

CHALLENGES OF VIRTUAL DESIGN AND CONSTRUCTION IMPLEMENTATION IN PUBLIC PROJECTS

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AGENDA

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- Finding the gap
- Aim and objectives
- Method
- Results
- Conclusions

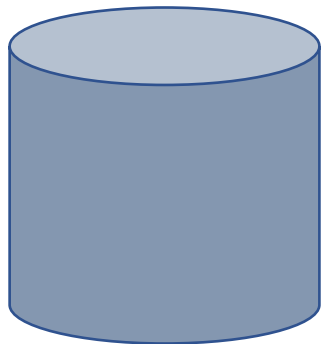
THE PROBLEM

- The drawbacks of the public sector projects are caused by poor management of the stages of planning and execution (design and construction), lack of government control, inherent fragmentation of the state contracting methods, financial obstacles, and incomplete basic engineering studies (Arnao, 2011). Therefore, the current problems are presented as project delivery delays, overbudget, and mistrustfulness from the stakeholders involved in this kind of projects.
- Since 2018 several Peruvian laws have established the adoption of Building Information Modeling (BIM) to enhance the delivery of public infrastructure. Although, the idiosyncrasy presented in the Peruvian public sector generates a strong rejection to this new project management approach

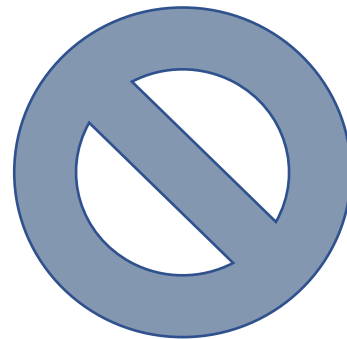
FINDING THE GAP

Several literature has shown the limitations and challenges on the implementation of VDC in a specific stage of a project and also in a wider implementation of VDC in the AEC industry.

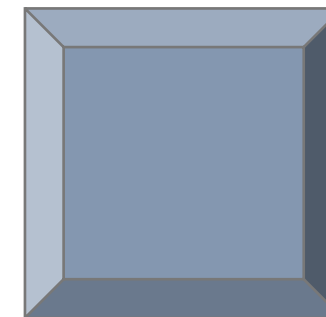
There is no study that addresses the VDC implementation challenges from the public client perspective and no study has analyzed the VDC implementation process in the Peruvian public sector.



Geometry and scheduling issues, and the linking of the geometry and the schedule (Heymaker and Fischer, 2001)



Lack of owner request or willingness to use VDC in its projects, the culture of minimizing cost in the AEC industry (Kunz and Fischer, 2012)



The reduction of the opportunities for collaboration between stakeholders due to the design-bid-build delivery method (Teixeira, 2014)

AIM AND OBJECTIVES

Aim: To determine the challenges found in the VDC implementation of Peruvian public projects.

Objectives:

- Create a “schema” for the VDC implementation challenges of the literature.
- Analyze the VDC implementation in a Peruvian public project developed by the author.
- Assess the VDC implementation experience with the schema of challenges.

METHOD

- The **first step** is collecting relevant studies in order to create a 'schema' for the challenges in VDC implementation. The material collected by the search is analyzed and classified based on a criterion, which defines the types of challenges in VDC implementation.
- The **second step** is studying the monthly reports (metrics) of the Peruvian public project presented to the Stanford professors by the author throughout the conference calls.
- The **third step** is applying the same criteria used in the schema presented in step one to determine the challenges of the VDC implementation of the Peruvian public project analyzed in step two.

RESULTS (schema of VDC implementation challenges)

Type of challenge	Challenge	Reference
Legal issues and contracting methods	Define the scope of the implementation of VDC while the project is being developed because it was not defined in the requirements documents (EIR, contracts, etc.).	Teixeira 2014; Kunz et al. 2012
	Define the responsibility of licensed professionals in this multi-contributors environment.	Criminale et al. 2017
	Require the participation of the general contractor since the design stage of the project, despite the contract does not allow it.	Khazode, et al. 2008; Sun et al. 2017; Teixeira 2014
	Use data from BIM models produced during the VDC implementation to take decisions during the project, despite the contract does not state it.	Criminale et al. 2017; Chan 2014

Table 1. Schema for the challenges of VDC implementation (I)

RESULTS (schema of VDC implementation challenges)

Type of challenge	Challenge	Reference
Culture of the organization	Develop plans, protocols, standards, etc. before starting the VDC implementation.	Criminale et al. 2017; Chan 2014; Sun et al. 2017; Azhar et al. 2007
	Promote and create the proper environment for the involvement and collaboration between stakeholders (subcontractors, end-users, etc.) in the VDC implementation.	Khanzode, et al. 2008; Criminale et al. 2017; Sun et al. 2017; Azhar et al. 2007; Teixeira 2014; Kunz et al. 2012
	Involve all the departments of the institution in the VDC implementation process lead by the general managers of the institution.	Criminale et al. 2017; Sun et al. 2017; Kunz et al. 2012
	Consider the whole lifecycle of the project looking for integration between its stages.	Khanzode, et al. 2008; Sun et al. 2017; Kunz et al. 2012
	Promote the use of digital format documents and data instead of continuing working with printed documentation.	Azhar et al. 2007

Table 1. Schema for the challenges of VDC implementation (II)

RESULTS (schema of VDC implementation challenges)

Type of challenge	Challenge	Reference
People	Capacitate the professionals from the stakeholders (client and providers) in a short period of time to implement VDC in the project.	Criminale et al. 2017; Chan 2014; Sun et al. 2017; Kunz et al. 2012
	Break the resistance to change from the professionals involved in the project to implement VDC.	Criminale et al. 2017; Sun et al. 2017; Teixeira 2014; Kunz et al. 2012

Table 1. Schema for the challenges of VDC implementation (III)

RESULTS (VDC experience of the author)

Centro de Emergenia Mujer (CEM) was module inside a police building and the client was the Ministry of Interior (MININTER). The delivery method of this project was Design-Bid-Build (DBB), and the legal framework used involved the State Contracting Law of Peru and the National System of Multi-year Programming and Investment Management INVIERTE.PE.

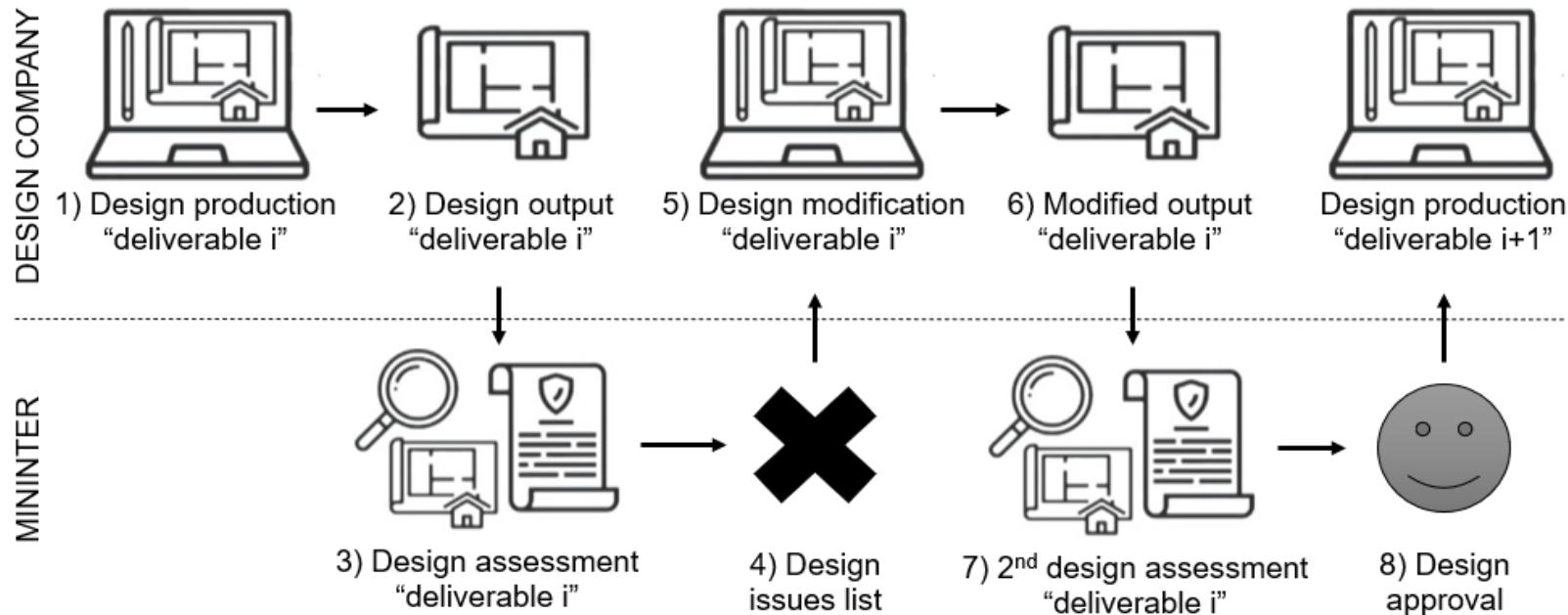


Figure 2. Design production and design assessment of typical Peruvian public projects.

RESULTS (Challenges related to legal issues and contracting methods)

- To involve a general contractor in the project design, despite the CEM project was delivered by the DBB method, which does not allow the involvement of contractors in early stages of the project. The State Contracting Law of Peru states restrictions for applying other delivery methods (Design-Build) and most of the public institutions must use DBB, which does not allow to implement VDC collaboratively.
- To deal with the contractual conditions between MININTER and the members of the assessment team hired by this institution. Most of the architects and engineers hired by MININTER did not even have a contractual obligation of being located inside the MININTER offices, which caused delays in the project design assessment.

RESULTS (Challenges related to the culture of the organizations)

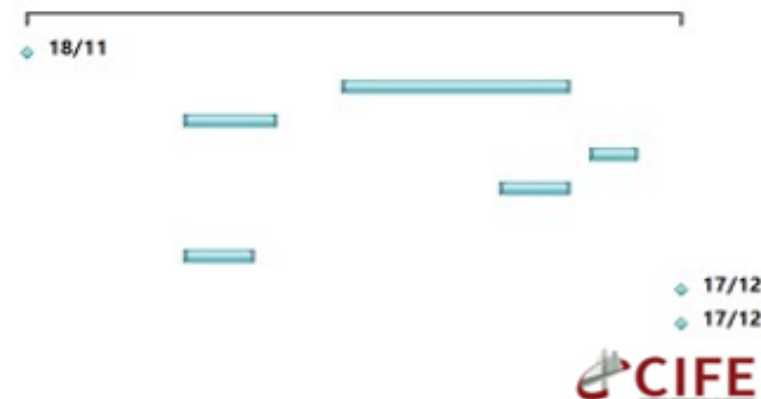
- The lack of knowledge of the internal procedures and current status of MININTER, which lead us to produce process maps with almost all the departments of MININTER as its managerial documents did not show the information flow between the departments inside this institution.
- The lack of a collaborative working approach inside the institutions is a big challenge experienced. The PPM metric 'assessment time per deliverable (production of review)' shown in the next figure helps to understand this challenge.

RESULTS (Challenges related to the culture of the organizations)

PPM METRICS

MOTIVO	IN - CEM (Coord)	ARQ			ESTR			IISS			IIEE			BIM			COSTO Y PPTO			OUT - CEM		OPS-OGIN
		IN	OUT	Dif.	IN	OUT	Dif.	IN	OUT	Dif.	IN	OUT	Dif.	IN	OUT	Dif.	IN	OUT	Dif.	Coord.	Dif.	
ENTREGA 1	18/11/2019	01-dic	13-dic	12	25-nov	28-nov	3	13-dic	16-dic	3	09-dic	11-dic	2			0	25-nov	27-nov	2	17-dic	29	17-dic
ENTREGA 2				0			0			0			0			0			0		0	
ENTREGA 3				0			0			0			0			0			0		0	
ENTREGA 4				0			0			0			0			0			0		0	
SUBSANACIÓN FA (1ERAVEZ)				0			0			0			0			0			0		0	
SUBSANACIÓN FA (2DA VEZ)				0			0			0			0			0			0		0	
SUBSANACIÓN FA (3ERAVEZ)				0			0			0			0			0			0		0	
SUBSANACIÓN FA (4TAVEZ)				0			0			0			0			0			0		0	

LAMUD ENTREGA 1 ETAPA 3	29 días?	Inicio	Fin
ingreso al CEM	0 días	lun 18/11/19	lun 18/11/19
arq.	10 días	lun 02/12/19	mié 11/12/19
est	4 días	lun 25/11/19	jue 28/11/19
iiss	2 días	vie 13/12/19	sáb 14/12/19
iiee	3 días	lun 09/12/19	mié 11/12/19
bim			
cos.ppto	3 días	lun 25/11/19	mié 27/11/19
salida del CEM	0 días	mar 17/12/19	mar 17/12/19
notificación OES. OGIN	0 días	mar 17/12/19	mar 17/12/19



PROJECT PRODUCTION INSTITUTE

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Figure 3. Isolated work between professionals.

RESULTS (Challenges related to the people)

- The lack of VDC capabilities and misconception of this method from the team members of MININTER and from the design company affected negatively the project. The team members of the design company argued that they believed that BIM was a 3D model that can produce the drawings “rapidly” without any additional effort.
- The ICE metric ‘% of people (designers) involved in the solutions’ shown in the next figure represents the lack of commitment of the designers (hired by the design company) to develop proper solutions to the technical issues addressed during the ICE sessions as no ICE session was fully attended by the designers.

RESULTS (Challenges related to the people)

ICE SESSIONS METRICS

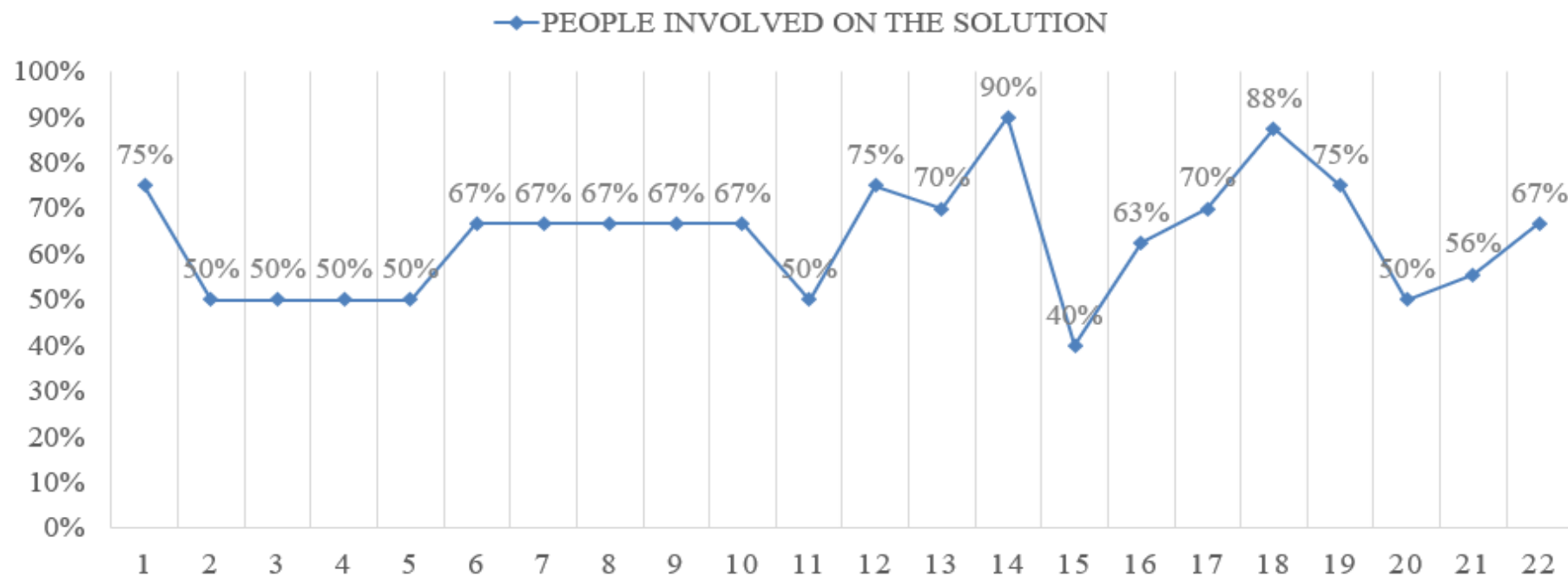


Figure 4. People involved on the solutions of the problems throughout ICE sessions.

CONCLUSIONS

The types of challenges are related: the legal framework generates fragmentation throughout the development of the project and between the parties involved in it. The parties involved in the project lack collaboration, due to the legal framework and the inherent resistant-to-change culture of the Peruvian AEC industry, which generates a lack of commitment between the stakeholders (people).

The implementation of VDC (metrics) makes transparent inherent problems related to the management of Peruvian public projects, as the production metrics provide data to control times and demonstrate that the implementation of VDC must overcome several challenges, not only in the project and people level, but in the organizational and legal framework level too.

THANK YOU!

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