

Profession and strategy of BIM managers in Japan

Takashi Kaneta ^{1*}

¹ *Department of Architecture and Architectural Engineering, Kyoto University, Kyoto 6158540, Japan*
E-mail address: kaneta@archi.kyoto-u.ac.jp

Abstract: Building Information Modeling (BIM) comes to be implemented into architectural design, construction, and maintenance in Japan in order to convert design information throughout a construction project. However, various problems are taking place in data transaction. It is not also clear about the role and the responsibility of the architects and the engineers in charge. There is a movement to establish a BIM manager as a general coordinator concerning BIM in Singapore and other countries, though it is not yet popular in Japan. This paper deals a BIM manager as a new profession in a construction project. The function and skills necessary to a BIM manager is analyzed, and the strategy of Japanese general contractors is discussed. General contractors from Japan are operating BIM in Singapore compatible with open system of supply chain. This style is different from the one in Japan even they belong to the same company. In this paper it is analyzed based on the survey in detail.

Key words: Building Information Modeling, general contractor, architect, drawing, project management

1. INTRODUCTION

Building Information Modeling (BIM) comes to be implemented into architectural design, construction, and maintenance in Japan in order to convert design information throughout a construction project. However, various problems are taking place in data transaction. It is not also clear about the role and the responsibility of the architects and the engineers in charge.

The development and application of the standalone type by leading general contractors are conspicuous, but the majority of other projects highlight the gap between Integrated Project Delivery (IPD) and the actual design office work.

Although the former is gorgeous as the strength of individual companies, it is extremely vulnerable to grasp the global market with a single company like Microsoft and others. Rather, it becomes a barrier to Japan's overall technical strategy, which may rather adversely affect international standardization and standard competition.

Although the latter relates to the structure of building production which has not been solved so far, we worried that some of the tone is being disseminated easily as if it can be solved by introducing even BIM.

For these reasons, from the viewpoint of management, we have grasped obstacles to the spread of BIM and wanted to return to the essential task of building production and propose solutions for that.

There is a movement to establish a BIM manager as a general coordinator concerning BIM in Singapore and other countries, though it is not yet popular in Japan.

This paper deals a BIM manager as a new profession in a construction project. The function and skills necessary to a BIM manager is analyzed, and the strategy of Japanese general contractors is discussed.

General contractors from Japan are operating BIM in Singapore compatible with open system of supply chain. This style is different from the one in Japan even they belong to the same company as shown in Fig.1. In this paper it is analyzed based on the survey in detail.

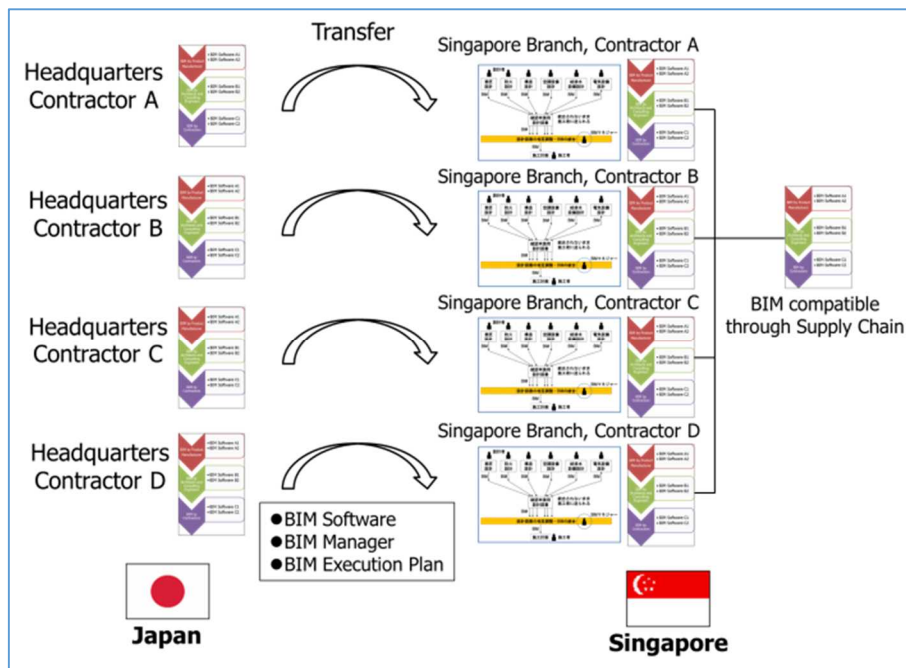


Fig. 1. BIM in construction industry of Japan and Singapore[1]

2. METHOD OF THE RESEARCH

First of all, we conducted a questionnaire survey to find out how Japanese general contractors operate BIM in Japan and Singapore. The outline of the questionnaires is shown in Table 1.

Table 1. Questionnaires of the survey

No.	Questionnaire
1	Which BIM software do you use ? (in concept design, architectural design, structural analysis, structural design, steel fabrication, environmental design, air-conditioning & mechanical ventilation, plumbing, quantity survey, and shop drawing)
2	In a specified building project, how did you assign BIM manager ? How did you organize a team to support installation of BIM ?
3	How do you train the skill and ability of BIM manager ?
4	What is the right and responsibility of BIM manager ?
5	Are there data transfer among the client, architect, engineer, inspector, general contractor, subcontractor, and construction worker ?
6	How do you feel about the support by the government and public institutions to BIM ?

3. RESULTS

Results of the survey are shown in Tables 2 to 7.

3.1. BIM software

As shown in Table 2, in Singapore, all of 4 general contractors use Revit and Tekla Structure. This is influenced by the Singapore government specifying the software and providing the library.

In contrast, in Japan, ARCHICAD and originally developed software are used. The Japanese government does not recommend specified software.

Therefore, compatibility between BIM in Japan and BIM in Singapore is not considered even within the same company.

Table 2. Major BIM software

Contractor	In Japan	In Singapore
A	ARCHICAD REBRO	Revit Architecture Revit Structure Tekla Structure Revit M&E
B	ARCHICAD <Original software for steel work> J-BIM	Revit Architecture Revit Structure Tekla Structure Revit M&E Revit A/S/ME/Navis
C	<Original software for architectural design>	Revit Architecture Tekla Structure
D	ARCHICAD <Original software for reinforcement work>	Revit Architecture Tekla Structure

3.2. BIM manager

Answers on BIM manager are shown in Tables 3 to 7. There are considerable differences between Japan and Singapore. Generally, in Singapore, government-led influence is strong, and each company is considering each solution to similar challenges. However, in Japan, because each company has high degree of freedom, each company's strategy is disjoint.

Table 3. BIM team and BIM manager

Contractor	In Japan	In Singapore
A	A task force team was started in 2010. It was organized in full service as BIM promotion group in December, 2013, then BIM promotion office in April, 2016. The person in charge of BIM promotion is assigned in each domestic branch office and BIM implementation in the branch office is supported by him/her. A staff of engineering work (section chief equivalence) often takes charge in each project.	The staffs of a BIM group who operates BIM software are consisted fully by local staffs. Under the BIM manager who integrates the team, there are generally more than one BIM coordinators who treat the BIM model and carries practical adjustments. About 40 people out of about 70 inhouse drawing staffs in the company can use BIM software.
B	BIM standard has been developed by ourselves. To prevent know-how to be copied by competitors, we did not outsourced the development. We established BIM data transfer with a steel fabricator. The system efficiently works through internal supply chain from shop drawing of the steel frame to quality management at the factory and the construction site.	BIM manager is elected from experienced staffs in shop drawing and is given a training as BIM manager. BIM operators are either inhouse staffs or outsourced people by project basis.
C	Our partner and we appointed the persons in charge of BIM promotion office from each section of architectural design, engineering, construction, and building survey as well as BIM specialists of both companies. We published BIM standard specification as a tool so that mutiple sections using BIM can access BIM data unitarily, which can be a help to manage a project efficiently.	BIM team with the engineering supervisor at the top is formed for each building element. BIM coordinator controls about 40 operators to unify the input method. The superior manager creates rules for input of the model. The right to access the model is given to subcontractors, and the model will be modified based on the rules. Operators of subcontractors are also working in the same building on the construction site.
D	There is a company-wide BIM promotion team, where standardization of BIM and environment improvement are carried out. In the workplace, each department has a person in charge who actively uses BIM in practice, and there is also a system to support it. People who can use BIM are not limited to specific departments.	There are 16 operators inhouse and (12+16) operators outside.

Table 4. Training skill and ability of BIM manager

Contractor	In Japan	In Singapore
A	<p>For new recruits, to master basic operations in web education. From time to time, mid-career employees bring the framework model of their own project to the headquarters training room and are instructed the actual scaffolding and construction plan. In addition, technical support by the headquarters BIM promotion office is implemented according to each project's request. BIM shop drawings are instructed at the affiliated company through practical training. As for BIM manager, we will assign rotation to BIM promotion office. We are changing the support method according to objectives and skill.</p>	<p>Education and training are given in external organizations such as construction schools operated by BCA, and BCA academy. BIM group in our branch consists of non - Japanese people, including local employees from Singapore and neighboring countries, including BIM managers.</p>
B	<p>In the case of a large construction site, shop drawings are drawn by multiple staff. But there are few people who can use BIM, and it is also a problem not to have sufficient BIM experts on site. For that reason, we focus on shop drawings of structural frame to put emphasis on BIM.</p>	<p>BIM operation requires different management methods than CAD. We established BIM Operation Manual based on BIM operation results at multiple sites and we train BIM managers. From the viewpoint of “shop drawing”, it is also important to include constructability and ease of use at the construction phase. In addition to the skills of BIM, education of construction knowledge and sense is also given at the same time.</p>
C	<p>The existence of BIM operator is indispensable. As the partner has supported the development of the system that makes steel frame data and steel staircase data converted into the building construction model, the relationship not only consulting but also providing operators has become a strength. It is effective in the part of system adjustment.</p>	<p>An experienced engineer, an alumnus from the Department of Architecture, is assigned as BIM coordinator. Model input method is unified and is taught to operators by lessons and tests weekly. As there is a difference of ability among newcomers, we consult with operators about the means to prevent wrong overwriting and mistakes.</p>
D	<p>We believe that our system can contribute to upgrading the level of engineers including employees involved in design and construction and to transfer technology to next generation.</p>	<p>The model we are making is a secondary work as intellectual property. After delivering the model to the owner, all that we can do is to save the model only. However, know-how never disappears.</p>

Table 5. Right and responsibility of BIM manager

Contractor	In Japan	In Singapore
A	Depending on the characteristics of each project, we propose range of application and operation method from BIM promotion office. In the actual operation at the site, it is left to the person in charge of the on-site construction personnel, but the headquarters / branch office department supports it as necessary.	As a supervisory control at our branch, we have established a system to create a base model in BIM at the bidding phase. BIM group manages the BIM model and shares information. BIM manager is concurrently serving as the drawing manager (this one is the main duty). It is usually assumed that BIM is located as part of the role of integrating the shop drawings under the project manager.
B	We are not planning to make the shop drawings of all the projects into BIM for the near future. Shop drawings drawn with 2D CAD will be still mainstream. Many companies are promoting BIM by top-down, but our company is in the construction site basis. We provide information on BIM utilization, but we respect the intention of the site. It will not proceed quite easily unless the manager of the site and the person in charge of drawing are consciously working with BIM.	Using BIM, one model is built in cooperation with the owner, the architect, the contractor, and the subcontractors. The authority of management is unified in BIM manager. However, because the owner and the architect have authority to decide items of options, it is the responsibility of the contractor (BIM manager) to indicate the options and to ask for decisions. By visualizing in 3D, BIM contributes to the accuracy and promptness of decision making.
C	How to utilize BIM for daily tasks is a common problem of each section. At the design phase, it is important to create the model easy-to-use in the construction phase. For that purpose, we also started discussion on modeling rules. While increasing the number of project cases, we would like to prepare a more user-friendly framework.	The BIM attachment of the confirmation application has been carried out formally, but it is on the way. We could not get the BIM model at the time of bidding. We Japanese feel that we are not good at projects that are bound by strict and detailed contracts. We have BIM manual. It is supervised by BIM coordinator.
D	In the construction industry in Japan, the liquidity of the labor force is low, so BIM manager cannot be a new independent profession. BIM managers in Japan are required to have a plenty of knowledge and experience to be able to further drive the whole in addition to BIM. We think that this is quite difficult.	The external BIM manager is standing the owner side. The BIM manager earned reward from the owner just to point out the delay of our work. Singapore BIM Particular Conditions are widely used. Contract terms apply to all BIM users.

Table 6. Data transfer among stakeholders

Contractor	In Japan	In Singapore
A	It is widely implemented for available parts such as adjustment with the design, comprehensive adjustment of the relevant construction, planning and adjustment of the construction plan, information transmission, and decision making. There is no room for discussion of using BIM. However, at this stage, it is a major premise that BIM utilization is optimized in each phase, and then it is important to consider data transfer among stakeholders. Data transfer has been already started with the available parts.	Even if we receive BIM data, it is not a level that we can use as it is. The production drawings in exterior works are almost drawn in 2D. Subcontractors only in MEP works draw in 3D. However, it is very helpful for reviewing drawings. Also in shop drawing and interference check (obligation to utilize BIM in the contract is construction modeling, completion modeling, and BIM execution plan). Regarding the fitting of the exterior material, it was effective for studying to faithfully realize the design concept and examining the fitting of the steel foundation as the joint portion with the structure. It is voluntarily operated such as shop drawing, interference checking, and simulation, which are the C-score acquisition requirements. It also helps BIM fund correspondence. Only some of the MEP subcontractors can handle BIM. In exterior work, the difference is intense depending on the subcontractors. Almost zero for interior works. The response of MEP subcontractors is most welcome.
B	The problem with BIM is the output of the shop drawings. Since it does not become the format of the shop drawings of our company's style, it has to be rebuilt. Because this is extremely tough, the complaints within the company are erupting. When there is a step in the framework, it is necessary to consult with the formwork carpenters how to build the formwork. Using BIM, the carpenters understand very quickly. If BIM is used, it is important that the basis for estimating the quantity of the frame is recorded.	BIM are effectively utilized among owners, architects, supervisors, general contractors, subcontractors, and workers. Adjustment of design drawings and complementation of missing information are promoted among owners, architects, supervisors, and general contractors. Between general contractors and subcontractors, information from subcontractors is reflected in the model. Currently it is limited to subcontractors of MEP works and steel fabricators, but it will expand in the future. General contractors and workers use BIM and 3D printer models for communication. All of them are very effective.
C	We asked electric equipment suppliers and machinery equipment suppliers to provide 3D BIM data.	Since it is a lump sum contract, we must compel the cost of BIM from somewhere. 2D and BIM are running in parallel. BIM was rebuilt at the construction phase. For example, the range of a slab was not accurate. It was easy to understand the conflict of structure and MEP because it was visualized clearly. A facility manager that understands BIM is necessary. It is requested to prepare "BIM as built".
D	At the design phase, we check the joint of the column and the beam in 3D model. At the construction phase, the construction engineer coordinates with the concrete construction drawings, checking the reinforcement work plan. The subcontractor of reinforcement work will create fabricating charts / processing books considering construction. We developed BIM software in cooperation with the subcontractor of reinforcement work. In the future, we are considering deployment to automatic machining by CAM, utilization for inspection supervision by design supervisor, examination of beam penetrating sleeve position in cooperation with MEP BIM software.	In many cases, the architect hands over the BIM without noticing the mistake, and the general contractor notices the mistake. In the project, we could not obtain the model at the time of bidding, and so we had to make a model inhouse with great haste. It is quite doubtful whether the BIM file which takes 30 minutes to open on an ordinary PC can really be used for facility management. Some subcontractors cannot use BIM well.

Table 7. Support by the government

Contractor	In Japan	In Singapore
A	There is a gap between ideal and practical level. We are utilizing BIM on a voluntary basis in practice, and we are stepping up operations while steadily achieving results. Public organizations have poor knowledge and experience, and there seems no active movement. In the future, it will suffice to respond at request for standardization, specifications, and regulations.	BCA also knows that data transfer between design and construction is not well done. Our branch has practiced the voluntary utilization of BIM, apart from the contract with the owner, even for projects before the BIM model was obliged to be submitted in the building confirmation application. It was for C-score acquisition. Although we feel that BCA's response as a position to lead the promotion of BIM is quick, the actual contents are not enough. It is good to update to the next step, but we feel that the consultant / contractor cannot catch up the policy. It seems that BIM requirements in public projects are very high and we cannot afford to include in the contract what we cannot realize it. Especially it is found in facility management.
B	Since the state of BIM developed by each general contractor remains as standalone, the speed of deployment is slow in Japan.	As part of policy taken by the Singaporean Government to promote productivity of the construction industry, BIM utilization is mandated from the design phase. Naturally the utilization of BIM is spreading to the downstream phases of construction and facility operation. Although the use of BIM has hurdles such as cost, time, and resources, we are forced to jump by "authority" of a public institution. But in the meantime there will be time to jump normally. It is easy to imagine that the results at that time are overwhelming. In addition, public efforts such as publishing BIM standardization manual, education, tool purchase cost support, and organizing BIM's grand prize are also enhanced and can be evaluated.
C	In Japan, BIM implementation projects by the Ministry of Land, Infrastructure, Transport started from 2010. BIM guidelines were announced in March 2014. It is expected that implementation of BIM will rapidly increase in the future. Because there is no standard of data format, it is not yet generalized.	We are glad that BIM software is unified in Singapore. Cost of the hardware was partly subsidized by the Singaporean government, but it was only slightly from the whole. We do not think positively that there is a good point in reimporting BIM from Singapore into Japan.
D	Even in Japan, there is a movement to try to maintain a library of BIM models that all users can use. We expect that information will become open in the future.	In BCA's BIM guide there is a standard form of the BIM execution plan. In the project, BIM consultant told us that BIM execution plan should be made with taylormade. We think that it became our property as a result.

4. DISCUSSION

At this time there are no definitions of the clear function of a BIM manager in a construction project. It can be assumed that consulting firms of European or American system are recommending themselves by each project in Singapore and other countries. There is a situation that skill and qualification are not systematized about a BIM manager.

The quality, the ability, and the responsibility on the contract, necessary to a BIM manager, are shown based on the survey. Ideal “to-be” model of a BIM manager in a construction project is shown in Fig.2.

In Japan, a BIM manager in the supply chain of a construction project can be considered as an engineer from design firms or general contractors. This is the point unique to Japanese construction industry, because general contractors have ability to coordinate design works.

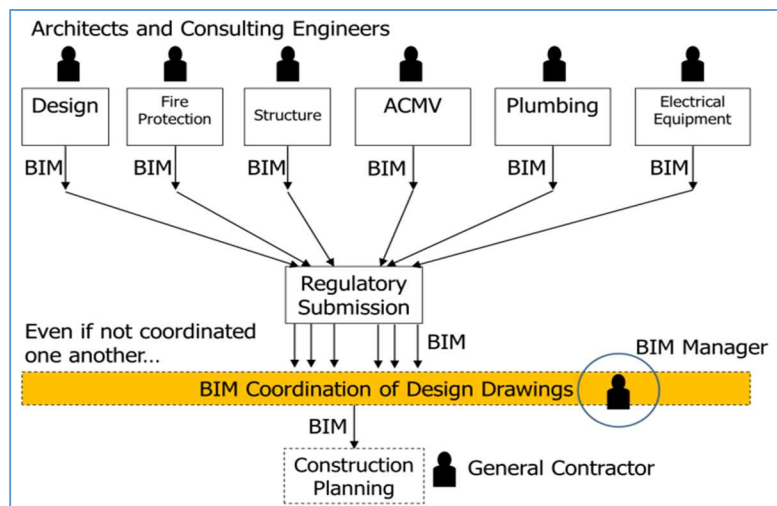


Fig.2. BIM Manager in “to-be” model of a construction project[1]

5. CONCLUSIONS

In this paper, we investigated how Japanese general contractors operate BIM in Japan and Singapore, and clarified the difference. Furthermore, I also made a point of view on the functions of BIM managers considered in both countries. Because the building production systems of both countries are different, it is natural that there are differences. However, the fact that each general contractor is independent in Japan is feared to hinder international competitiveness. Also, it is believed that the general contractor who is acting in common in Singapore, is using another BIM in Japan, which also adversely affects overseas expansion of each company.

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