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The Impact of the Covid-19 Pandemic Crisis on BIM Architectural Practice in France

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Abstract:
The pandemic crisis of covid-19 has affected the world of industry and construction worldwide. In France, the government has made lockdown and telecommuting mandatory for some areas for months. In recent years, the BIM (building information model) is increasingly adopted in construction, research has shown that in France, agencies that use BIM software and regularly exchange their digital BIM models with their partners are a minority, and that France is not a leader in this field. In this research we will answer the question of how the Covid-19 pandemic crisis has impacted BIM architectural practice in France, based on questionnaires sent to architectural design offices, we will demonstrate the new collaborative tools used and their contributions to the adoption of BIM in agencies.
Keywords: BIM; covid-19; architectural practice; collaboration; France.

1. Introduction

In December 2019, a COVID-19 pulmonary epidemic emerged in Wuhan, the World Health Organization qualified it on March 11, 2020 as a global pandemic (Ranney et al., 2020). More than 85 countries were infected in a short time (Woertz, 2020).
The spread of the virus has resulted in a large number of deaths and has strongly impacted the medical sector. (Choudhury et al., 2020) To deal with the spread of the COVID-19 virus, several countries have imposed strict restrictions, the introduction of a total or partial quarantine (self-isolation of the population, shutdown of all non-vital businesses) and the cessation of transportation.
This research will concern the construction industry in France. The pandemic has affected all industries and sectors as many restrictions have been imposed in all countries. The construction sector has been strongly impacted. (Al Amri & Marey-Perez, 2020) According to a study by Price Waterhouse Coopers[1] (2020), there are three main concerns caused by COVID-19 for engineering and construction. The concerns are financial, international recession, and influence on the workforce. Architectural organizations in all countries have proposed strategies for adapting to the Coronavirus on the construction site for architects, builders, contractors.
In France, the government has set up recommendations and sanitary measures such as hygienic "barrier gestures" and physical distancing. Restrictions of travel to the strict necessities (food shopping, care and work when telecommuting is not possible), outings near the home (individual sports activity, dog hygiene), the closure of borders in the Schengen area as well as the penalization of violations related to these new rules, The interdiction of movement in several forms (national containment, partial) depending on the number of cases in the regions on three occasions:
from March 17 to May 11, 2020 not included, that is 1 month and 25 days;
from October 30 to December 15, 2020 (1 month and 15 days);
from April 3 to May 3, 2021, i.e. 28 days.
The confinement has pushed a large part of the agencies to move to telecommuting and exchange information in digital format. In some countries such as the United Kingdom, agencies and architectural offices are working in BIM Building Information Modeling unlike France where BIM is still in its infancy (Hochscheid, 2021).
The Building Information Modeling (BIM) is a method of construction of a digital model offering the possibility of assembling, in the same model, multiple information specific to the various trades participating in the project. The information shared on the model (properties, geometries, access rights, text documents, etc.) allows different actors to work together on the same medium (Aurélie de Boissieu, 2013) (Kocatürk & Medjdoub, 2011).
This method could have facilitated the work of actors during the containment. But according to the survey of (Hochscheid & Halin, 2020) in France 12% of agencies use a BIM software and regularly exchange their digital models BIM with their partners, 30% of agencies do not work at all with BIM practices but theyuse a modeling software "BIM" without carrying out exchanges BIM with its partners, and 58% of agencies do not work at all with BIM practices.

2. Material and Methods

[1] PricewaterhouseCoopers. (2020). COVID-19: What it means for engineering and construction: PwC. Retrieved May 27, 2020, from PwC website: https://www.pwc.com/us/en/library/covid-19/coronavirus-impacts-engineering-construction.html

Government restrictions and sanitary measures have impacted the economy of several countries, such as Oman where (Al Amri & Marey-Perez, 2020) construction has been considered the mainstay of the country's economy and tourism.
In France, the recommendations of covid-19 have influenced and changed architectural practices from the design stage in the agency to the construction site.
Al-Ashmori et al (Al-Ashmori et al., 2020) show that agencies working with BIM have the advantage of reducing the complexities and difficulties of managing a project (He et al., 2017). BIM improves the communication process, provides a collaborative platform and supports interoperability between different business areas (Alreshidi et al., 2017), (Ghaffarianhoseini et al., 2017), (Miettinen & Paavola, 2014), (Oraee et al., 2017). Furthermore, BIM can increase performance and improve productivity throughout the project life cycle if successfully implemented (Migilinskas et al., 2013) (Nick & Gary, 2020), (Haron et al., 2015), (Azhar, 2011).
We have established this research because the French government since a few years has started to take interest in BIM. It had set as a goal a BIM plan in place and implemented by early 2022. With teleworking many sectors have gone digital. The purpose of our research is to answer the following question: “how the pandemic crisis of Covid-19 has impacted the architectural practice of BIM in France and the use of digital in the field of architecture?”.
To do this in this paper our work will be divided into two phases:
Phase 1: Government decisions in relation to the construction sector: We will start with a literature review and collection of information on government decisions towards the construction sector.
Phase 2: Case study. Based on Elodie Hochsheild's(Hochscheid & Halin, 2020) research on the BIM practice of agencies, we have drawn up a questionnaire and sent it to architectural agencies in order to make a comparison before and after COVID-19 and to follow the evolution of BIM practices in the agencies.

3. Results

Phase 1: Government decisions in relation to the construction sector during the project review in France

From a practical point of view

In France, in Tableau 1, the Order of Architects declared on March 16, in relation to the health situation, recommendations for all actors in the construction sector during the different phases of the project, in our research we will take into consideration only the first phase of design and project study (*Coronavirus*, 2020a) (*Coronavirus*, 2020b)

Tableau 1: The French government's recommendations to architectural agencies.

Recommendations for consideration	Parties concerned
The implementation of teleworking by equipping computer workstations with adapted software, and informing their clients of the probable impossibility of meeting their contractual deadlines in the study phase.	architects and their partners in project management
The College invites caution and recommends not accepting a continuation of activity if the sanitary conditions cannot be met. In the case of a site visit, if the barrier measures are applicable and the sanitary conditions are met, it is possible to go there. As concerns dialogue with the project owner, the government's instructions aim to limit contact as much as possible, so it is preferable to favour telephone or video-conference contact.	architects
The time limit for the instruction of authorisations under instruction on 12 March can be suspended until 24 May 2020. From 24 May onwards, the classic instruction period would resume. This does not mean resuming the procedure with a full deadline, but continuing the appraisal initially started. For authorisations filed between 12 March and 23 May 2020, the starting point of the appraisal period will be postponed to 24 May 2020. In practice, the purpose of this order is not to systematically suspend the investigation of building permit applications but only to adapt the rules to allow the investigating departments that do not have the human or material resources to postpone it to 24 May 2020. This means that applications for planning permission that should and/or must be examined between 12 March 2020 and 24 May 2020 can be examined. Local authorities that have already taken the step of dematerialising planning permission (compulsory from 1 January 2022) are organising themselves to continue examining applications.	urban planning department and project management

From an economic point of view

The deadline for payment of professional fees, which was set for 31 March 2020, has been extended to 31 May 2020.

The URSSAF (Union for the recovery of social security contributions and family allowances) and business tax service networks have taken exceptional measures (Coronavirus, 2020b).
As regards URSSAF:
For companies: possibility of postponing the payment date for employee and employer contributions scheduled for 15 March 2020 by up to three months.
For self-employed workers: the monthly due date of 20 March will not be deducted, and they may request payment deadlines, an adjustment of the contribution schedule or the partial or total coverage of their contributions, or the allocation of exceptional aid.
With regard to corporate taxes:
For companies: possibility of requesting the postponement without penalty of the payment of their next direct tax instalments.
For self-employed workers: possibility of modulating the rate and instalments of the withholding tax.
All these points have been demanded by the president of the order of architects who has issued a request to the Minister of the Economy and the Minister of Culture in order to alert them to the consequences of the ordinance extending the deadlines for the instruction of town planning authorisations as well as to the inadequacy of the calculation of support measures for architectural agencies(*Instruction des permis et aides aux entreprises*, 2020).
In (*Résultats de l'enquête "Comment va votre agence ?*, 2021), there have been many surveys on the impact of Covid-19 on architectural agencies from an economic and architectural practice point of view, and the Ordre des Architectes in its survey "How is your agency doing?" asks about the financial situation of agencies and the state of their cash flow.
The information website for construction professionals Batiactu has also carried out a survey on ACTIVITY, INNOVATION AND PROFESSIONAL PRACTICES.

Phase 2: Case study

Since March 14, 2022 the French government has removed most of the restrictions and sanitary measures (vaccination pass, mask in public places), after which we decided to start our survey within architectural offices and agencies. Our survey focuses on the impact and evolution of BIM practice and the changes in architectural practice in offices and agencies due to COVID-19 pandemic. In this article we will analyse the responses of 4 architectural practices in France.
We have taken two sizes of agencies, 2 small agencies with 1 to 5 employees and 2 medium sized agencies with 6 to 11 employees.

The impact of the COVID-19 pandemic on the economic side of the agencies

For the small agencies: one agency laid off staff because of the pandemic and did not hire at the same time, and the other only hired.
For medium-sized agencies: one agency laid off and hired staff and the other neither hired nor laid off during the pandemic.

Tableau 2: The impact of the COVID 19 pandemic on the economic aspects of institutions related to staff layoffs and employment

Agency size	Small agency		Average agency	
Dismissal	yes	no	yes	no
Recruitment	no	yes	yes	no

Teleworking in architectural offices

The French government had announced a confinement 3 times for a total duration of more than 3 months, according to the survey we have one agency out of two which did not telework for several reasons (unavailability of equipment, non-respect of the recommendations...). The agencies that have teleworked confirm that they have done so for a period of between 1 and 3 months.

Tableau 3: Teleworking in architectural offices

Agency size	Small agency		Average agency	
Teleworking	yes	no	yes	no
Duration of telework	From 1 to 3 months	0	From 1 to 3 months	0

Collaborative work in an architectural practice

In order to measure the level of BIM and collaborative working, we asked about the workflow within the agency.
One agency confirmed that they work collaboratively on the same project and that everyone does their own part of the work.
In three agencies the stakeholders work individually, each stakeholder works on their own project from start to finish.

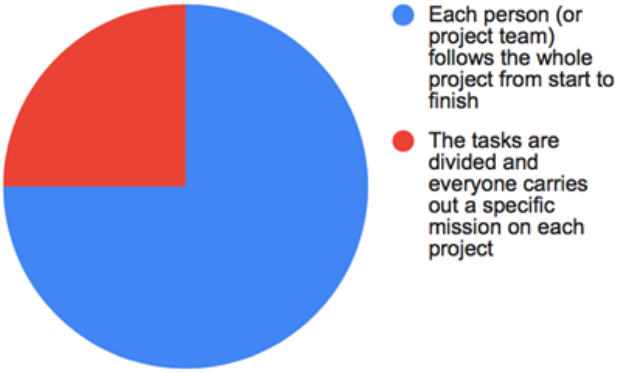

Figure 1: Division of tasks within the same project within the agency.

Integration of new technologies

In three agencies the managers have a supportive attitude to change, including one agency that has implemented a BIM system. However, in one agency the managers are indifferent.

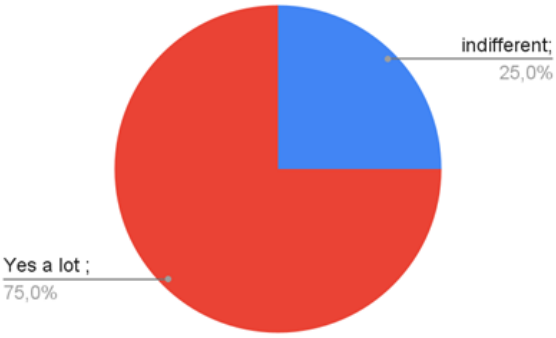

Figure 2: The use and integration of new technologies within the company by managers**.**

Methods of exchange within the agency

100% of the agencies questioned confirmed the use of a common physical server, although 50% of the agencies still exchange information by email and 25% use USB keys to transfer files.

Level of digital implementation in agencies

According to the agencies surveyed in Figure 3, digital practices in agencies have not changed after the pandemic and the level of application is the same before and after COVID-19.

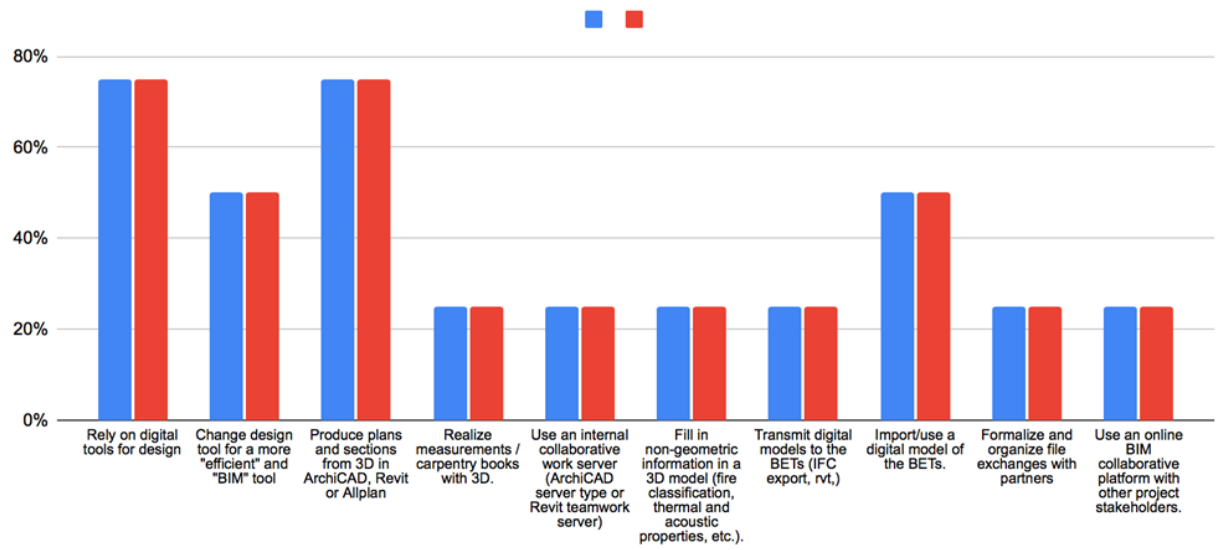

Figure 3: The level of digital integration and BIM practices in agencies before and after covid-19.

4. Discussion

This research has not been done for a long time, we will continue to generate more responses and send the questionnaire on other platforms to get more responses, then we will make a comparative analysis with previous surveys that were conducted before the COVID-19 to be able to reach conclusions.

5. Conclusion

From the analysis of the results we can deduce that despite the pandemic and the situation in which the agencies found for more than 3 months.Only 30% of the agencies are confident about digitalization. More than half of the agencies are not thinking of using BIM in the near future.

One of the main causes is that BIM replaces the architect.

Our proposal to answer this problem is to make seminars / webinars to inform and sensitize agencies and reassure architects on the issue of BIM

This research was prepared for the conference and is not yet complete because a very important number of agencies have not yet responded to the survey.

References

Al Amri, T., & Marey-Perez, M. (2020). *Impact of Covid-19 on Oman's Construction Industry*. *9*, 2020. https://doi.org/10.47577/tssj.v9i1.1021

Al-Ashmori, Y. Y., Othman, I., Rahmawati, Y., Amran, Y. H. M., Sabah, S. H. A., Rafindadi, A. D., & Mikić, M. (2020). BIM benefits and its influence on the BIM implementation in Malaysia. *Ain Shams Engineering Journal*. https://doi.org/10.1016/j.asej.2020.02.002

Alreshidi, E., Mourshed, M., & Rezgui, Y. (2017). Factors for effective BIM governance. *Journal of Building Engineering*, *10*, 89-101. https://doi.org/10.1016/j.jobe.2017.02.006

Aurélie de Boissieu. (2013). *Modélisation paramétrique en conception architecturale : Caractérisation des opérations cognitives de conception pour une pédagogie—Recherche Google* [Ecole Nationale Supérieure d'Architecture Paris la Villette Ecole Doctorale Ville Transports et Territoires, PRES Paris Est]. https://www.google.com/search?q=Mod%C3%A9lisation+param%C3%A9trique+en+conception+architecturale+%3A+Caract%C3%A9risation+des+op%C3%A9rations+cognitives+de+conception+pour+une+p%C3%A9dagogie&rlz=1C1CHBF_frFR884FR884&oq=Mod%C3%A9lisation+param%C3%A9trique+en+conception+architecturale+%3A+Caract%C3%A9risation+des+op%C3%A9rations+cognitives+de+conception+pour+une+p%C3%A9dagogie&aqs=chrome..69i57.3125973j0j7&sourceid=chrome&ie=UTF-8

Azhar, S. (2011). Building Information Modeling (BIM) : Trends, Benefits, Risks, and Challenges for the AEC Industry. *Leadership and Management in Engineering*, *11*(3), 241-252. https://doi.org/10.1061/(ASCE)LM.1943-5630.0000127

Choudhury, P. R., Ghosh, R. K., & Sindhi, S. (2020). Covid-19 Crisis, Pandemic Resilience and Linkages to Land : An Exposition. In *Working Papers* (id:13058; Working Papers). eSocialSciences. https://ideas.repec.org/p/ess/wpaper/id13058.html

Coronavirus: Déclaration du Conseil national de l'Ordre des architectes. (2020a, mars 16). Ordre des architectes. https://www.architectes.org/actualites/coronavirus-declaration-du-conseil-national-de-l-ordre-des-architectes

Coronavirus : Questions juridiques. (2020b, mars 25). Ordre des architectes. https://www.architectes.org/coronavirus-questions-juridiques

Ghaffarianhoseini, A., Tookey, J., Ghaffarianhoseini, A., Naismith, N., Azhar, S., Efimova, O., & Raahemifar, K. (2017). Building Information Modelling (BIM) uptake : Clear benefits, understanding its implementation, risks and challenges. *Renewable and Sustainable Energy Reviews*, *75*(C), 1046-1053.

Haron, A. T., Marshall-Ponting, A. J., Zakaria, Z., Nawi, M. N. M., Hamid, Z. A., & Kamar, K. A. M. (2015). An industrial report on the Malaysian building information modelling (BIM) taskforce : Issues and recommendations. *Malaysian Construction Research Journal*, *17*(2), 21-36.

He, Q., Wang, G., Luo, L., Shi, Q., Xie, J., & Meng, X. (2017). Mapping the managerial areas of Building Information Modeling (BIM) using scientometric analysis. *International Journal of Project Management*, *35*(4), 670-685. https://doi.org/10.1016/j.ijproman.2016.08.001

Hochscheid, E., & Halin, G. (2020, janvier 31). *Le BIM dans les agences d'architecture (France).* Ordre des architectes. https://www.architectes.org/le-bim-dans-les-agences-d-architecture

Hochscheid, E. (2021). Diffusion, adoption et implémentation du BIM (Building Information Modeling) dans les agences d'architecture en France.

Instruction des permis et aides aux entreprises : Le CNOA demande un soutien à l'activité des architectes. (2020, mars 31). Ordre des architectes. https://www.architectes.org/actualites/instruction-des-permis-et-aides-aux-entreprises-le-cnoa-demande-un-soutien-l-activite-des

Kiviniemi, A., Karlshøj, J., Tarandi, V., Bell, H., & Karud, O. J. (2008). *Review of the Development and Implementation of IFC compatible BIM*. https://orbit.dtu.dk/en/publications/review-of-the-development-and-implementation-of-ifc-compatible-bi

Kocatürk, T., & Medjdoub, B. (Éds.). (2011). *Distributed intelligence in design*. Wiley-Blackwell.

Miettinen, R., & Paavola, S. (2014). Beyond the BIM utopia : Approaches to the development and implementation of building information modeling. *Automation in Construction*, *43*, 84-91. https://doi.org/10.1016/j.autcon.2014.03.009

Migilinskas, D., Popov, V., Juocevicius, V., & Ustinovichius, L. (2013). The Benefits, Obstacles and Problems of Practical Bim Implementation. *Procedia Engineering*, *57*, 767-774. https://doi.org/10.1016/j.proeng.2013.04.097

Nick, A., & Gary, H. (2020). *Digital Product Data for Lifting Productivity*. Branz. https://d39d3mj7qio96p.cloudfront.net/media/documents/ER56_Digital_product_data_LR12038.pdf

Oraee, M., Hosseini, M. R., Papadonikolaki, E., Palliyaguru, R., & Arashpour, M. (2017). Collaboration in BIM-based construction networks : A bibliometric-qualitative literature review. *International Journal of Project Management*, *35*(7), 1288-1301. https://doi.org/10.1016/j.ijproman.2017.07.001

Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical Supply Shortages—The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. *New England Journal of Medicine*, *382*(18), e41. https://doi.org/10.1056/NEJMp2006141

Résultats de l'enquête « Comment va votre agence? Etat des lieux et perspectives ». (2021, janvier 12). Ordre des architectes. https://www.architectes.org/actualites/resultats-de-l-enquete-comment-va-votre-agence-etat-des-lieux-et-perspectives

Woertz, E. (2020). *COVID-19 in the Middle East and North Africa: Reactions, Vulnerabilities, -Prospects*. https://www.giga-hamburg.de/en/publications/giga-focus/covid-19-middle-east-north-africa-reactions-vulnerabilities-prospects