Cabrera Ana., et. al. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 14, Issue 12, December 2024, pp 09-14

RESEARCH ARTICLE OPEN ACCESS

Project Management Maturity in Construction MSMEs in Southeastern Mexico

Cabrera Ana*, García Jesús**, Zaragoza Nicolás*, González José*
**Department of Construction, Universidad Autónoma de Yucatán, México*
*** Former graduate student, Universidad Autónoma de Yucatán, México*

ABSTRACT
The construction industry operates under strict deadlines, limited budgets, and extensive interaction among human resources from various knowledge fields. These factors, combined with the unique nature of each project, represent a significant challenge to management. This necessitates the implementation of project management, which is essential for planning, organizing, and supervising both resources and tasks required to achieve specific objectives within a defined time and cost frame. Although project management is not a new topic, it is crucial to measure its positive influence on the industry. This research evaluates the project management maturity level in the local construction sector. The study assessed the maturity level in areas such as initiation, planning, scheduling, execution, quality, and project closure through surveys conducted with 30 professionals in the sector. This descriptive, cross-sectional research with a quantitative approach used a structured questionnaire with closed-ended questions based on the 32 key practices outlined in the Organizational Project Management Maturity Model (OPM3). The findings revealed that construction project management in Southeastern Mexico currently ranks at a low maturity level, scoring 56.31%. According to CIM3, this places it at the upper boundary of immaturity level 1/3 and, according to OPM3, at the standardization process phase.
Keywords: Construction Companies, Maturity Models, Project Management.

Date of Submission: 01-12-2024 Date of acceptance: 11-12-2024

---

1. INTRODUCTION

Over time, there has been an increasing interest in identifying organizational needs related to various tasks, including the planning and control processes of projects. Such efforts aim to secure competitive advantages necessary for market sustainability.

In the 1980s, systematic project management was already recognized in the construction sector; however, its adoption was slow [1]. More recent research reveals that the sector has not yet to achieve solid level of implementation due to factors such as lack of knowledge and limited adaptability to the unique nature of construction projects [2].

Thus, assessing the current state of project management in construction companies is essential to establish a baseline, better understand their position, and generate improvement strategies that support market competitiveness [3].

To measure the degree of implementation of project management processes, maturity models are employed. These models compare organizations against a standard, judging their capability to execute successful and repeatable projects [4]. Maturity models diagnose an organization's ability to properly manage projects by establishing rules, procedures, and guidelines that contribute to continuous improvement [4].

Several maturity models exist, including the Organizational Project Management Maturity Model (OPM3) and the Construction Macro Maturity Model (CIM3). The latter is specifically designed for the construction industry and provides performance indicators (KPIs) that facilitate comparisons between countries and the development of improvement initiatives [5].

Studying project management maturity levels is crucial, as organizations with high maturity levels demonstrate greater success in terms of project efficiency and effectiveness, leading to competitive advantages in the market [6]. However,

despite the various maturity models developed in the past two decades, knowledge on their application within organizations remains scarce [6].

In Southeastern Mexico, no recent studies have measured construction project management maturity, despite the significance of industry contribution of 6-7% of the country's Gross Domestic Product (GDP) [7]. Additionally, infrastructure development projects significantly enhance societal quality of life. According to data from the National Institute of Statistics and Geography (INEGI), Mérida is home to 479 construction companies, mainly focused on residential and non-residential building projects, including shopping centers, industrial facilities, and service buildings [8].

The objective of this study was to measure the maturity level of the construction industry in Southeastern Mexico across the stages of initiation, planning, scheduling, execution, quality, and project closure

II. METHODOLOGY

This research employed a descriptive approach, considering the limited number of recent studies in the field. The study design was cross-sectional, aiming to describe the current state of the sector. The unit of analysis was the construction industry in Southeastern Mexico. According to data from the National Statistical Directory of Economic Units (DENUE), 479 construction companies operate in the selected municipality, divided between residential and non-residential projects. However, this study excluded non-construction companies, such as those providing related services [8].
To obtain meaningful results, the sample size was determined using (3) [9]:

$$n=\frac{N\cdot Z^2\cdot P\cdot Q}{E^2\cdot(N-1)+Z^2\cdot P\cdot Q} \qquad (3)$$

N = Population size
n = Desired sample size
Z = Statistical parameter related to confidence level
E = Maximum acceptable estimation error
P = Probability of the studied event occurring
Q = Probability of the studied event not occurring

The study used a 95% confidence level with a 5% margin of error. Assuming equal probabilities for P and Q (50%), the required sample size was 177. However, due to time and resource constraints, the study aimed for a minimum of 30 samples, supported by the Central Limit Theorem, which states that a sample size of 30 provides a good approximation to reality [10].

The OPM3 maturity model, considered the leading standard [11] [12], was used in this research. OPM3 encompasses approximately 488 best practices or indicators, of which half are applicable to construction project management. Experts in project management reduced this list to 32 practices, grouped into four milestones that align with aspects of the PMBOK framework. The reduction was based on their expertise, knowledge of the sector, project experience, procedures, and client demand [13]. Table 1 provides a list of these 32 key practices.

Table 1. List of 32 Key Practices (Indicators)

	Milestone: Initiation
1	Project Management Policies
2	Process for developing the project charter
3	Process for identifying project stakeholders
Milestone: Planning	
4	Process for developing the project management plan
5	Processes for defining the project scope
6	Processes for creating the Work Breakdown Structure (WBS)
7	Processes for defining project activities
8	Processes for sequencing project activities
9	Processes for estimating activity resources
10	Processes for estimating activity durations
11	Processes for developing the project schedule
12	Processes for estimating project costs
13	Processes for determining the project budget
14	Processes for planning project quality
15	Processes for developing the human resource plan
16	Processes for improving project communications
17	Processes for planning project risks
18	Processes for identifying and analyzing project risks
19	Processes for planning project procurements
	Milestone: Execution
20	Processes for directing and managing project execution
21	Processes for performing quality assurance
22	Processes for acquiring equipment, machinery, and tools
23	Processes for directing the project team

24	Processes for distributing project information
25	Processes for conducting project procurements
Milestone: Monitoring and controlling.	
26	Processes for monitoring and controlling project work
27	Processes for implementing project changes
28	Processes for controlling project scope
29	Processes for controlling the project schedule
30	Processes for controlling project costs
Milestone: Conclusion	
31	Processes for closing the project or project phases
32	Processes for closing project procurements

Based on this list, a closed-ended questionnaire was developed to evaluate the use of the 32 key practices. The instrument was administered to professionals working in construction companies. The questionnaire grouped questions into five process groups proposed by OPM3, and included four additional groups from CIM3, which is specific to the construction industry. General information about the respondents was also collected.

For each indicator, a quantitative scale from 1 to 4 points was used, Table 2 shows the criteria used:

Table 2. Scores and descriptions

Score	Description
1	Not present
2	Low
3	High
4	Optimal

Once the score for each indicator was determined, the ratings for each of the project management process groups were calculated. This rating was computed by summing the points obtained and dividing them by the maximum possible score, then multiplying by 100.

To determine maturity by group, the scale defined in the CIM3 model was used, as it allows for the evaluation of the different areas shared by construction projects and provides a direct maturity level. To classify the level of the evaluated areas, quantitative values were assigned to the CIM3 model scales as shown in Table 3.

Table 3. CIM3 Scale and Corresponding Quantitative Values

Indicator	Score
Immaturity (0)	0-30%
Immaturity (1/3)	31-60%
Transitional immaturity (2/3)	61-90%
Full maturity	90-100%

Finally, to define the overall maturity in project management, weights were established for each of the process groups considered in the measurement instrument. The basis was the number of key practices and the percentage of contribution in the OPM3 Model. A weight of 20% was assigned to the initiation and closure groups. These groups are considered to have the least weight due to their implications, as they are generally more administrative processes rather than construction specific. For the planning and execution areas, a weight of 30% was used because these groups require exhaustive and intensive management due to the amount of monetary, human, material resources, and dynamics involved. The control group was assigned a weight of 20% since this phase involves key activities for achieving the project's planned objectives. Finally, groups not included in the OPM3 were given a weight of 5%, except for the quality group, which was weighted similarly to the groups in the OPM3 Model. Table 4 shows the process groups and their weight to the general maturity.

Table 4. Process groups and contribution percentage to Maturity Model

Model	Group	Subgroup	%
OPM3	Project Initiation Management (AP)	N/A	10%
OPM3	Planning	Time Management (PT) Cost Management (PC)	15% 15%
OPM3	Control (CL)	N/A	20%
CIM3	Human Resource Management (RH)	N/A	5%
CIM3	Quality Management (CA)	N/A	15%
CIM3	Communication Management	N/A	5%

	(CO)		
CIM3	Risk, Health, and Safety Management (RSS)	N/A	5%
OPM3	Project Closure Management (CP)	N/A	10%

III. RESULTS

A total of 30 professionals from the construction industry participated in the study. Of these, 12 were employed in micro-enterprises, 9 in small enterprises, 5 in medium-sized enterprises, and 4 in large enterprises

Table 5 presents the maturity levels in project management for each respondent. The average maturity level was 56.31%, placing it at the upper boundary of the Immaturity (1/3) level, as defined in Table 3.

Table 5. General Maturity Level by Respondent

Percentage per respondent			
No.	%	No.	%
1	50.08%	16	48.47%
2	39.29%	17	43.83%
3	86.92%	18	58.42%
4	43.58%	19	56.88%
5	55.92%	20	37.89%
6	70.04%	21	31.56%
7	37.48%	22	73.55%
8	24.14%	23	64.61%
9	37.32%	24	75.41%
10	47.25%	25	72.98%
11	65.23%	26	88.99%
12	48.59%	27	69.86%
13	66.30%	28	87.45%
14	29.30%	29	69.96%
15	41.43%	30	62.14%

In addition, the maturity level of each of the nine areas considered in the measurement instrument was calculated. According to the analysis conducted, the local construction industry is at a transitional immaturity level in aspects such as work control, communication, and project budgeting, with scores of 68.65%, 78.13%, and 69.59%, respectively. Meanwhile, the aspects with the lowest scores are in the areas related to risks, health and safety, human resources, planning, and project initiation, with scores of 40.28%, 40.52%, 44.11%, and 45.60%. The results are presented in Table 6.

Table 6. Maturity Levels by Process Group

Process Group	Score	Maturity Level
Project Initiation	45.60%	Immaturity (1/3)
Scheduling	44.11%	Immaturity (1/3)
Budgeting	69.59%	Transitional Immaturity
Human Resources	40.52%	Immaturity (1/3)
Quality	52.07%	Immaturity (1/3)
Communication	78.13%	Transitional Immaturity
Risks, Health, and Safety	40.28%	Immaturity (1/3)
Project Control	68.65%	Transitional Immaturity
Project Closure	50.63%	Immaturity (1/3)
Overall Maturity Level	56.31%	Immaturity (1/3)

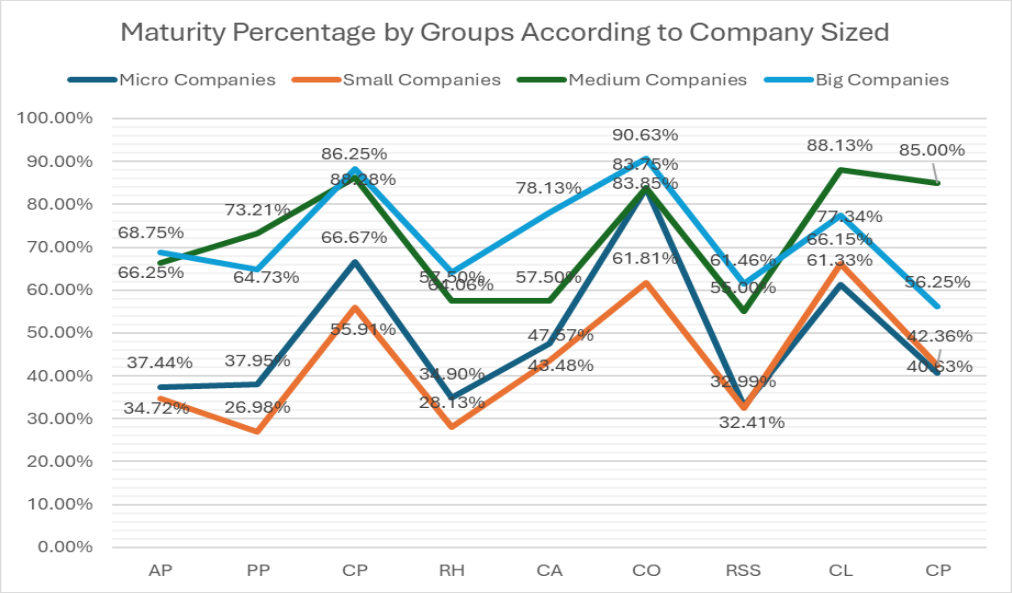
Results were also analyzed by company size. Figure 1 illustrates these findings. It was observed that in micro and small enterprises, the lowest scores are in project initiation, work scheduling, human resources, and risk management and analysis. The groups with the highest scores are budgeting, communication, and control. It is understandable that communication processes are at a high maturity level, as communication in small organizations tends to be fluid and direct. However, for the proper growth of the company, this starting point should be used to propose policies or guidelines that allow maintaining this level of maturity, even with future growth.

In contrast, medium and large enterprises scored lowest in quality and in managing risks, health, and safety, likely due to the inherent complexity of their organizational size and structure. These challenges require organized strategies, committed leadership, and a culture that values effective management. Issues such as bureaucratic inefficiencies may also slow decision-making processes and corrective actions, negatively impacting risk and quality management. However, medium and large enterprises excelled in initiation

and closure processes, often formalized through contracts specifying tasks and deliverables.

This analysis highlights areas of opportunity and strengths across companies of different sizes, enabling tailored guidelines to improve maturity levels according to organizational needs.

Figure 1. Maturity Levels by Company Size



IV. CONCLUSION

Construction project management in Southeastern Mexico currently exhibits a low maturity level, scoring 56.31%. According to CIM3, this score places the region at the upper boundary of the Immaturity (1/3) level, while OPM3 categorizes it within the standardization process phase.

Processes such as budgeting, communication, and project control achieved higher scores under the methodology used in this study. Conversely, the lowest scores were observed in risk, health, and safety management, human resources, and project scheduling, highlighting these as areas of opportunity for the local construction industry.

A notable weakness is that most processes in the local industry are based on past experiences rather than written standards. Research indicates that construction companies could benefit from implementing information systems to address the complexity of their processes. These systems would allow for detailed cost analysis and control, providing insights into variable trends over time to guide decision-making.

This aligns with observed differences between micro and small enterprises and medium to large enterprises. The latter often utilize manuals, policies, and procedural guidelines, contributing to their higher maturity levels.

It is recommended that micro and small enterprises adopt strategic planning practices, setting short-, medium-, and long-term goals. Developing manuals, guidelines, and policies would support achieving these objectives.

Future studies should consider case studies with direct observations within construction companies to gather primary data, as the findings of this research rely on perceptions from surveyed personnel.

REFERENCES

[1] C. Hendrickson and A Tung, Project Management for Construction: Fundamental concepts for owners, engineers and builders (Pittsburgh, PA: Prentice-Hall, 1989).
[2] B. Sánchez Saiz, Fundamentos y prácticas de gestión de proyectos y obras. (Pamplona, N: Universidad de Navarra, 2020)

[3] K. Eby (2024, apr 26). Cómo elegir un modelo de madurez de gestión de proyectos: 7 modelos, herramientas y evaluaciones [Online]. Available: https://es.smartsheet.com/content/project-management-maturity. [Accessed: 02-dic-2024].

[4] L. Solarte-Pazos and L.P. Sánchez-Arias, Gerencia de proyectos y estrategia organizacional: el modelo de madurez en Gestión de Proyectos CP3M© V5.0, INNOVAR. Revista de Ciencias Administrativas y Sociales, 24 (52), 2014,5-18.

[5] C.J. Willis, and J.H. Rankin, The construction industry macro maturity model (CIM3): theoretical underpinnings. International Journal of Productivity and Performance Management, 61 (4), 2012, 382-402.

[6] F. Blacklund, D. Chronéer and E.Sundqvist, Project Management Maturity Models – A Critical Review: A Case Study within Swedish Engineering and Construction Organizations. Procedia - Social and Behavioral Sciences, 119, (2014), 837-846.

[7] El sector de la construcción en México – Datos estadísticos", Statista. [Online]. Available: https://es.statista.com/temas/6622/el-sector-de-la-construccion-en-mexico/. [Accessed: 02-dic-2024].

[8] Instituto Nacional de estadística y geografía (2020). Directorio Estadístico Nacional de Unidades Económicas. DENUE. [Online]. Available: https://www.inegi.org.mx/app/mapa/denue/default.aspx. [Accessed: 02-dic-2024].

[9] QuestionPro. Tamaño de la muestra. [Online]. Available: https://www.questionpro.com/es/tama%C3%B1o-de-la-muestra.html. [Accessed: 02-dic-2024].

[10] H. Alvarado and C. Batanero, Significado del teorema central del límite en textos universitarios de probabilidad y estadística. Estudios Pedagógicos Online, 34(2), (2008), 7-28.

[11] KPMG International. Global Construction Survey 2015: Climbing the curve. [Online]. Available: https://assets.kpmg.com/content/dam/kpmg/pdf/2015/04/global-construction-survey-2015.pdf. [Accessed: 02-dic-2024].

[12] KPMG International. Project and programme management survey. [Online]. Available: https://assets.kpmg.com/content/dam/kpmg/pdf/2015/04/Project-Survey-Sweden-2015.pdf. [Accessed: 02-dic-2024].

[13] J. A. Morales Viveros and A. B. Rojas Meléndez, Evaluación del nivel de madurez en la gestión de proyectos de una organización caso de estudio. bachelor thesis, Universidad del Valle, Palmira V, (2012).