SciencePG
Science Publishing Group

BIM Implementation Plan in Building Works in the Design Stage in the Provincial Municipality of Puno

Yvan Huaricallo Vilca

Civil Engineering School, National University of the Highlands, Puno, Perú

Email address:
yhuaricallo@unap.edu.pe

Abstract: The construction industry in the public sector has failed in recent years, due to deficiencies in the management of processes in the tenders and the contractual execution of public works and this problem has been replicated in the Provincial Municipality of Puno, which is why the The main objective of this research is to know the consequences of the implementation of the Construction Information Model in the terms of reference formulated by the user area in the Provincial Municipality of Puno, the Survey method was used, based on an information survey. of the knowledge and uses of the methodology of the Construction Information Model that the officials and public servants of this entity have, a statistical history of the behavior of the works by contract in buildings from 2016 to 2020 was made, results such as as deficiencies in contractual and administrative procedures; That is why the projects in this entity are not successful and even most of the works do not have a technical-financial settlement to date. A mapping of the traditional processes used by the Provincial Municipality of Puno was carried out according to its organization chart and it has been detected that the process for a project to be viable at the design level is long and for the same project to be executed there are facts. bureaucratic; Therefore, a new mapping of processes is proposed with the methodology of the Construction Information Model to streamline the processes of the entity, and finally a proposal for improvement is proposed with the pilot plan or implementation of the approach of the terms of reference with guidelines of the methodology of the Construction Information Model in projects that are in the bidding stage to obtain a level of detail indicated in the technical specifications of each project.

Keywords: BIM, Process Map, Implementation, Terms of Reference

1. Introduction

The Peruvian state, through national government entities, has been promoting information models in construction through supreme decrees, legislative decrees, directorial resolutions and provisions for the progressive incorporation of this methodology in public investment. The BIM methodology proposes many changes with respect to the traditional way of working [1]. BIM uses add value to public projects; being the generation of various design proposals, four-dimensional planning and preventive maintenance programming BIM uses, applying them from early stages is also necessary for greater benefits and direct them to continue adding public value [2]. The deficiencies are found in the lack of details and incompatibility of specialties, architecture, structures and facilities [3], This leads to the deduction that the plans are not delivered to work compatible, since these deficiencies are not identified at the stage of the preparation of the Technical File (by consulting or prepared in the plant), as a consequence of which the Provincial Municipality of Puno in the period (2016-2019) it is found that 60% of works have been paralyzed in their contractual stage, and 100% of works by contract present deadline extensions [4]. The objectives of the research is to propose technical specifications with BIM guidelines in the terms of reference [5, 6], Know the consequences of bidding projects at the design level through consultative support. A diagnosis was made in the Provincial Municipality of Puno of the strategic processes, operational and support frameworks for engineering projects at the design level [7], identifying Peru in the context of investment. Statistics were made on the status of contract works tendered by the Municipality from 2016 to 2020, with the term extensions in most of these projects as a pathology [8]. In order to have results of the current management of the BIM methodology that the officials and servers of the Provincial Municipality of Puno have [9], I use the method of the Survey

of 17 people between officials and public servants who work in the areas related to design, construction, operation and works maintenance [10]. Once the current process map in the Provincial Municipality of Puno has been identified, a mapping of design processes with BIM implementation is proposed, working in 6 phases [11], working with inputs, processes and outputs in each of the phases, having as results plans, compatible technical specifications and a proposal for concurrent engineering meetings with those involved in the design stage [12]. With the use of these processes, statistics show that the projections of savings with the BIM methodology at the level of time saved during the execution stage of the project is 63 days, and at the level of costs in % saved with respect to the original amount of the contracts is 0.98%. Based on the collected flows, an evaluation of processes was carried out to define the general diagnosis, which details the strengths [13], weaknesses, opportunity and threats of the current state of the processes [14]. Based on this, the scope of the roadmap is established with short-term goals.
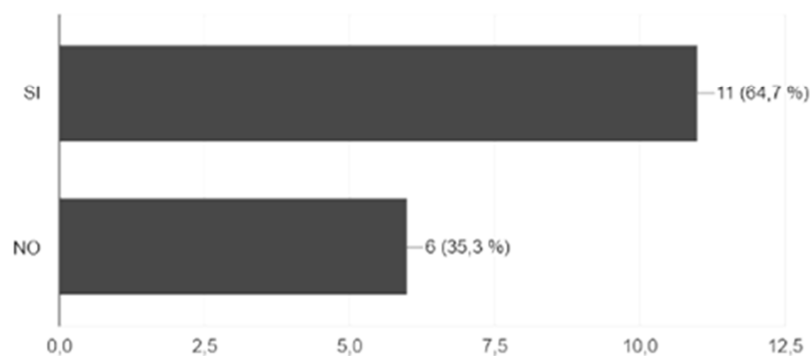
2. Materials and Methodology

This research is exploratory in nature because it focuses on a little explored and current topic. A case study was carried out through surveys using Google forms in the Provincial Municipality of Puno corresponding to the local government level in the BIM implementation plan in building works in the design stage [15]. This procedure seeks to identify the current management of the BIM methodology that officials and public servants have in the Provincial Municipality of Puno.

3. Results

In the first question: Do you know the BIM methodology, it is obtained that 64.7% know the BIM methodology, this is due to the fact that this methodology has been disseminated in Peru this year and they are more than half of the respondents, and 35.3% do not know or is just in the process of learning this methodology.
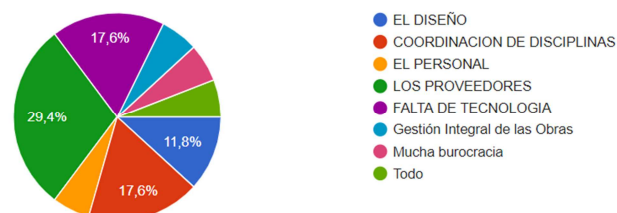

Source: self made

Figure 1. *First Question Survey.*
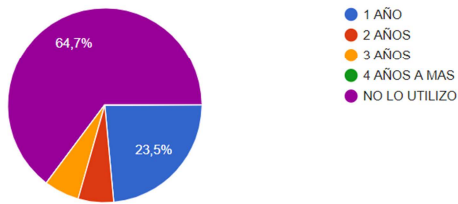

Source: self made

Figure 2. *Fourth question- Survey.*

This graph reflects that the most common deficiency in the work of the provincial municipality of Puno are the suppliers with 29.4%, this reflects that the purchases that generate the supply area are inefficient and as a consequence of them the projects request deadline extensions for Due to this reason for the non-supply of materials, in many cases the logistics area of the MPP structures the requirements together and waits for other user areas to be able to jointly upload them to SEACE for tenders or simplified awards.

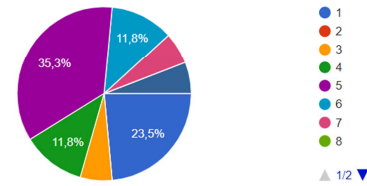¿CUANTO TIEMPO UTILIZA LA METODOLOGÍA BIM?

17 respuestas

Source: self made

Figure 3. *Eighth question- Survey.*

When asking the respondents how long they use the BIM methodology, 64.7% indicate that they have not yet used this methodology despite knowing some BIM software, this is also a response to the fact that this methodology in the public sector is recent and is in its infancy for the Peru and the other point is that in the Puno region, there are no construction companies that use these methodologies, they continue to execute works with traditional methodologies and professionals, no matter how much knowledge they may have of these BIM software, will not be able to apply it.

DEL 1 AL 10 QUE VALOR LE ASIGNARÍA A LA COMUNICACIÓN ENTRE ESTUDIOS Y OBRAS

17 respuestas

Source: self made

Figure 4. *Ninth question- Survey.*

When asking the respondents, what value would they assign to the communication that exists between the Office of Final Studies and the Office of Works and Maintenance of the Provincial Municipality of Puno is 35.3% who qualify the communication between these two as a medium term of the range. offices this response to all bureaucratic processes, workload of each office, and mainly the communication time between the execution of works and the preparation of technical files.

IMPROVEMENT PROPOSAL

The following graphs show the mapping of activities for the design and those involved.

Source: self made

Figure 5. *Phase N°06-ICE meetings with suppliers and workers.*

In Phase No. 06, an attempt is made to improve the model with the participation of strategic or key suppliers such as elevators, generator sets, metal covers, air conditioning, fire-fighting water, among others that have an incidental cost in the project. At the same time, the participation of

equipment suppliers is sought, which will be supported with 3 quotes so that the entity can evaluate and validate it in the ICE meetings that are being held during the design phases of the project [16].

In the Entries we have work sessions as a result of which are

the technical specifications of the specialties mentioned. In the processes we have the human resources to the project manager, BIM manager, the modeler and the strategic suppliers and in the Techniques and tools it is the analysis of the information and the judgment of exports or experts of those involved in the project. In the outputs we have the detailed Plans of Equipment, Furniture, Windows, glass partitions and Technical Specifications.

SAVINGS PROJECTION WITH THE BIM METHODOLOGY: The projection of money is about costs that have been generated in the history of the works studied in chapter III, and with respect to time, they are the excess times generated in the extensions of the term.

Time saved during the execution stage of the project using the BIM methodology	63 days
Money Saved in% by the Entity: with respect to the amount of the original contract.	0.98%

4. Conclusion

1) Through the surveys carried out in the Provincial Municipality of Puno to 17 people between officials and public servants, 64.7% know the BIM methodology this due to the permanent diffusion by the state, 85.7% manage some BIM software, it has been identified that the most common problems on site are the suppliers due to the bureaucracy of the same entity, however 88.2% of the respondents indicate that they do NOT know of any company or Municipality that has used the BIM methodology, that 58.8% of the respondents Prefer to use some BIM software unlike CAD, 70.5% use CAD for more than 4 years, 64.7% of respondents indicate that they have NOT yet used the BIM methodology.

2) A mapping of processes of the Provincial Municipality of Puno has been carried out where it can be verified that the processes are very slow and bureaucratic, processes have also been proposed during the BIM implementation within the Definitive Studies office in order for the processes to be more collaborative.

3) To date, the provincial municipality of Puno does not have a BIM implementation, and does not show much interest in implementing it, since its priority is to execute works by direct administration.

4) To date, the BIM implementation is in the beginning for standardization in the public sector, and is being explored through prototypes or pilot plans through definitive studies in tenders, these guidelines are helping to detect an enormous number of errors that they usually jump at the construction stage. Where we are anticipating errors in the design stage, this shows that the BIM methodology is bringing different benefits to the construction industry in the Peruvian state.

5) The terms of reference must include the specifications with the BIM methodology as a model so that the entity can tender the technical files and can carry out the follow-up through officials with this knowledge.

6) A roadmap has been proposed where, through a consultancy or initiative of the entity, a follow-up of BIM specialists is carried out for the start-up or prototyping with one or some technical files, bidding them and hiring a designer with BIM expertise to be able to generate models, and technical file with a level of detail indicated in the technical specifications of this research thesis.

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

Acknowledgements

References

[1] J. Salinas and G. Prado Luján, "Building information modeling (BIM) to manage desing and construction phases of Peruvian public projects = Building information modeling (BIM) para la gestión del diseño y construcción de proyectos públicos peruanos," *Building & Management*, vol. 3, p. 48, Aug. 2019, doi: 10.20868/bma.2019.2.3923.

[2] "PLAN DE IMPLEMENTACIÓN DE METODOLOGIA BIM.pdf." Accessed: Jun. 11, 2022. [Online]. Available: https://repository.ucatolica.edu.co/bitstream/10983/15347/1/PLAN%20DE%20IMPLEMENTACI%C3%93N%20DE%20METODOLOGIA%20BIM.pdf

[3] Y. Huaricallo Vilca and L. Montesinos Gallegos, "Implementación de BIM en obras de edificaciones en la Municipalidad Provincial de Puno," *Implementation of bim in building works in the provincial municipality of puno*, Oct. 2020, Accessed: Jun. 11, 2022. [Online]. Available: https://repositorioacademico.upc.edu.pe/handle/10757/653409

[4] A. Hussain, M. Jamil, M. U. Farooq, M. Asim, M. Z. Rafique, and C. I. Pruncu, "Project Managers' Personality and Project Success: Moderating Role of External Environmental Factors," *Sustainability*, vol. 13, no. 16, Art. no. 16, Jan. 2021, doi: 10.3390/su13169477.

[5] H. Begić and M. Galić, "A Systematic Review of Construction 4.0 in the Context of the BIM 4.0 Premise," *Buildings*, vol. 11, no. 8, Art. no. 8, Aug. 2021, doi: 10.3390/buildings11080337.

[6] A. J. McNamara and S. M. E. Sepasgozar, "Intelligent contract adoption in the construction industry: Concept development," *Automation in Construction*, vol. 122, p. 103452, Feb. 2021, doi: 10.1016/j.autcon.2020.103452.

[7] G. Demirdöğen, N. S. Diren, H. Aladağ, and Z. Işık, "Lean Based Maturity Framework Integrating Value, BIM and Big Data Analytics: Evidence from AEC Industry," *Sustainability*, vol. 13, no. 18, Art. no. 18, Jan. 2021, doi: 10.3390/su131810029.

[8] K. Dhawan, J. Tookey, A. GhaffarianHoseini, and A. GhaffarianHoseini, "Consolidating loads for sustainable construction in New Zealand: a literature review-based research framework," Smart and Sustainable Built Environment, vol. ahead-of-print, no. ahead-of-print, Jan. 2022, doi: 10.1108/SASBE-08-2021-0151.

[9] I. Musonda and C. Okoro, "Assessment of current and future critical skills in the South African construction industry," *Higher Education Skills and Work-based Learning*, vol. ahead-of-print, no. ahead-of-print, 637477344000000000, doi: 10.1108/heswbl-08-2020-0177.

[10] M. Regona, T. Yigitcanlar, B. Xia, and R. Y. M. Li, "Artificial Intelligent Technologies for the Construction Industry: How Are They Perceived and Utilized in Australia?," *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 8, no. 1, Art. no. 1, Mar. 2022, doi: 10.3390/joitmc8010016.

[11] M. Regona, T. Yigitcanlar, B. Xia, and R. Y. M. Li, "Opportunities and Adoption Challenges of AI in the Construction Industry: A PRISMA Review," *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 8, no. 1, Art. no. 1, Mar. 2022, doi: 10.3390/joitmc8010045.

[12] B. Succar, "Building information modelling framework: A research and delivery foundation for industry stakeholders," *Automation in Construction*, vol. 18, no. 3, pp. 357–375, May 2009, doi: 10.1016/j.autcon.2008.10.003.

[13] W. Liu, Z. He, H. Chen, and C. Lin, "Comparative Analysis Chinese Green Buildings' of Input–Output Effect Based on Data Envelope Analysis," *Buildings*, vol. 12, no. 5, Art. no. 5, May 2022, doi: 10.3390/buildings12050659.

[14] S. Perera, S. Nanayakkara, M. N. N. Rodrigo, S. Senaratne, and R. Weinand, "Blockchain technology: Is it hype or real in the construction industry?," *Journal of Industrial Information Integration*, vol. 17, p. 100125, Mar. 2020, doi: 10.1016/j.jii.2020.100125.

[15] V. L. Borges Viana and M. T. Marques Carvalho, "Prioritization of risks related to BIM implementation in brazilian public agencies using fuzzy logic," *Journal of Building Engineering*, vol. 36, p. 102104, Apr. 2021, doi: 10.1016/j.jobe.2020.102104.

[16] P. Metallinos, "Interpretation of the concept of 'discount' in Technical Works Tenders," *HOLISTICA – Journal of Business and Public Administration*, vol. 10, no. 1, pp. 16–23, Mar. 2019, doi: 10.2478/hjbpa-2019-0002.