations'

[7] TimoKäkölä' Validating the Design Theory for Managing Project Scope during Software Sourcing and\ Delivery'

[8] Chung-Suk Choand G. et al. (2001) evaluated the status of a building project during pre-project planning.

[9] Peter R. Dumont et al. (1997) et. al.measured and managed the level of scope definition as project planning progressed. Following are the highlights of their research.

[10] Chu Tih-Ju et al. (2014) developed IGBP-PDRI model to enhance the performance of project execution, in making buildings energy efficient and reduce carbon emissions

[11] Evan Bingham, G. Edward. Gibson (2016) have developed a novel risk management tool, called the project definition rating index (PDRI) for infrastructure projects,