

DERIVE ESTABLISHMENT STRATEGY OF BIM LIBRARY MARKET AND OPTIMAL REVENUE-SHARING STRATEGY BETWEEN THE BUSINESS PRINCIPALS

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ABSTRACT

As the construction industry is becoming more large-scaled and complex, the BIM technology has been utilized throughout the industry. Since 2008, the construction industry in South Korea (Korea) has required carrying on BIM-based project continually. According to this trend, BIM S/W market, as well as BIM library market is also gradually activated. Many countries have already been establishing Web-based BIM library market, also Korea has been trying to establishing this Web-based BIM library market. In this study, through market research of Web-based BIM library market of advanced countries including the U.S.A. and U.K., establishment strategy of BIM library market to be derived by late starters that introduce BIM such as Korea, Japan and China was deduced based on current establishment status of BIM library market in Korea. In addition, deal with an issue that a clear revenue-sharing system between business principals of Web-based BIM library market is not available at the current stage was presented as a factor of inhibiting activation of BIM library market. So in order to offer a reasonable revenue-sharing strategy in BIM library market as conceptual level, a methodology and process of applying Game theory being used for deriving. It is expected that a reasonable revenue-sharing model between business principals would be presented as its standard of BIM library market to be more activated in the future.

KEYWORDS

BIM, Library market, Revenue-sharing, Game theory, Application, Korea, Distribution System

INTRODUCTION

Recently, IT (Information Technology) is being expanded throughout the whole construction industry. This IT has been applied to construction industry of traditional method in a form of convergence and a technology called BIM (Building Information Modeling) is considered to be a typical outcome of IT convergence in the construction industry. Through BIM technology, diversified effects including enhancement of design productivity, visualization of information, review of constructability, minimization of design change and process control could be gained [1]. In addition, a research on verification and measurement method for such BIM effects have been performed as well [2]. As such, introduction of BIM technology may be considered to be a new paradigm and a key strategy in the construction industry.

Introduction level of this BIM technology has a tendency of being developed stage-by-stage. Difference of level exists in applying BIM between leading countries of BIM introduction such as the U.S.A. and Europe (U.K., Denmark, Finland, etc.) and late starters such as Korea, Japan, China, Taiwan and Hong Kong who are gradually expanding its introduction [3][4][5].

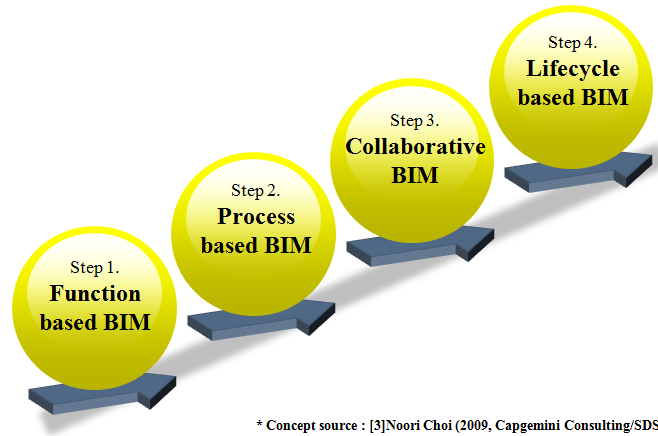


Figure 1- 4 Stage Development Model of BIM

In case of Korea, in view of the level of technical introduction of BIM, it is considered to remain at a function based BIM stage as yet. However, it shows a tendency of being gradually developed to Process based BIM as one-step advanced level and in case of advanced countries, they are at the stage of Process based BIM or Collaborative BIM [3].

If late starters of BIM introduction like Korea wish to utilize BIM in a broad sense, breaking away from Function based BIM that is applied to simple design at the initial construction stage, activation of BIM is required as a prerequisite. In order to activate BIM market, major issues such as establishment of BIM library market, improved interoperability between BIM S/W and its standardization are required to be solved. In case of Korea, as a result of questionnaire for difficulty of BIM introduction or its inhibiting factors by targeting design companies, more than 66% of personnel concerned pointed out lack of BIM library and Contents and as such, establishment and activation of BIM library market are judged to be a considerably important issue [9]. Therefore, in this study, activation strategy of BIM library market and methodology of optimal revenue-sharing strategy among business participants based on its activation are intended to be reviewed and analyzed.

Research Scope and Method

In this study, major strategy in a perspective of market infrastructure that is required to be provided by BIM library market of late starters like Korea that is under its establishment stage is intended to be presented through survey of typical Web-based BIM library market of U.S.A. and U.K. that are considered to be advanced countries in the BIM technology. In addition, in order to derive optimal revenue-sharing strategy among BIM library developers (suppliers) and BIM library web managers for its activation, a methodology of conceptual level is intended to be presented based on the market furnished with similar distribution system. Main process to be performed in this study is as shown on below Figure 2.

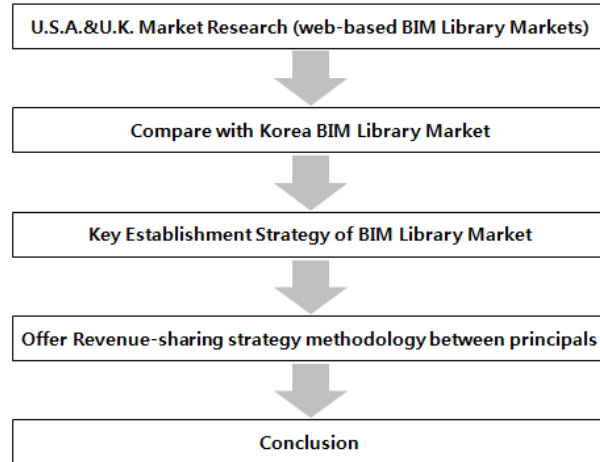


Figure 2- Main Process in this Study

ESTABLISHMENT STRATEGY OF BIM LIBRARY MARKET IN KOREA

Concept of BIM library market and its Importance

In this study, BIM library market is defined as a market in which diversified product objects of Specialized Construction Contractors (SCC, e.g. companies of furniture, mechanical, electrical equipments etc.) and specialized objects supplied by individual developers (designers) in addition to basic object (in ArchiCAD) or Family (in Revit) such as wall, column, beam, slab provided by diversified Design BIM S/W including Revit, ArchiCAD, Bentley and Digitalproject.

The reason why BIM library is important is that contrary to existing 2D CAD information, as each object (set of these objects is collectively called as library) has parametric attribute in BIM technology, utilization level being derived from one single object model is very high [6]. The reason why BIM library market in which this BIM library is distributed is required is that it is hard to provide BIM object information for the products of SCC of each country all over the world based on existing Design BIM S/W due to its complexity and diversity [6][9]. In addition, another reason is that as emergence of individual developer by activation of BIM library market is expected [6][7] and the objects provided by these developers are based on individual creativity or technical power, not a standardized object, a market where copyright or technical fee for such objects could be acknowledged is required [8].

Market Research & Analysis of Advanced Countries

NBS (National Building Specification), a public institution for the development of U.K. construction industry, has established and utilized web-based BIM library market called “National BIM library” on a national level since November, 2011 [10]. Because BIM will be extensively applied to all the public sector contracts of U.K. from 2016 in line with its national policy of activating BIM. Furthermore, as diversified objects of SCC are established through web-site such as BIMSTORE even in private sector, it is being efficiently utilized by personnel concerned including designers, construction contractors and interior designers etc.

Through the following Table 1, main characteristics of web-based BIM library market of U.K. and the U.S.A. could be confirmed. Common point is that upload and download of BIM objects are provided free of charge. And local or global SCC of each country is positively participating in activation of BIM library market.

Table 1- Market Research in web-based BIM library markets

Market	Country/ Nature	Number of library	Support File Form	Characteristics
NBS	U.K. / Public	App. 200 ea	ArchiCAD, Revit, Bently, Tekla, Vectorworks, IFC	<ul style="list-style-type: none"> -Free distribution of library -Free provision of library preparation guideline -Update of new library every weeks -Positive participation of SCC -S/W interoperability is emphasized by supporting diversified formats -Guarantee of various institutions (academia, BIM S/W enterprise) -library classification by work item and materials (not systematic)
BIMSTORE	U.K. / Private	App. 3,300 ea	ArchiCAD, Revit, Bently, IFC	<ul style="list-style-type: none"> -Free distribution of library -Free provision of library preparation guideline and template -Positive participation of SCC -library classification by work type (arch., structure, MEP), work items (ceiling, door, column, etc.) -library classification by SCC
BIMSTOP	U.S.A. / Private	App. 3,000 ea	2D, Sketchup, ArchiCAD, Revit, Bently, Vectorworks, IFC	<ul style="list-style-type: none"> -Free distribution of library -Free upload/download permitted even to individual developers -Positive participation of SCC -Alliance relationship with global contractors -Separate classification of object provided by Freelancer (considering activation of individual developer) -Classification of library by each user (Architects, Designers, Engineers, etc.) -Classification of library by each country provided to SCC

SMARTBIM	U.S.A. / Private	App. 4,500 ea	Revit	<ul style="list-style-type: none"> -Free distribution of library -Positive participation of SCC -Contains objects of 130-odd SCC -Contains space information contents by each building type -Classification of library by SCC
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BIM library market Status of Korea

Korea is showing a tendency of gradually expanding its area from existing function-oriented BIM to process-oriented BIM [3]. Along with this tendency, Korean academia is also exerting exceptional effort for establishing BIM library market. Following Figure 3 shows Web-based BIM standard library test version under establishment by buildingSmart Korea. Extensive participation by SCC has not been satisfactory so far but classification system for classified control of objects required for performing the projects by each work type including architectural, mechanical & electrical engineering has been prepared in reality. And file format for each object is being supported so that relevant file could be directly used in Revit and ArchiCAD that are typical Design BIM S/W.



Figure 3- BIM standard library test version in buildingSMART KOREA

Related study is that BIM library market is required to be formed based on a concept of an integrated market so that diversified libraries would be distributed as one single web site on an integrated basis, not as dispersed BIM library market based on each SCC being presented previously [9]. From its study, the test version of buildingSMART KOREA is considered by this concept.

Key Establishment Strategy of BIM library market

When comparing the case of BIM library market of advanced countries being analyzed, Key establishment strategy of BIM library market to be derived for the countries that are at their early stage of BIM introduction including Korea.

First, an effort of trying to convert product information to BIM object by SCC and distribute such BIM object free of charge is required. Second, distribution system through which BIM object is provided through systemized classification system by BIM object users (Designers, Engineers, Construction Contractors, etc.) or each manufacturer is required to be provided. Third, objects of file format that could be used for diversified BIM S/W in addition to typical BIM S/W are required to be provided and integrated file format such as IFC (Industry Foundation Classes) is also required to be supported.

Current Problem of BIM library market

As mentioned in background and objective of this study, in case of Korea, it could be realized that inhibiting factor of BIM activation is lack of BIM library market [9]. This factor could be solved through an effort of establishing BIM library market on a sustained basis. However, one new fact that could be confirmed through analysis of web-based BIM library market of advanced countries is that objects are distributed free of charge in most of BIM library market and this implies that BIM library market of advanced countries also still remains at its establishment stage in view of the fact that a market in a real sense has not been formed yet as economic principal (Developer and Administrator) is available but economic deed for relevant objects is absent. In other words, a clear revenue-sharing system has not been established between developers who develop BIM objects and web administrator of BIM library market.

Products of SCC being provided by existing catalogue are required to be converted to BIM objects as its additional business and this factor entails additional cost. But if a certain level of revenue is generated against this additional cost, it is clear that SCC would exert their efforts more positively in order to make such products as BIM objects. If not only revenue system of SCC but also that of web administrator of BIM library market should be established, BIM library market of private sector as well as that of public sector would be further activated. Therefore, it is considered that the problem of BIM library market may be attributable to lack of revenue-sharing system between business principals.

ACTIVATION STRATEGY OF BIM LIBRARY MARKET

Survey similar market to BIM library market

BIM library market has considerable similarity with Smart-phone application market in terms of its distribution features or features among business principals. Such similar distribution structure could be confirmed in a process that individual or corporate developers provide diversified kinds of contents to Application market, such application is controlled by its managers and purchased by the users. Application market of Smart-phone is mainly divided into two major markets depending on typical SDK (S/W Development Kit) called iOS and Android. Market is formed based on clear revenue-sharing system of 7:3 between two business principals (i.e., application developer and supplier of relevant SDK) [7] [11]. Following is Table 2 that compared features of BIM library market and Smart-phone application market.

Table 2. Comparison of Features of Application market and BIM library market

BIM library market	Features	Application market
Developer & Administrator	Business Principal	Developer & SDK Provider
Individual or Enterprise	Features of Developer	Individual or Enterprise
Free of Charge or Paid System	Contents Payment Method	Free of Charge or Paid System
Unclear	Revenue-sharing System	7:3 (Developer : Provider)
At an early stage	Level of Activation	Activated
Diversified	Range of Contents	Diversified
Production depending on Individual S/W	Interoperability	Production depending on individual OS
Incomplete Product (Combination of Various Objects is required.)	Completeness	Complete Product (Independent utilization is possible.)

Mathematical methodology of Game theory being progressed in the study of deriving optimal revenue-sharing strategy of Smart-phone application market [7] is intended to be applied to deduction of optimal revenue-sharing strategy between the business principals of BIM library market.

Direction for deriving Revenue-sharing Strategy of BIM library market

Game theory is a methodology of deriving a strategy as well as a mathematical tool that may analyze performance by mutual influence under the environment where various decision-makers exert their influence mutually and induce a reasonable decision-making [7] [12]. This game theory could be applied to the following Figure 4 process in order to derive revenue-sharing strategy of BIM library market.

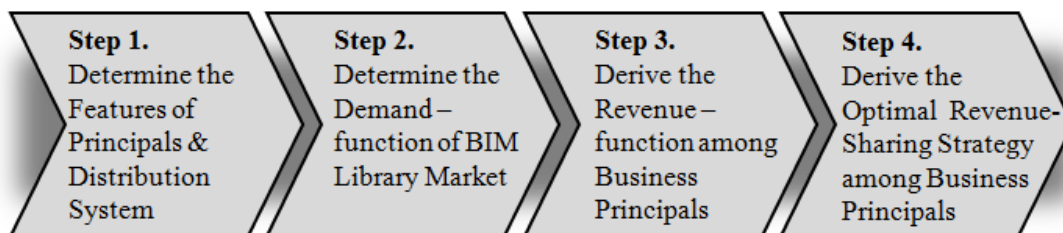


Figure 4- 4 Process to derive optimal Revenue-sharing strategy in BIM library market

CONCLUSION

In this study, through survey of BIM library market of advanced countries including the U.S.A. and U.K. in terms of their BIM technology, establishment strategy of BIM library market to be derived by late starters that introduce BIM such as Korea, Japan and China was deduced based on current establishment status of BIM library market in Korea. In addition, an issue that a

clear revenue-sharing system between business principals is not available at the current stage was presented as a factor of inhibiting activation of BIM library market. So in order to offer a reasonable revenue-sharing strategy in BIM library market as conceptual level, a methodology and process of applying Game theory being used for deriving.

Currently, BIM library market has just been waiting for positive participation of SCC but in the future, BIM library market to be more activated and individual developer as well as corporate developer is expected to be emerged as a development principal. And most of libraries or contents are used free of charge under the pretext of activation of BIM library market but in the future, establishment of standard for copyright or revenue-sharing rate of contents market is considered to be required. Accordingly, this study is expected that a reasonable revenue-sharing model between business principals would be established through Game theory and such model would be presented as its standard of BIM library market to be more activated in the future.

ACKNOWLEDGEMENT

This work is financially supported by Korea Minister of Ministry of Land, Transport and Maritime Affairs(MLTM) as 「U-City Master and Doctor Course Grant Program」 .

REFERENCES

- [1] Su-won. Yoon (2009), *A BIM Study in Construction Phase: D3 city Project*
- [2] Kristen Barlish (2012), *How to measure the benefits of BIM*
- [3] Noori. Choi (2009), *Overview of BIM and Advice on Introduction to Local Construction Companies*
- [4] Cheol-Ho. Choi (2008), *BIM as Future Construction Technology and its Stage-by-stage Application Strategy*
- [5] Sang-ho. Lee (2011), *History of BIM and the Future*
- [6] HAUDREPORT (2011), *Technical evolution of BIM: BIM Status and its Application Cases*
- [7] Sung Jun. Park (2011), *Optimal revenue sharing strategy between smart phone O/S provider and application developers using Stackelberg game model*
- [8] Jae-sang. Ahn (2012), *A study of Copyright Protection for Activation of BIM library Development*
- [9] Dae-gu. Cho (2010), *Developing BIM library and Contents Exchange System for Collaborative Work Environment*
- [10] <https://sites.google.com/site/bimprinciple/in-the-news/thenationalbimlibrary>
- [11] KIPA, DRM Inside (2006), *Research Data: Survey of Reasonable Revenue-sharing based on Distribution Structure*
- [12] Kwang-woo. Park (2011), *Value Evaluation for New Contents of Internet and Analysis of Revenue-sharing based on Game Theory*
- [13] BIM library market-web sites of U.K., U.S.A. and KOREA
 - (1) U.K., NBS, <http://www.nationalbimlibrary.com/>
 - (2) U.K., BIMSTORE, <http://www.bimstore.co.uk/>
 - (3) U.S.A., BIMSTOP, <http://www.bimstop.com/>
 - (4) U.S.A., SMARTBIM, <http://www.smartbim.com/>
 - (5) KOREA, buildingSMART KOREA, <http://kbims.buildingsmart.or.kr/Default.aspx>