LEGAL ISSUES CONNECTED WITH BUILDING INFORMATION MODELING (BIM)

القضايا القانونية المتعلقة بنمذجة معلومات البناء (BIM)

By

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APPENDIX A

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Dedication

To my Mom and Dad, with all my heart, for their constant support and encouragement.

"This achievement is the result of your true love and generous cares"

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First and foremost, I would like to express my sincere gratitude to my advisor, Dr. Ayman Masadah and Dr. Abba Kalo, for giving me opportunity to work with them. Working under their supervision

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Ahmed Alhaddad

ABSTRACT:

The primary objective of this dissertation study was to explore and explain various legal concerns and issues related to building information modeling (hereinafter referred to as "BIM"). The secondary objective of this research was to highlight the advantages of BIM implementation in different fields. In a nutshell, the present study was carried out in the form of a mixed research design.

The next advantage of this study stems from the fact that the conducted research not only underlined the advantages of BIM implementation, but also underscored major problems and challenges that need to be addressed in the course of implementation. As a result of the study, it was established that BIM is not merely one of several available models of interaction, but that is an up-to-date and advanced model that set forth for consideration a new philosophical paradigm for practice, particularly due to its intrinsic capacity of encouraging both the combination and practical actualization of different roles of all participants in a concrete project. On the other hand, a noticeable benefit of this study is that the research findings and inference clearly illustrate how Building Information Modeling (BIM) can make significant contributions to the development of construction industry. The aforesaid illustration became possible, particularly when it was established by means of research that the salient features of BIM implementation have direct relationships with a multiplicity of office products, such as word processing, graphic products, and spreadsheets. The findings of this study contain applied knowledge and guidance on how to utilize BIM in ship-building, aviation, automobile, and other industries.

Keywords: BIM, Building Information Modeling, IPD, Collaborative Project Deliver

نبذة مختصرة:

الهدف الأساسي من هذه الأطروحة هو تسليط الضوء على أهم القضايا المتعلقة بنمذجة معلومات البناء من الجوانب القانونية المختلفة (المشار إليها فيما يلي باسم "بيم"). و الهدف الثانوي هو عرض مزايا و فوائد إستخدام "البيم" في مختلف المجالات. أجريت هذه الدراسة على أساس تصميم البحوث المختلطة. مع العلم أن هذا النوع من الدراسات ينبع من حقيقة أن الأبحاث التي أجريت لا تأكد فقط على مزايا تنفيذ "البيم" في المشاريع، ولكنها تعمل على تأكيد حل المشاكل والتحديات التي تحتاج إلى معالجة في سياق تنفيذ المشروعات الرئيسية. وكنتيجة لهذه الدراسة، ثبت أن "البيم" ليس مجرد نموذج واحد من النماذج العديدة المتاحة للتواصل بين فرق العمل في عملية البناء و الإنشاء في المشاريع، و تعد الفائدة الثانية لهذه الدراسة هي حقيقة أن هذه الأطروحة ليس فقط للتركيز على فوائد إستخدامات "البيم" بل تشمل إعطاء نبذة ووصف عن نوعية المشكلات و التحدديات التي تواجه عمليه تطبيق إستخداماته من خلال المشاريع. و كنتيجة أخرى لهذه الدراسة يتميز "البيم" بأنه ليس مجرد الطريقة الوحيدة مقارنة مع شتى الطرق المتوفرة لإدارة المشاريع بل إنه الطريقة المثلى و الأحدث إذا جاز الوصف فلسفيا و حرفيا و نجد ذلك تحديدا من خلال القدرة على تشجيع الجمع بين الإدراك العملي و توزيع الأدوار المختلفة لجميع المشاركين في صياغة و إنشاء المشروعات كجملة واحدة و من ناحية أخرى تخلص نتائج هذة الأطروحة بأنها أثبتت أن نمذجة معلوات البناء ساهمت بشكل فعال و كبير في مجالات صناعات التشييد في عملية البناء حول العالم. إن ما أوضحته هذه الأطروحة من خلال البحث بأن تطبيق نمذجة البناء له علاقة مباشرة من خلال أستخدام المنتجات المكتبية من مثل إنشاء و طباعة الرسومات و جداول الكميات و البيانات المتعلقة في المشروع بشكل أدق و منظم مقارنه مع الطرق التقليدية الأخرى.و كنتيجة لذالك خلصت هذة الأطروحة على أن العلم المستفاد من إستخدام نمذجة البناء لا يقتصر فقط على علم البناء و التشييد بل يمتد إلى عدة مجالات أخرى من مثل الطيارن و صناعات السيارت و عدد لا منتهي من العلوم و الصناعات الأخرى.

كلمات البحث: BIM، نمذجة معلومات البناء، IPD، تسليم المشروع التعاوني

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LIST OF ABBREVIATIONS

2D BIM – two-dimensional BIM model

3D BIM – three-dimensional BIM model

4D BIM – four-dimensional BIM model

5D BIM – five-dimensional BIM model

6D BIM – six-dimensional BIM model

AIA – American Institute of Architects

BIM – Building Information Modeling

CAD – Computer Aided Design

CGL Insurance – Comprehensive General Liability Insurance

CM – Certificate of Management

ConsensusDocs – a catalog of standard forms of building contracts

DOCS – a catalog of standard forms of building contracts

E&O Insurance - Error and Omission Insurance

HVAC – Heating Ventilation and Air Conditioning System

IPD – Integrated Project Modeling

LLC – Limited Liability Company

RUCAPS – Really Universal Computer Aided Production System

CHAPTER I - INTRODUCTION

1.1 Introductory notes

The overall purpose of this thesis is to explore and explain various legal concerns and issues related to building information modeling (hereinafter referred to as "BIM"). That is, the present study has mixed investigatory nature. On the one hand, it is conceived as an exploratory study directed at the provision of answers to the following questions:

1) What is a building information modeling?

2) What are major legal matters connected with building information modeling?

3) How is it necessary to address various legal matters connected with building information modeling?

In addition to this, the current project is also explanatory. This implies that, aside from exploring different legal issues connected with building information modeling, a special emphasis will be placed upon the reasons and causes underlying various manifestations of the legal considerations and legal issues in question. The key objective of the explanatory part of the project is to provide a comprehensive answer to the following question: Why does a particular legal consideration matter?

1.2 Background of BIM

The first and foremost issue to be addressed in the framework of the present project is to ascertain and construe the meaning of the category of "building information modeling". Thus, the first formal use of the category of "building modeling", in the sense of the present-

day “building information modeling”, can be traced in Robert Aish’s model.[1] The term “building information modeling” covered the following essential elements: automatic drawing extraction, 3D modeling, parametric components, temporal phasing of processes, relational databases, etc. Specifically speaking, Aish demonstrated the applicability of various components of BIM (Building Information Model) through a case study of the “Really Universal Computer Aided Production System” (hereinafter referred to as RUCAPS), where the system was applied to the phased refurbishment of Heathrow Airport.[2] However, at that time, the concept at issue had the meaning of “Building Model”. With the flow of time, the term “Building Model” metamorphosed into the concept “Building Information Model”. The first formal use of the term “Building Information Model” is connected with a paper of van Nederveen and Tolman.

In addition to the development of the concept at issue, it was also possible to observe the evolution of the R&D efforts focused on commercial instruments and academia making the practical use of the BIM approach. A wide spectrum of the software behaviors and functions attributed to the present-day generation of instruments, such as Bentley Building, Autodesk Revit, VectorWorks, and AllPlan, should also be associated with the design objectives of the manufacturers of earlier commercial software.[3] To better grasp the

[1] W Chan and C Armenakis, “3D Building Evacuation Route Modelling and Visualization” (2014) XL-2 Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.

[2] W Chan and C Armenakis, “3D Building Evacuation Route Modelling and Visualization” (2014) XL-2 Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci.

[3] Y Lin and others, “Development of BIM Execution Plan for BIM Model Management during the Pre-Operation Phase: A Case Study” (2016) 6 Buildings.

specificities and significance of BIM, it is vital to find a viable definition of BIM as an operational concept.

1.3 Definition and Characteristics of BIM

In analyzing various theoretical studies and pieces of empirical research, it is attainable to come to the conclusion that there is no unified definition of the term "BIM". Moreover, there is a wide array of definitions the critical overhaul of which may help provide important insights into the meaning of BIM as a multi-faceted phenomenon. A diversity of scholars and practitioners address BIM as product-oriented, process-oriented, or constructor-practical phenomenon.[4] The other experts tend not to agree with the aforesaid approaches to the phenomenon at issue by viewing BIM as a much broader and more analytic substance. Thus, BIM may be defined as process that is completely independent of software for implementation. From the contrasting point of view, BIM may be considered as both a process and product of implementation.

In order to eliminate the ambivalence and inconsistencies in the myriad definitions of BIM, it is suggested to focus more on the salient features and essential characteristics of this phenomenon. Thus, BIM should be defined as a model which is based upon the most recent and promising developments in various applied industries, such as construction, engineering, and architecture whose key feature lies in the fact that the model can be easily and efficiently utilized for the purpose of design, planning, construction, and operation of any facility. [5] In other words, BIM helps applied professionals, such as engineers, architects, and

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[4] P Macleamy, *Report On Building Information Modelling* (HM Government 2012).

[5] S Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) *Leadership and Management in Engineering* 11.3, 241-252.

constructors make visualization of what is to be established in a simulated environment. In this connection, BIM sets forth a new philosophical paradigm for practice, because it encourages combination and practical actualization of different roles of all participants in a concrete project.[6] In elaborating further on salient features and essential characteristics of BIM, it is vital point out that Building Information Modeling (BIM) makes significant contributions to the development of construction industry, because most of its salient features pertain primarily to a variety of office products, such as word processing, graphic products, and spreadsheets. Regardless, it is also possible to notice a significant penetration of BIM in other fields of applied knowledge, such as ship-building, aviation, automobile, etc. This is especially because of the prominence of BIM's other essential characteristic – that BIM is an electronic modeling (Smith, 2013). In other words, most of its processes are carried out electronically.

1.4 Integrated Project Delivery

Integrated Project Delivery (hereinafter referred to as IPD) is another operational concept that requires clarification and interpretation. First of all, it needs to be pointed out that IPD is closely connected with BIM. The significance of IPD is well manifested at the transformative stage of the industry, when the precepts of safety must be carried out in the framework of the specific design process in order to start scheduling for safety matters earlier.[7] The integration of safety is expected to facilitate safer design and decrease iteration loops. In this connection, the integration of construction safety may give momentum in

[6] R Crotty, *The Impact Of Building Information Modelling* (Spon 2012).

[7] M O'Reilly, "The Construction Contract" (2007) 2007 Construction Law Handbook.

Integrated Project Delivery (IPD). Therefore, the term "integrated project delivery" may be defined as an approach to project delivery that joins business practices, business systems, people and structures into a single process that collaboratively fasten together the insights as well as talents of all actors to provide more optimized results, reduce waste, raise value by means of all phases of supplementation, design, and construction. Also, it is extremely important to add that the principles of IPD are applicable to a diversity of contractual agreements and IPD groups can engage individuals outside the general triangle of architect, owner, and contractor.[8]

Integrated Project Delivery ("IPD") is an approach in the provision of big projects to participants, such as the owner, builder, design professional, and possibly lower-tier participants) perform a contract whereby they cooperate in designing agree development process and to a certain extent, the economic risks share related to defective design. IPD is a matter of substantial interest and to create a feeling of promise for builders and Design Professionals. One of the significant questions is whether the collaborative design component should relate to a collective final project design responsibility beyond the design professional (and its engineering offices).[9]

1.5 Justification for BIM

After the basic definition and salient features of BIM have been ascertained, it is vital to provide arguments in defense and justification of BIM as the phenomenon at issue. The first and foremost argument that justifies BIM is that BIM is highly needed for new

[8] C Hsieh and I Wu, "Applying Building Information Modelling In Evaluating Building Energy Performance" (2012) 11 Gerontechnology.

[9] R Garber, BIM Design: Realizing the creative Potential of building information modeling (Wiley 2014).

buildings, facilities, and other projects, because of the former's capacity to overwhelm uncertainties of the building environment and vicious documents, which usually prevail in current structures. Also, it might be appropriate to note that extremely quick development of BIM research increases the demand of the up-to-date overview of the implementation of BIM, as well as the research of existing buildings.[10] As a matter of research, many findings demonstrate that there are still not total BIM implementation in present-day buildings, particularly because of the challenges of (1) conversion effort, (2) information improvement, and (3) handling of uncertain data. In spite of quick improvements and developing standards, sophisticated research opportunities are given rise from automation and BIM adoption to modern structures' standards.

1.6 Benefits of BIM

Significant amount of justifications of BIM may be deduced from the overhaul of its benefits. All benefits of BIM may be categorized as follows: (1) tangible benefits; (2) semi-tangible benefits; and (3) intangible benefits. As far as tangible benefits of BIM are concerned, it needs to be pointed out that the wealth of information and data that can be easily accessed about project sites has developed substantially with better images of Earth and better mapping techniques. Nowadays, BIM helps ensure that every project commences with aerial imagery and digital elevation, coupled with the laser scans of existing infrastructure. The next tangible benefit of BIM is that the shared model has much more information and data and any drawing set and, thus, BIM makes it possible for every

[10] J Underwood, Handbook of Research on building information and Construction Informatics: Concepts and Technologies (IGI Global 2009).

discipline to connected and annotate their intelligence to the project at issue. The fact is that BIM drawing instruments are much faster than the 2D drawing instruments. In elaborating further, it needs to be underscored that the BIM model helps also preserve control by involving such instruments as autosave and connections to project history. Also, BIM assists in promoting cooperation between different participants of the project, because collaborating and sharing in the framework of the model is much easier than doing the same with the help of drawing sets. Besides, the model contains a wide array of functions that can be enable only by way of a digital workflow. Also, one of the important benefits of the BIM lies in the fact that the system makes it possible to visualize and simulate that makes it possible for designers to visualize such issues as the sunlight during various seasons, as well as the quantity or calculation of building energy performance. There is also no exaggeration to say that the BIM model is very helpful in automating clash detection of components, including the ductwork and electrical conduit that operate into a beam. By modeling the aforesaid things, the model may help guarantee a perfect location and fit of all components that are created off-site, permitting the elements to be easily attached to the place rather than creating on-site.

In discussing the semi-tangible and intangible benefits of BIM, it is deemed wise to focus upon the following issues as better decision-making capabilities, improved product quality, and increased availability of data. The major difference between tangible benefits of BIM, on the one hand, and semi-tangible and intangible benefits of BIM, on the other hand, lies in the fact semi-tangible benefits that can be quantified, but not in monetary terms. By contrast, intangible benefits are non-quantifiable, depicted as qualitatively.

1.7 Overview of BIM

The analysis of benefits of BIM necessitates making overview of BIM as a phenomenon at issue. BIM systems have developed through several systems of software upgrades, while the leading companies in the industry adopt BIM on live projects.[11] A large number of prominent companies clearly demonstrate their intention to adopt BIM in their operations, whereas a vast majority of other companies have already experienced the benefits of BIM. BIM may be viewed as an outstanding development in such industries as engineering, construction, and architecture. BIM may be used for construction, design, planning, and functioning of any facility.

1.8 Other Considerations (4D/5D Modeling)

Apart from traditional BIM, it is also possible to discern 4D and 5D modeling. 4D BIM is widely used in the CAD industry. It refers to the intelligent correlation between separate 3D CAD element, or, alternatively, under the schedule or time related data.[12] The use of 4D together with BIM aims at indicating on the fourth dimension – time. As far as 5D BIM is concerned, 5D BIM is a concept, which is applied both in the CAD and different industries of construction, and relates to the reasonable correlation among individual 3D CAD conglomerates and elements with specified constraints (4D BIM constraints), as well as with the information that relates to costs.[13] The adoption of 5D models makes it possible for different participants of a construction project, such as owners, contractors, designers, or

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[11] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

[12] *Id.*

[13] J Swan, B Reiter and N Bala, *Contracts* (LexisNexis Butterworths 2006).

architects to make a practical visualization of the progress of construction activities, as well as its pertinent costs with the flow of time.

In analyzing various types of models in detail, it needs to be asserted that, in the framework of many projects, engineers and other participants may work with not only 2D, but also 3D, 4D, 5D and 6D BIM to foster project collaboration, coordination, risk mitigation, asset management, logistic planning and cost estimate. The 3D model is very useful for visualization. On the other hand, 4D BIM utilizes time as an additional component that is not made a practical use in the framework of 3D BIM. That is the application of the 4D model is facilitate where the component of time is necessary. In elaborating further, 5D BIM model refers to the intelligent nexus between 3D CAD elements, the time component of 4D BIM, and with cost-related information and data. The development of 5D models made it possible to predict the progress of construction with its pertinent costs with the flow of time. The last but not least, 6D BIM model is wide utilized in the construction industry where it is necessary to connect the elements of 3D CAD elements with all facets of project life-cycle management data and information. The fact is that 6D is frequently utilized when a construction project is accomplished and it is essential to make a practical use of various operation manuals, photos, warranty data, manufacturer information and contract.

CHAPTER II – REVIEW OF LITERATURE

2.1 Introductory part

The overall mission of this literature review is to provide a critical overhaul of relevant academic publications and empirical studies in order to make insights and discern gaps in the existing knowledge. Also, literature review is conceived to lay a basis for the

subsequent employment of primary research methods, such as case study or unstructured interviewing.

2.2 BIM Partial Uses

In conducting the review of academic literature, it was possible to notice that a wide array of authors and practitioners focus on the discussion of BIM partial uses. In this connection, it is deemed wise to clarify the meaning of the term "uses" prior to delving deep into the problem of partial uses.[14]Thus, some experts purport that it is not substantial to construct the whole project with the imbued use of BIM on the project. Actually, a large number of contractors are engaged with different projects based on intelligent models without being aware of it. Also, it needs to be asserted that the designer, as well as a specialty contractor or supplier may be engaged in utilizing constructs for the personal benefit and not providing the information to other users of the processes. There is no exaggeration to say that the practical use of the BIM "instrument" is promoted even under the conditions of its partial availability for the project. Besides, contractors frequently utilize intelligent models for to facilitate the performance of many traditional activities. All of this is covered by the generic term "partial uses" of BIM.[15] The concept of partial uses of BIM includes the following types of uses: a) assistance with scoping during purchasing and bidding; b) review of the scope for value engineering; c) coordination of construction sequencing; and d) demonstration of project approaches in the framework of marketing presentations.

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[14] D Kerns, *Duty of care* (Sentient Publications 2007).

[15] L Mahdjoubi, C Brebbia, and R Laing, *Building Information Modelling (BIM) In Design, Construction and Operations* (2015) Vol. 149. WIT Press.

In every case of partial uses of BIM, only part or elements of the scope and merely particular trades may be created. The "partial uses", in contrast to entire project models, are to constitute the means whereby many contractors are likely to facilitate gaining benefit from utilizing the BIM. The "partial uses" can be much less difficult to adopt, and the benefit of utilizing them is much more tangible to everybody. In a nutshell, a partial application of BIM may be deemed easier for the majority of contractors, while, on the other hand, some users may consider a partial use of BIM an excellent way to commence their acquaintance with the system's complexities.

2.3 Barriers to BIM

Notwithstanding the apparent benefits of using BIM, contractors and other users of the model may encounter various barriers. The nature of most barriers is dictated by the fact that BIM is the creation of the latest technology. In this connection, it should be identified that the key barriers of using BIM include fears, such as fear of change, fear of legal risk, fear of unknown, the time required to learn how to utilize the new software, initial investment costs and waste, as well as the lack of support from leaders of the corporation. Usually, the barriers may be characterized as a wall that needs to be overcome.[16] On one side of the wall, it is possible to see contractors who have never utilized the technological benefits at issue or gained the advantages of BIM by themselves. On the other side of the wall, it is possible to apprehend the contractors who have started utilizing the modeling and already begun to personally grasp the benefits BIM has to suggest.

[16] A Dib, *Legal Handbook for Architects, Engineers and Contractors* (Thomson/West 2007).

In evaluating the barriers to implementation and utilization of BIM, it needs to be acknowledged that the fundamental question is whether the fears and other barriers legitimate and prudent. The legitimacy and prudence of the barriers are often dependent upon the easiness and practicability of BIM as an up-to-date technology. The easier technology works, the more eager users overcome the barriers. In other words, the widely spread acceptance of benefits from BIM depends on people's understanding and acceptance of these benefits. If the benefits are comprehended and understood, the fears and other barriers should dissipate easily.

2.3.1 Commercial Issues

A set of barriers in the use of BIM may be deduced from a variety of commercial issues. Specifically speaking, the overall purpose of BIM lies in the promotion and facilitation of trade and commerce. In this connection, the inability to achieve the overall purpose of BIM undermines its viability as a modeling system. As far as commercial issues with BIM are concerned, it is reasonable to start the analysis with the issue that immediate advantages do not always accrue to the principal designer of BIM.[17] As a matter of commercial viability, the benefits of BIM for an owner lie in the possibility of design optimization, diminishment of design errors, fewer coordination issues, and fewer construction errors which generally give rise to fewer claims and conflicts. In addition to this, it needs to be asserted that the commercial issues take place in the context of management and operation of the facility by means of the as-built model. In this connection, some experts are prone to believe that the majority of commercial issues with BIM stem from the economic

[17] K Artto and K Kahkonen, *Managing Risks in Projects* (Taylor and Francis 2013).

advantages of BIM.[18] However, the actual economic benefits of BIM are not always clearly perceivable, because the wealth of information retrievable from the virtual model does not guarantee that design experts will earn decent, if any, compensation for the information.

Aside from the above, commercial issues in the use of BIM may also be associated with such barriers as the lack of standard BIM contract documentation. In elaborating on this commercial issue, it needs to be pointed out that the absence of standard contract documents which regulate BIM handicaps the development of BIM in the ultimate analysis. From the commercial perspective, standard contract documents help fulfill three major objectives: (1) provide legal framework for the practical implementation of BIM; (2) give birth to consensus allocation of risks and the interplay between dispute resolution, insurance, and risk assumed; and (3) diminish efforts taken in formalizing the roles and duties of the project participant by means of documentation.[19]

2.3.2 Legal Concerns

In the exploration and treatment of barriers of BIM, legal concerns and issues should not be underestimated. They are as important as the commercial ones. In discussing the commercial issues in detail, it is extremely interesting to note that most of the legal concerns revolve around the issues of risk allocation, such as responsibility or collaboration, duty of care, privity, third-party reliance, economic loss, etc. In a nutshell, each possible legal issue and concern deserves attention and immediate response, because, it contrast to commercial issues and concerns, the former may entail not merely economic consequences for the

[18] M Cook, *Building Enterprise Information Architectures* (Prentice Hall 1996).

[19] R Crotty, *The Impact of Building Information Modelling* (Taylor & Francis Ltd 2011).

implementer of BIM, but also legal outcomes, such as legal liability and legal ramifications.[20] A more detailed exploration and interpretation of legal issues and concerns are provided in the following sections of this study.

2.3.3 Technical Issues

Notwithstanding the seriousness of the legal concerns and commercial issues related to the use of BIM, there are also technical matters that should be taken into consideration. The knowledge of technical issues is expected to help the implementer of BIM overcome certain barriers to BIM. Thus, a wide range of technical issues related to BIM is connected with the debates around the use of universal model as opposed to multiple models, and vice versa. From the theoretical perspective, BIM has strong reliance upon a single information source that fulfils the requirements of all project participants.[21] However, the implementation of BIM is not deprived of changes and alterations to design and components of BIM, such as electrical, structural, architectural, and mechanical changes. The fact is that, upon the utilization of the model, supplier and contractor information is integrated in BIM, expanding upon its design and elements. Another possible technical issue may be linked to the phenomenon of interoperability. Moreover, professionals confess that neither issues nor processes of BIM can be completely comprehended outside the context of interoperability. Specifically speaking, the Structural Engineering Institute unravel that the most popular complaint is insufficient operability of parametric modeling (BIM) software in various vendors. The concept of interoperability may be delineated as the capability to communicate

[20] W Allensworth and others, *Construction Law* (American Bar Association 2009).

[21] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.

and manage project data and electronic systems among cooperating business entities.[22] The actual ability of various applications to edit, use, exchange, and facilitate information depends upon general standards for delineating systems and elements. Also, the Standards and Technology Institute provides that more than fifteen billion USD are wasted, because of insufficient interoperability.

The last but not least, technical training and expertise constitute the other group of technical issues related to the barriers of BIM use. As a matter of fact, it is incumbent on design professionals and other implementers of BIM to be conscious of various technical aspects prior to finalizing the conversion of their systems to BIM.

2.4 Legal Impact of BIM

After a brief analysis of technical issues associate with the use and barriers to use of BIM, it is deemed wise to focus more on the legal concerns of BIM. To start with, it is suggested to take a closer look to the legal effects projected by BIM. The key legal impact of BIM obviously stems from the principal function played by BIM in any construction or other applied contract, namely the function of responsibility allocation for construction and design among the different parties to the contract.[23] The overarching significance of this function is that the failure to properly define the allocation of responsibility for construction and design among the contracting parties will inevitably result in a legal conflict. The legal conflict usually pertains to the question of who is responsible and who is not responsible. Among other things, the conflict in question may also impede the actualization of the rights and

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[22] *Id.*

[23] D Mitchell and R Ream, "Professional Responsibility: The Fundamental Issues in education Reforms" (2015) Advances in Medical Education.

entitlements of the contracting parties, especially in terms of who has the right to utilize design documents.[24] It is unreasonable to forget that the application of BIM as a project delivery scheme, or, in other words, a delivery method, brings into light outstanding opportunities and risks connected with construction operations and design. Probably, the most powerful source of legal concern and impact related to BIM stems from the fear that is connected with the level of cooperation.

2.4.1 Spearin Doctrine

The *Spearin* doctrine ensures contractors' protection and is frequently applied as an affirmative defense to an owner's claim of defective or non-conforming product. The legal principles, which are deducible from the doctrine, provide that if a contractor erects a structure according to the specifications and plans of the owner, and the building does not act as initially conceived, the employee will not be found liable for the defects and failures. In other words, it is incumbent on the contractor to strictly follow the requirements and plans of the owner in order to be relieved from any legal liability. If, in the course of work, some defects emerge, it is considered that the defects are derivatives of the defective plans and specifications, not the attributes of the contractor.[25] Hence, it follows that Spearing doctrine successfully shifts the burden of liability from a contractor to the owner's engineer or architect. This operation is usually defined as "the implied warranty" of the owner with regard to the adequacy of the specifications and plans. In order to better understand the

[24] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.
[25] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

rationale underlying the *Spearin* doctrine, it is essential to scrutinize the original source of the doctrine – *United States v Spearin* (1918). The case at issue, which has given rise to the *Spearin* doctrine, revolved around the controversy between the contractor who relocated a sewer as part of a bigger overall construction project and the government that terminated the contractor after the sewer had failed and the contractor's working place was flooded.[26] The issue raised by the aforesaid case was the issue of liability for damages – who was actually liable for the incurred damages.

As a result of the investigation in *Spearin* case, it was established that an adjoining 7-foot sewer was, to a certain degree, dammed, in order to divert more water to the specific 6-foot sewer. The contractor refused to go on working until the government assumed responsibility for the inflicted damages. The government discharged the contractor. That was the main reason of the contractor's suit. The Supreme Court of the United States ruled in favor of the contractor by providing a holding that is now referred to as the Spearing doctrine: in case the contractor is bound to erect building according to specifications and plans drafted and conveyed by the owner, there will be no liability for the contractor for the outcomes of defects in the specifications and plans at issue.[27] After the holding of the US Supreme Court had been made, many courts started following the *Spearin* doctrine. Actually, the Spearing doctrine was followed by the court as a defense to an owner's allegation of a non-conforming and defective work. The doctrine provides the implied warranty that consists of two major

[26] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.
[27] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

parts. First, the warranty provided that the data and other information delineated in the specifications and plans would be precise and accurate. Second, the warranty provides that the specifications and plans, if actualized, would be consistent enough to complete the objective of the project.

The *Spearin* doctrine has been addressed by courts in a variety of other cases. Thus, in *Dugan & Meyers Construction*, the court pointed out that the *Spearin* doctrine should be utilized by the referee to ascertain whether a contractor can expect accurate, complete and buildable plans and may obtain the recovery of damages stemming from the owners' failures.[28] On the other hand, in *Central Ohio Join Voc*, the court found out that the *Spearin* doctrine was irrelevant to the jury's decision, because Peterson did not commit a breach of the contract but was excused.[29] Also, in *Fireman's Fund*, the court established that the *Spearin* doctrine should be regarded as the font of an implied warranty of design specification that helps shed light on whether the contractor has obligation to follow the plans.[30] In elaborating further, the court in *Country Mutual Insurance* held that the key significance of the *Spearin* doctrine lies in the provision of the specific safeguard for contractors from liability if the contractors erect a facility in conformity with the plans provided by the owner.[31] In like manner, the court in *Thomas & Marker Construction* underscored that the *Spearin* doctrine has application to the cases that do not pertain to government specification, that is, the doctrine applies to the contracts between private entities and private parties.[32]

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[28] *Dugan & Meyers Constr. Co. v Ohio Dep't of Admin. Servs*, 113 Ohio St. 3d 226.

[29] *Central Ohio Joint Voc. Sch. Dist. Bd. of Educ. v Peterson Constr. Co*, 129 Ohio App. 3d 58.

[30] *Fireman's Fund Ins. Co v United States*, 92 Fed. Cl. 598.

[31] *Country Mut. Ins. v Gyllenberg Constr*, Inc., 2004 U.S. Dist. LEXIS 13056.

[32] *Thomas & Marker Constr., Co. v Wal-Mart Stores, Inc*., 2008 U.S. Dist. LEXIS 79072.

Also, it is extremely interesting to note that the court in *Rick's Mushroom Service* established that the *Spearin* doctrine has application behind the procurement contract, and that the contractor had no actual right to recover the costs of defending and filling the lawsuit itself.[33] Besides, the court in *Hardwick Brosers* ruled that the *Spearin* doctrine should be applied in a specific and narrow context.[34] The doctrine was addressed when the court evaluated the government contractor's claim for an equitable adjustment that had failed due to inadequate inspection of the government-provided performance specifications and the site which, in the ultimate analysis, has not invoked the implied warranties. Equally important, the court in *Martin K. Eby Construction* verified that the *Spearin* doctrine entails the implied warranty of constructability.[35] The court found the doctrine's importance in that the doctrine should not be confined to defective design specifications. Also, the court in *City of Holland* opined that the application of the *Spearin* doctrine should specifically be applied to the plaintiff's use of the Megalug restraint with the plain end riser reducer fitting.[36] The last but not least, in *Rick's Mushroom Service*, the court highlighted that the *Spearin* doctrine must be taken into consideration when analyzing the contract for provision of services, cooperative agreement versus procurement contract.[37]

2.4.2 BIM Impact on Spearin Doctrine

In analyzing the Spearing doctrine in detail, it is essential to focus on two major legal issues that arise in terms of BIM impact on the doctrine at issue. The first issue rests on

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[33] *Rick's Mushroom Serv. v United States*, 521 F.3d 1338.

[34] *Hardwick Bros. Co. II v United States*, 1998 U.S. App. LEXIS 20861.

[35] *Martin K. Eby Constr Co v Jacksonville Transp. Auth.*, 436 F. Supp. 2d 1276.

[36] *City of Holland v Grand River Constr*, 2016 Mich. Cir. LEXIS 167.

[37] *Rick's Mushroom Serv v United States*, 76 Fed. Cl. 250.

the contractor's point of view and questions whether the change in cooperation among players at the stage of design devoid the contractor of the responsibility safeguards for errors supplied by the *Spearin* doctrine.[38] The second issue in question relates the question of whether the cooperation enable by BIM at the time of the design phase eliminates the traditional protection of designers from responsibility for contractor instruments and methods. If the answers to the aforesaid questions are found, it will be possible to accurately define the role of the parties and execute the appropriate control over the cooperative process. As a matter of fact, it is significant to accentuate on that no new legal issue exists in this domain.

2.5 Ownership of the BIM

The question of ownership of the BIM model and data constitutes another important legal issue that needs to be explored and construed by means of this research. From the legal perspective, the question of ownership is frequently associated with the question of control. However, it is imprudent to consider the categories of ownership and control the same. The significance of ownership in BIM-related issues stems from the fact that both the ownership of the model and utilization of the data that the model contains and produces, constitutes one of the most controversial concern.[39] A corollary tension emerges by virtue of the fundamental cooperative essence of BIM, layered over traditional, less-cooperative project delivery systems. As a matter of fact, BIM potentially is deprived of established protocols for

[38] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.
[39] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.

determining responsibility when something happens incorrectly with the product, into which may participates have already contributed significant amount of data. The original concerns over ownership usually deal with the complexity in tracking the genesis of a problem after it emerges, particularly when the appropriate data may have been entered into the model weeks, months, years, or days prior to the manifestations of the problem.

2.6 Allocation of Risks

The allocation of risks is another legal concern that has capacity to create barriers and inconsistencies on the road towards the comprehension and utilization of BIM. Briefly speaking, risk allocation is important, because the utilization of BIM inevitably changes the correlation between parties by blending their roles and responsibilities. Therefore, a BIM legal framework usually favors less cooperative environment with clearer defined responsibility.[40] Also, there is no exaggeration to say that the coordination, either through BIM technology or something else, constitutes their major service to the project. According to the results from Spring Center Arena, BIM coordination is likely to reinforce communication, which reduces construction time and cost. In other words, it diminishes the overall risk. As the leaders of construction collaboration, construction managers and contractors are empowered to encourage and foster the distribution and sharing of BIM technology on every single project. In this connection, relevant contract language may become a remedy for the problem of risk allocation.

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[40] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

2.7 Privity of Contract

Privity of contract constitutes a group of interrelated legal issues that should be significant in terms of barriers of BIM and means of overcoming the barriers at issue. In analyzing the frames within which third parties may utilize a project, it is deemed wise to assert that the extent is a highly contested legal issue. Thus, the use of cooperative models is likely to diminish the successfulness of designers' defenses of absent privity. It is incumbent on BIM designer to actually understand that there are other individuals who may rely upon the preciseness and viability of the model.[41] Generally speaking, it is highly probable that the primary objective of the model lies in the supplementation of subcontractors' and contractors' uses.

The Second Restatement of Torts provides that the person who negligently supplies information is liable if the information at issue is intended for the plaintiff to rely upon. Hence, it follows that the Second Restatement of Torts establishes responsibility and obligations before third parties, because third parties may be those individuals who rely upon the information provided to them. Under the Second Restatement of Torts, the provision of liability is required only if there is a definite intention to affect and approach a class or group of individuals.[42] To that end, both the contractors and subcontractors who rely on the system at issue will be entitled to sue the designer for damages inflicted by negligent mistakes. In a

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[41] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009)

[42] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.

nutshell, considerations must be provided to require to waive the consequential damages as a precondition to utilizing the model or otherwise restrain damages, because of model errors.

2.8 Professional Design Responsibility

Professional design responsibility should be considered another legal consideration associated with building information model. In evaluating the legal dimensions of this consideration, it is vital to state that it is fairly complicated to guarantee that the professionals of design will always drive changes of the adoption and modification of the data that constitutes a digital model. This legal consideration intertwines with other legal concerns and issues, such as duty of care. For the overall idea of protection of public safety and health, it is found necessary for every licensed design professional to always be in charge of the modification and creation of the data that constitutes a digital model. However, this is not presently required and, probably may not be the final consequence.

2.9 Duty of Care

In analyzing duty of care, it is necessary to clarify that this legal consideration obligates the manager to utilize the skill and care usually exploited by representatives of the profession. To that end, it is possible to deduce that design professional liability always rests upon the duty of care. A general comprehension of the duty of care is conceived to enhance the understanding of this concept and how it reveals itself in practice.[43] A sample duty of care clause in a contract is likely to sound as a provision that obligates a professional to perform his obligation in a way consistent with care traditionally illustrated by design professional

[43] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

practitioners carrying out identical services at the same location, and under the same similar conditions and circumstances. Tort liability may take place if the duty of care is not followed, whereas contracts often evaluate contract of care the liability standard. Due to the fact that the roles are constantly changing, it is impossible to find clearly defined standards of care. As a matter of fact, the professional's agreements must expressly define reliance without a clear verification. However, the actual capability to rely upon another individual's work may be limited by professional ethics carved in statutes and sources of ethics.

2.9.1 Economic Loss Rule

The Economic loss rule, also known as economic loss doctrine, should be considered a legal doctrine that is frequently questioned as an affirmative defense to contractors' actions against design creators. In a nutshell, the doctrine regulates that absolutely economic losses cannot be compensated through a cause of action of negligence. As far as the issue of privity and defenses of third-party reliance is concerned, the practical value of the aforesaid defenses varies among jurisdictions and frequently depends upon specific facts.[44] This notwithstanding, the use of a cooperative model is a factor aiming at the support of a claim of the contractor that it should to receive a compensation of its economic losses.

2.9.2 Interview Analysis

As the foregoing discussion must suggest, the generally small sample size and the lack of response from owners justified the performance of a follow-up interview. The interview was scheduled and performed by an owners' representative who has had previous

[44] J Underwood, *Handbook of Research on building information and Construction Informatics: Concepts and Technologies* (IGI Global 2009).

experience not only with BIM technology, but possess significant experience with large scale complex projects.[45] The feedback from the interview showed that BIM benefits, such as improved quality of finished product and saving of money and time, echoed the result of the previous interview. However, the interview in question also offered a new viewpoint from the owner's perspective which makes the compensation valid, because compensation is still one of the primary obstacles that prohiBIM quick adoption of BIM as a method of delivery.

2.10 Appropriate Insurance

Aside from the above, the applied-knowledge industries are subject to substantial professional and general liability exposure, taking into consideration that the implementation of BIM in those areas will have to address strict requirements of law. In this connection, it is possible to notice that the insurance domain has to deal with the discrepancy between the provision of professional services, on the one hand, and methods and means, on the other hand. As the foregoing discussion must suggest, BIM, coupled with the methods of its project delivery, only blurs the frontier between the contractor and designer. As a matter of fact, the professional services, as well as methods and means, are becoming more and more intertwined, and, therefore, it is very difficult to separate one from the other. Moreover, BIM is found to significantly speed up the trend of integration.[46] The general comprehension of the disparity between professional liability policies and general liability policy arises as an urgent and helpful issue at the present-day point in time.

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[45] W Bandara, G Gable and M Rosemann, "Factors and Measures of Business Process Modelling: Model Building through A Multiple Case Study" (2005) European Journal of Information Systems 14.4, 347-360.
[46] Chuck Eastman, et al. *BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors* (John Wiley & Sons 2011).

As a matter of general practice, it is incumbent on the contractor to perform the precepts and requirements of the Comprehensive General Liability (CGL) insurance.[47] In a nutshell, the Comprehensive General Liability (CGL) insurance is designed to cover unexpected and unusual losses without including liability for the provision of professional services. The fact is that the designed must embrace the professional liability insurance. The key significance of professional liability insurance lies in the fact that the insurance safeguards against claims and demands concerning the legal duty of the policyholder to make compensation for a mistake or omission in his professional work. This type of insurance is also known as E&O insurance. The significance of the insurance is highlighted by design firms. Actually, the E&O insurance, namely, errors and omissions insurance, provides furtherance in dealing with claims and demands of professional liability in the provision of technical services by design professionals.[48] However, the aforesaid type of insurance is not conceived to cover liability originating from methods and means. Also, it is extremely important to note that the insurance coverage must perfectly fit in the integrated domain of BIM in order to guarantee that the project at issue is properly covered and that possible claim disputes between various policies is prevented. One possible settlement of this problem can be found in the following steps. First, it is possible to alter the way whereby personal injury and material damage are insured for both types of insurance – general liability and

[47] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[48] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

professional liability insurance.[49] Second, another way is to provide a requirement for the insurer for both professional liability and general liability to consent to a mixed claim agreement or endorsement. Third, as an alternative, it is necessary to develop a professional liability BIM endorsement in order to provide a broader coverage for professional services, such as technical consulting.

Aside from the above, the best model of coverage must be itself protected by insurance that makes coverage of the economic losses to the parties if the model is lost or damages by computer viruses. In this connection, the obligation to obtain insurance goes to the party that has assumed or is assigned the risk of hosting the model. It is incumbent on that party to procure insurance coverage for the economic losses in addition to any other losses and damages as discussed above.

CHAPTER 3 – CONTRACTUAL IMPLICATIONS OF BIM

The utilization of BIM on any project, irrespective of its duration, significance, or volume, gives rise to substantial contractual issues that are not likely to be solved by the standard forms of contract adopted in the industry.[50] The following key contractual issues stems from the utilization of BIM on any project: a) digital data protocols; b) coordination and reliance; c) project responsibility and risk; d) copyright and use of documents; e) available contract forms; etc. Each of the major contractual issues is to be analyzed in detail.

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[49] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[50] Chuck Eastman, et al., *BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors* (John Wiley & Sons, 2011).

3.1 Digital data protocols

Digital data protocols constitute one of the fundamental contractual issues related to the implementation of BIM in the framework of any project. Briefly speaking, it is substantial that the contract defines the particular software and hardware to be utilized. It is necessary for the team working on the project to create different elements of the BIM models, and, thus, the contract should provide an accurate definition of clear protocols for specifying which participants of the project will be able to make, alter, and/or utilize different components of the model.[51] In order to be enforceable, the contract between the project team must clearly and explicitly reflect the parties' intention to make a practical use of digital data, and to subsequently create protocols concerning the transmission and use of the data at issue. In this connection, it is essential for the parties to clearly identify who are going to embrace the burden of responsibility for administering the centralized electronic document management system for the project at issue.

The development and performance of digital data protocols constitutes some sort of a plan. It is vital that all provisions of the plan are properly recognized and construed in the contract between the participants of the project.[52] The plan may be very complex. The main complexity of the plan lies in the fact that the parties to the contract should be very precise and insightful by specifying the anticipated types of digital data to be utilized on the project. On the other hand, the parties must not only specify the types of anticipated digital data, but

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[51] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[52] Atul Porwal, and Kasun N. Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

also justify the applicability of the data to the project by placing a special emphasis upon the location of detailed description. In analyzing possible types of anticipated digital data, it is essential to note that the first and foremost type is project modifications and agreements.[53] This type of anticipated digital data should provide insight into the process and nature of agreements and modifications made on the project at issue. Also, it is important to describe where and how the data at issue applies to the project.

The next important type is project communications. This type of anticipated digital data conveys information about the means and methods of communication between different participants of the project. Moreover, the type of data should accurately define which software and hardware will be used from the purpose of project communications.[54] Also, the drafters of the contract should provide justifications of why the particular means or way of communications, including a software or hardware, is applicable to the project at issue. In elaborating further, architect's preconstruction submittals constitute the third major group of anticipated digital data that raises contractual issues and implications. As a matter of fact, the architect's preconstruction submittals are of specific importance, because, with the lack of the submittals, the project cannot proceed further.[55] Moreover, the nature and outcomes of the submittals frequently determine how the burden of risk under the contract is allocated.

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[53] Peter ED Love, et al., "Design error reduction: toward the effective utilization of building information modelling" (2011) Research in Engineering Design 22.3, 173-187.

[54] Atul Porwal, and Kasun N. Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects", (2013) Automation in Construction 31, 204-214.

[55] DBThompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology" (2006). http://www. aepronet. org/ge/no35. html (Available August 18, 2016).

Therefore, the issues concerning the architect's preconstruction submittals should be properly addressed by the contracting parties.

Equally important, the participants of the project are likely to encounter the contractual issues and implications connected with contract documents. Notwithstanding the fact that the contract may be viewed as a fully integrated written agreement between the parties, the field of BIM implementation may necessitate the existence of other documents that either add to or specify the provisions of the underlying contract.[56] Aside from the above, the existence of contract documents may be derived from the text of the underlying contract itself. Therefore, it is important for the drafters of the underlying contract to develop digital data protocols addressing various contract documents. In like manner, digital data protocols must also be address the issues of contractor's submittals and subcontractor's submittals.[57] Aside from the architect's preconstruction submittals, the submittals of contractors or subcontractors constitute issues of equal importance. If the contract does not address the issues of contractor's submittals and subcontractor's submittals, there is a high risk of protracted and expensive legal proceedings in case any dispute arises. Moreover, there must be digital data protocols that can help avoid the disputes in this sense.

In continuing the discussion of digital data protocols, it might be appropriate to note that modifications to the contract constitute one of the most important types of digital data protocols, because, with the lack of those protocols, it would be difficult to ensure the

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[56] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

[57] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

flexibility and adjustability of the underlying contract and the project itself.[58] In other words, the project cannot be rigid, because global challenges and metamorphoses have potential to frustrate the purpose of the project, make it impracticable or impossible. In this connection, the contract as the underlying instrument of the project must be specifically clear on how the implementation of BIM will be regulated in case the project needs to be changed. The same concern pertains to the issue of payment. Specifically speaking, the issue of compensation is one of the key drivers for the team to get together and bring the project into life. However, under specific circumstances, the terms and conditions of payment may be found unfair, insufficient, or frustrated.[59] Therefore, the digital data protocols, as well as the contract itself, should be flexible enough to reflect and justify various rates, allocations, and modifications of payments. The last but not least, the issues related to notices and claims should also be addressed and settled by means of digital data protocols in order to mitigate possible detrimental contractual implications.

3.2 Coordination and reliance

Coordination and reliance constitute the next contractual issue that needs to be addressed in the framework of this study. In analyzing this issue in question, it is essential to note that the contract regulating the implementation of BIM should accurately designate the extent to which participants of the project may rest upon each other's contributions to the BIM models, as long as the parties stick to the prescriptions of digital data protocols. Thus,

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[58] Peter ED Love, et al. "Design error reduction: toward the effective utilization of building information modelling" (2011) Research in Engineering Design 22.3, 173-187.

[59] DB Thompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology". <http://www. aepronet. org/ge/no35. html> (available August 18, 2016).

for instance, it would be essential for the architect to establish who is responsible for the coordination and assurance of the quality of other parties' contributions to the implementation of the BIM models, such as the owner's contributions, as well as the contributions of the contractor and subcontractors.[60] However, the attainment of reliance does not automatically entail coordination, and vice versa. In this connection, it is essential to approach to the concepts of reliance and coordination separately.

As far as the concept of reliance is concerned, it is extremely interest to note that the practical attainment of reliance depends not merely on the mutual intent of the contracting parties, but also on the peculiarities of the legal system. Taking into consideration that BIM poses a substantial transition in the means whereby construction projects are actualized, law-makers take strenuous efforts to determine which party to the contract is responsible and how reliance on others should be restricted or confined.[61] That is, the notion of reliance gets a practical sense when there is a tension between the law-makers' intent to accurately define duties and responsibilities of the contracting parties by restricting reliance of one party on the other, and the law-makers' need to foster cooperation and to promote reliance on information provided in the BIM, regardless of the means of development. In other words, coordination and reliance are not only contractual issues, but also the matter of statutory regulation. On the other hand, reliance and coordination constitute two major drivers that incite the law-makers

[60] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[61] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

to refrain from an absolute regulation of the parties' rights and obligation by giving the parties more contractual freedom.

The issues of reliance and coordination manifest themselves at different stages of BIM implementation. Thus, for instance, the importance of reliance and coordination can be traced in the contracting parties' approach to who will actually manage future BIM projects. There is no secret that the majority of big projects rely substantially upon expert engineers and architects and of record.[62] As a rule, architects have always been reluctant to carry the burden of the risk of other contracting parties, especially in terms of making alterations to their designs. However, the legislation of most states make is mandatory for the architects or engineers to become responsible for the risks of other parties. This is particularly because the architects and engineers are individuals with specialized knowledge. However, on the other hand, some jurisdictions provide that contractors play fundamental role in design, administration, performance, and construction. The desire of the architect to confine the liability while playing a crucial significance in BIM has led to inevitable confrontation in terms of who will play the major role in the future implementation of the BIM. In this connection, it needs to be acknowledged that the architects are afraid of the possibility that the contractors will assume a bigger component of the domain by obtaining a practical ownership over the BIM.[63] Also, there is fear among the architects that the contractor might sell the BIM to the treat and client the architect merely as a hired advisor. In this light, the

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[62] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

[63]DB Thompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology". <http://www. aepronet. org/ge/no35. html> (available August 18, 2016).

major contractual issue or implication arises when the contract remains silent on whether the contractor, the architect, or both, will actually dominate BIM as its core implementer. Hence, it follows that coordination and reliance depends on how the contract regulates the relationship between the contracting parties. If one party is to dominate the implementation of BIM, then the rest of the parties should rely on his domination. On the other hand, if the contract determines that both the architect and the contractor will dominate the implementation process, then the phenomenon of coordination appears to be more relevant.

There is no exaggeration to contend that coordination is always based upon consensus. It is impossible to effectively coordinate complex processes and projects, such as the BIM implementation unless there is a consensus among all contracting parties. Thus, the idea of consensus reveals itself through the acknowledgement that both the engineer and the architect go on being obligated under law to guarantee conforming of the BIM implementation with law.[64] This notwithstanding, the principle of coordination implies that both the engineer and the architect should act as information managers and must be equally responsible for the complete design model and drawings. In other words, the architect and the engineer are supplied with a wide spectrum of duties, such as the maintenance of the model as well as all relevant records, that the practical performance of the duties is possible only through coordination and reliance.

[64] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

3.3 Project responsibility and risks

Project responsibility and risks constitute the next group of contractual issues and implications concerning the actualization of BIM. The existence of these contractual issues and implications is based upon the contention that the contract should guarantee that the contracting parties do not undertake the duties that lie outside of their scope, insurable risk, and fee, solely by reason of taking part in the creation and implementation of the BIM models.[65] Specifically speaking, it is contended that the core idea of the contract is to provide that the actual participation in a BIM project does not automatically impose upon the architect responsibility for construction methods, means, and safety plans. In like manner, the participation of a contractor in the implementation of BIM does not make the contractor responsible for project design, unless the contract documents have explicit wording concerning the design delegation (e.g. design for the HVAC system).

In analyzing the issues of project responsibility and risks, it is essential to note that the specificity of project responsibility is often dependent upon the major risk allocation issues. The fact is that the main risk allocation issues are influenced by the peculiarities of the use of BIM. Some experts are prone to believe that the risks unique to BIM are minimal. Nevertheless, they still exist and may metamorphose into threats if not treated confidently, competently, and timely. Also, a mental note should be made that each risk is shaped by the uniqueness of the role played by every single contracting party.[66] Thus, for example, reliance

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[65] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[66] Atul Porwal, , and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

upon the information produced and stored in a BIM system brings into light issues regarding the role of the architect in carrying out professional services related to the construction process. When a BIM system is capable of producing concrete three-dimensional models and the contract is not well-drafted in terms of risks and responsibility, it will become questionable who is liable for the discernment of the final components imbued into a system conceived and created with the help of BIM technology.

Taking into consideration that the underwriters may consent to the advantages of early detection of the conflict and resolution through three-dimensional modeling. However, the underwriters are less prone to notice how they can support who has only insignificant membership in the BIM model, and who may embrace complete liability and responsibility for claims originating from the errors triggered by the utilization of the model at issue.[67] The major challenge for the insurer in this area is that the situation in question entails insuring an individual for all risks and losses inflicted either in part or in whole by the individual errors, acts, and omissions. The case law usually construe the contracts in the manner to show that the responsible party is responsible for all risks and liable for all damages originating from the acts of all contracting parties, as long as the party who assumed the responsibility and liability is actually responsible or liable to a great considerable degree for the ensuing damage or loss. The cooperation between subcontractors and contractors in the implementation of BIM has the potential to give rise to uninsurable risks of professional liability, where BIM is

[67] DB Thompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology". <http://www. aepronet. org/ge/no35. html> (available August 18, 2016).

actualized for the construction and development of a project at issue.[68] In like manner, the cooperation of the contracting parties in terms of the procedures, methods, and means of implementation can easily create the uninsured liability threats for the contracting parties and other professionals. As a matter of fact, it may be very difficult to insure both general liability risks and professional liability risks in situations where BIM is made a practical use.

Aside from the above, the actual reliance upon the information gathered and kept in the framework of a BIM system gives rise to question of the role of the architect in carrying out professional services related to the construction process.[69] Thus, it may be difficult to establish who is actually liable for the particularization of the final components included into a system developed and created by means of BIM technology. It is highlighted by some experts that the overreliance of professionals upon BIM technology may pose augmented liability on the part of the contracting parties if the information being input into a BIM system appears to be incorrect or the software itself processes the information in an incorrect way. The fact is that some contracting parties may be afraid of the incorrect processing of the information and, therefore, will seek to avoid embracing any responsibility related to these processes.[70] The incorrect processing of the information input into a BIM system may sometimes lead to catastrophic results – when the complete construction systems are found unworkable and the personnel ceases to understand the duties and objectives.

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[68] Salman Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) Leadership and Management in Engineering 11.3, 241-252.

[69] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[70] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

In view of the above, it is deemed wise to underline the legal issues pertaining to project responsibility and risks. The legal issues may arise in terms of determining responsibility and liability for mistakes in design where greater cooperation among the BIM implementation team projects decision-making for design components beyond the traditional contracting parties. Also, liability may be depended upon the type of information inserted in the information database. It is crucial to ascertain who possesses the actual ability to add or alter information.[71] Those who are practically able to add and alter data should be found liable for the errors and mistakes at issue. On the other hand, the liability may be attributed to those contracting parties who are identified through the amount of reliance contractors give to the output from the BIM system. At any rate, the major contractual issues arise due to the fact that the lines of responsibility and liability are actually blurred, whereas the risks of professional liability may spread from the traditional contracting parties to encircle contractors, subcontractors and building owners who are actually empowered by the contract to add or change the data in the BIM databases.

In elaborating further on the professional responsibility and risk related contractual issues, it is important to address the question of whether the use of BIM systems poses the risk of modifying the duty of care which is applied to the contracting parties for their obligations and functions in implementing building specifications and concepts. It is vital to note that the utilization of BIM does not entail "perfect" drawings. [72] The actual performance

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[71] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[72] Salman Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) Leadership and Management in Engineering 11.3, 241-252.

of the contracting parties, such as engineers and architects, is not immune from errors and mistakes that may stem from the changed orders at the time of construction, as well as future structural problems. Additionally, the owner of the project may be required to set aside a contingency fund, because of the contractual issues related to the coordination of construction. All these factors necessitate insurance. Experts underscore that a number of steps must be taken to facilitate the availability of insurance to cover the risks stemming from the implementation of BIM. Also, it is suggested that the contracting parties should either secure affirmative insurance coverage for BIM, or, as an alternative, avoid inserting into their contract the provision that will expressly exclude claims originating from the BIM.

3.4 Copyright and use of documents

Copyright and use of documents should be regarded as another important group of contractual issues and implications related to the implementation of BIM. It goes without saying that the overall purpose of the contract is to guarantee that the parties' participation in adoption and maintenance of the BIM models does not make inadvertent detrimental effect or frustration of the contracting parties' expectations with regard to the copyright of the documents drafted and created as the result of the use of the BIM models.[73] Besides, the contracting parties should be aware that the all parties' contributions to the BIM models, such as the contractor and its subcontractors have potential to be copyrightable and, therefore, the

[73] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

right of the use of these systems should be separately and particularly negotiated in all contractors that relate to the BIM implementation.[74]

In analyzing the contractual issues of copyright and use of documents, it needs to be contended that, under the existent copyright law, the term "author" means the owner of the copyright of the plans. In this connection, the contracting parties – such as the architect and the owner – should realize that, under the contractual provision related to "work for hire", it is incumbent on the one party to respect intellectual property rights of the other party or parties. Unless the contract stipulates otherwise, the architect is usually presumed the owner and author of the copyrights. In the framework of the BIM implementation process, a large number of parties may undertake to provide specifications and plans which may or may not be protected under copyright law.[75] The fact is that specifications and plans are not protected under copyright provisions. Taking into consideration that functional specifications and standardized documents are not protected as copyright, the issue of ownership and authorship is difficult to regulate in relation to these documents. However, the combination of individualized features and standardized documents may allow a contracting party to claim copyright protection.[76] It should be construed that, though the elements of a HVAC option may not be safeguarded by copyright laws, the original and unique combination of the standardized documents and personalized features may provide the party with the right to seek copyright protection of those "original" arrangements.

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[74] Salman Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) Leadership and Management in Engineering 11.3, 241-252.

[75] *Richmond Homes Mgmt, Inc., v Raintree Inc*. 862 F.Supp. 1517, 1524 (W.D.Va. 1994).

[76] *CSM Investors, Inc. v Everest Development Ltd*., 840 F.Supp. 1304, 1310 (D.Minn, 1994).

In proceeding further, the major copyright related challenge in the context of the BIM implementation is that different contracting parties may file different original plans which may constitute significant value and originality to be considered copyright. However, the aforesaid plans may be inseparably incorporated into a bigger model or plan, which is utilized in the course of the BIM implementation. [77] The contractual issue of ownership is not resolved in any standard form contract. Nor is it dealt with in the recent treatises on BIM implementation. Therefore, it is incumbent on the contractual parties to personalize their relationships under the contract in order to avoid possible intellectual property related disputes and controversies. The fact is that the AIA does not answer how the problem of copyright should be settled. On the one hand, its silence undermines the efficacy of copyright related protections. On the other hand, the AIA silence fosters the parties' contractual freedom, because they are not confined to certain frames within which their copyright related matters should be regulated. Additionally, the ConsensusDOCS provides that the ownership either by or between the architect/engineer and owner must be regulated in the agreement between them. However, no authority actually addresses any interests or rights of the subcontractors in the copyright protection of individualized plans.

Also, the ConsensusDOCS prescribes a set of important provisions that may shed light upon the entitlements and duties of the contracting parties in the context of copyright protection and use of documents.[78] One important requirement is that each contracting party

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[77] Salman Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) Leadership and Management in Engineering 11.3, 241-252.

[78] Chuck Eastman, *BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors* (John Wiley & Sons 2011).

should warrant that all copyrights are owned in all of its contributions to the project. Notwithstanding the fact that the aforesaid wording safeguards the parties, it does not solve the principal issue that a bunch of schemes may be integrated into a BIM project in the course of implementation and, therefore, may be filed as part of the complete model. If the integrated plans are utilized in a more recent project, the plans' owner might consider the plans a violation of copyright.

3.5 Privity, indemnities, and waivers

Another set of contractual issues and implications may be derived from contractual privity, indemnities, and waivers. The complex nature of the aforementioned contractual issues is dictated by the fact that the contract must always explicitly state that the contracting parties' participation in the adoption and implementation of the BIM models does not automatically give birth to contractual privity among the contracting parties and other participants in the BIM implementation who have not otherwise become parties to the agreements, for example between the subcontractor and architect, etc.[79] Nonetheless, if the utilization of BIM created unforeseen cases of liability, in conjunction with uninsured risk, it would substantially frustrate the purpose of the project or in any other way discourage the adoption of the BIM. Therefore, it is essential for the contract between participants of the BIM implementation to always address mutual indemnities and waivers which relate to all contractual issues discussed above. Concerning the issue of contractual privity, both the project contracts and the BIM addendum exist to guarantee that the contracting parties do not

[79] Salman Azhar, "Building information modeling (BIM): Trends, benefits, risks, and challenges for the AEC industry" (2011) Leadership and Management in Engineering 11.3, 241-252.

embrace responsibilities to act outside their fee, scope, and insurable hazard, and that the proceeding of BIM implementation does not give birth to privity among the contracting parties who have not otherwise become parties to the agreements.[80] In this connection, the contract should explicitly prescribe that the parties "without privity", such as the architect, are not responsible for the construction methods, means, and safety programs, and that the contract should also guarantee that the parties "without privity" can exercise control over the BIM implementation in conformity with registration laws.

In order to resolve the contractual issue of privity, it is incumbent on the contracting parties to follow a set of general guiding principles. Thus, it is important that no contract relationships or risks are restructured. Also, the contracting parties should be aware of the fact that no privity of contract is created among participants of the project, unless the participants are actual contracting parties.[81] Also, there is an obligation for every party to the BIM implementation, especially the contracting parties to the underlying contract, to incorporate a similar BIM addendum in all subsequent subcontracts. Interestingly enough, there should be no decrease of duties or roles of engineer or architect. Also, it is extremely important to note that the contributors to the BIM models, such as the contractor and subcontractors, must not carry out performance of design services. Also, the BIM model itself should not be utilized for the purpose of extracting material or objecting quantities.[82] The fact

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[80] DB Thompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology". <http://www. aepronet. org/ge/no35. html> (available August 18, 2016).

[81] Atul Porwal, and Kasun N Hewage, "Building Information Modeling (BIM) partnering framework for public construction projects" (2013) Automation in Construction 31, 204-214.

[82] Bilal Succar, "Building information modelling framework: A research and delivery foundation for industry stakeholders" (2009) Automation in construction 18.3, 357-375.

is that the design model surpasses and rules over any other existing model. Additionally, there may be addendum controls that operate over the underlying contract. The aforementioned guiding principles are considered useful and significance in dealing with contract privity related issues. However, they do not deal with other contractual issues, such as indemnities and waivers.

As far as the issue of indemnities is concerned, it needs to be pointed out that the US jurisprudence, as well as the laws of other common law countries, places a special emphasis upon evaluating individual liability and minimization of "collaborative" responsibility. As a matter of practice, architects and other participants of the BIM implementation are prone to rely on various disclaimers to guarantee that the project works and other substantial materials released in digital form are not encroached or misapplied.[83] Those participants of the BIM implementation who supply other participants with project drawings have an irresistible concern. In order to avert possible liability for amendments introduced to BIM models after the end of the control, the implementers of the models have recourse to various disclaimers. The development and incorporation of disclaimers make it possible for the participants of the BIM implementation to substantially decrease, mitigate, or even eliminate their liability. However, the resort to indemnification forms and notices frequently gives rise to the tensions and confrontations between the competing concerns and interests of other participants of the BIM implementation and the recipients of the forms. All this may create a substantial

[83] Noble & B Heart, "The AIA's New Digital Data Documents" (2008) 28 Construction Law 12, 13.

impediment on the road towards a complete actualization of BIM through the unburdened exchange of electronic information.[84]

The actual wish of various participants of the BIM implementation, such as engineers, architects, and designers, to confine their liability to certain minimums by means of using disclaimers should not be considered either irrational or unreasonable. This fear of liability is enrooted in the decision of the US Supreme Court in *U.S. v Spearin*.[85] The decision has already been briefly discussed in the preceding sections of this project. However, it is deemed wise to reiterate that, in the case at issue, the US Supreme Court decided that an owner providing specifications and plans to a contractor gives birth to an implied warranty that the design part is inherently adequate for the project. In this light, if the contractor could prove that he adhered to the specifications and plans, the owner providing the specifications and plans (the owner), rather than the contractor, would be find liable for any defects or inconsistencies. In view of the above mentioned decision, architects are afraid of a situation when they may be found liable for the damages and losses incurred as a result of the defects stemming from the subsequent alterations made without their knowledge to the previous provided specifications and plans.[86] Despite the fact that some experts question the applicability of the US Supreme Court's decision in *Spearin* to BIM and its implementation, the fear of possible liability incites the architects and other responsible participants to insist on the provision of disclaimers or, otherwise, they tend not to embrace the BIM.

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[84] D Larson & K Golden, "Entering the Brave New World: Introduction to Contracting for Building Information Modeling" (2007) 34 Wm. Mitchell L.Rev. 75, 93.

[85] *U.S. v Spearin*, 248 U.S. 132 (1918).

[86] R Volk, J Stengel, and F Schultmann, "Building Information Modeling (BIM) for existing buildings—Literature review and future needs" (2014) Automation in construction 38, 109-127.

The issues of indemnifications and waivers are closely connected with the issue of risk allocation. As a matter of fact, the underlying contract between different participants of the BIM implementation may prescribe that either each or certain party is liable for contributing to the BIM model, and that the contributions entail risks in terms of liability. However, in order to mitigate the risks, the parties may draft the contract in the manner that to the extent a design model is described in contract documents, the participants of the project may rest on the preciseness of information in the model at issue.[87] Hence, it follows that though the contract does not alter the duty of care, it may determine both the use of a BIM model and corresponding risks with this use.

3.6 Available contract forms

After the contractual issues of privity, indemnities, and waivers have been given due consideration, it is essential to discuss the implications and concerns related to available contract forms. To start with, it needs to be asserted that, prior to 2007, the standard AIA contract documents did not adequately address the legal issues, especially the contractual issue, that originated from all types of digital data transmissions among the participants of the BIM implementation. Specifically speaking, the pre-2007 AIA contract documents did not deal in any meaningful way with the digital data transmissions related to Word documents, CAD documents, and emails, as well as BIM models. However, in 2007, the AIA drafted the standard forms of the agreements between owners and architects, to which the parties have to

[87] DB Thompson, and Ryan G Miner, "Building information modeling-BIM: Contractual risks are changing with technology". <http://www. aepronet. org/ge/no35. html> (available August 18, 2016).

refer for transmission of "electronic data."[88] Thus, for example, the Digital Data Protocol ExhiBIM (form E201) serves to govern data transfers between the architect and the owner and should be attached to the underlying contract (currently the B101 and B103 agreement forms). Also, the Digital Data Licensing Agreement (form C106) is purposed to be a separate and independent agreement between the participants of the BIM implementation who are not in the contractual privity, such as the architect and the contractor or a subcontractor.

Notwithstanding the existence of the forms, none of the forms explicitly refer to the adoption of a BIM model. Nor does any of the standard forms effectively address the contractual issues delineated in the preceding sections of this project. In order to fill the gaps in the 2007 editions of the standard forms, the AIA issues its 2008 Building Information Modeling Protocol ExhiBIM (form E202). The ExhiBIM is actually intended to be incorporated in a large number of AIA owner-contractor and owner-architect agreements.

Alternatively, there is a family of other construction related agreements. This group of agreements is called ConsensusDocs. The aforesaid family of construction industry agreements was created by a consortium of industry groups, including the AGC.[89] Here, it is vital to mention two popular ConsensusDocs standard forms that deal with digital data transfers: the 2007 Electronic Communications Protocol Addendum and the 2008 BIM Addendum. The former standard form agreement encircles a wide spectrum of digital operations, from email, to payments. On the other hand, the latter standard form agreement

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[88] Howard W Ashcraft, "Building information modeling: A framework for collaboration" (2008) Constr. Law. 28, 5.

[89] Peter ED Love, et al. "Design error reduction: toward the effective utilization of building information modelling" (2011) Research in Engineering Design 22.3, 173-187.

addresses specifically BIM models. The latter has been explicitly written to take into consideration the federated essence of BIM models. Both of the standard contract forms are purposed to be ascribed to all BIM related project contracts. Together, these standard forms are called to expressly address the complete range of contractual issues.[90] However, despite specific modifications that may be required for a particular project, at present time, it seems that either the ConsensusDocs 301 BIM Addendum form or the AIA's E202 BIM Protocol ExhiBIM form has potential to help actualize an exhiBIM to an agreement drafted under the AIA standard form or any other model of underlying architect-owner agreements.

CHAPTER 4 – CONTRACTUAL IMPLICATIONS OF COLLABORATIVE PROJECT DELIVERY (IPD lite)

4.1 Traditional contractual issues related to the IPD implementation

Apart from the Building Information Modeling (BIM), there are a wide spectrum of contractual issues and implications to the addressed in the framework of Collaborative Project Delivery (hereinafter referred to as "IPD"). Prior to delving deep into the contractual problems related to the implementation of IPD, it is essential to delineate the nature and fundamental components of the IPD as the subject of contractual regulation.[91] Thus, the term "collaborative project delivery", also known as "integrated project delivery (IPD)", can be defined as a cooperation and conjunctional operation of systems, people, and business structures that are combined together in order to promote the insights and talents of all actors.

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[90] Salman Azhar, et al, "Building Information Modeling (BIM): A new paradigm for visual interactive modeling and simulation for construction projects" (2008) Proc., First International Conference on Construction in Developing Countries.

[91] R Ghassemi, and B Becerik-Gerber, "Transitioning to integrated project delivery: Potential barriers and lessons learned" (2011) Lean construction journal, 32-52.

The mission of the IPD is to facilitate and optimize the outcomes of a particular project, as well as to raise the value of the product, or diminish the waste. To every intent and purpose, the IPD is practiced to attain the maximum effectiveness at all stages of fabrication, design, and construction of the project at issue.[92] Hence, it is possible to distinguish several sequential stages through which the IPD can be actualized. Thus, conceptualization may be considered the initial stage of the IPD. At this stage, the participants of the project engage in expanded programming.[93] The second sequential stage of the IPD is the criteria design stage. At this stage, the participants of the project develop an expanded schematic design of the project in order to visualize the project and clearly understand their duties.[94] The next stage of the IPD may be defined as the detailed design stage. This stage of the IPD implementation is the logical sequential continuation of the preceding stage. However, in lieu of general criteria of the schematic design, this stage is associated with a more particularized work of the participants on the design development. After this, the stage of implementation documents occurs. At this stage, the participants of the IPD draft and compile implementation documents, and, thus, the majority of contractual issues and implications may be solved or avoided at this stage of the IPD implementation. Agency review stage and buyout stage follow the implementation documents stage.[95] These stages are essential for the formalization

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[92] MD Ryall, and RC Sampson, "Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development projects" (2009) 55(6) Management Science, 906-25.

[93] S Cho, G Ballard, R Azari, and Y Kim, "Structuring ideal project delivery system" (2010). In Proceedings of International Public Procurement Conference 2010.

[94] S Davenport, J Davies, and C Grimes, "Collaborative research programmes: building trust from difference" (1998) Technovation, 19(1), 31-40.

[95] MD Ryall, and RC Sampson, "Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development projects" (2009) 55(6) Management Science, 906-25.

and authorization of the project prior to the actual commencement of the building works. The IPD implementation finalizes with the construction, closeout, and facilities management stages.

4.1.1 Relationship of design services to compensation

After the concept of the IPD has been defined and interpreted, it is vital to place a special emphasis upon the contractual issues to be addressed in the framework of the IPD implementation. The major contractual issues arise either within the framework of traditional CM-at-risk, or in the context of the agreement between the architect, the owner, and CM concerning a more innovative model of the relationships.[96] Regardless of the contractual form, the various participants of the IPD implementation are highly likely to encounter the issues with relationship of design services to compensation. In analyzing the first contractual issue, in needs to be clarified that the IPD requires a very precise and careful implementation. If the IPD is implemented properly, it is incumbent on the architect and owner to achieve a much higher level of design achievements at the initial stage of the implementation.[97] Thus, the contracts between the participants of the IPD implementation should seek a tighter cooperation and coordination among all actors. The presence of the aforesaid contractual issue implies that the contracts between the parties must guarantee that the constructability reviews, phasing review, estimation of the costs, as well as engineering proposals, are reflected in line with compensation.

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[96] H Halttula, A Aapaoja, and H Haapasalo, "The contemporaneous use of building information modeling and relational project delivery arrangements" (2015) Procedia Economics and Finance, 21, 532-9.

[97] R Müller, JR Turner, "The impact of principal–agent relationship and contract type on communication between project owner and manager" (2005) International Journal of Project Management, 398-403.

4.1.2 Phasing of design services

Phasing of design services is the next possible contractual issue that may be given birth in the framework of the IPD implementation. In a nutshell, the issue of phasing necessitates engaging in the process of reconsideration of the traditional definition of design phases.[98] The need for such rethinking both originates from and is driven by the actual needs and expectations of the actual participants reflected in the contract.

4.1.3 Project responsibilities and risks as well as the issue of contractual privity

The next group of contractual issues deals with contractual privity, project risks and responsibilities. The aforesaid group of contractual issues relates to the intents and efforts of the contracting parties directed at undertaking duties and responsibilities that lie outside the fee, scope, and insurable risk.[99] Here, it needs to be reiterated that the IPD implementation does not automatically give rise to contractual privity among the actors who have not actually entered in a contract, such as the relationships between the contractor and the subcontractors. In order to give rise to the contractual privity, it is incumbent on the contracting parties to prescribe in their contract that the architect has no direct responsibility with regard to the methods, means, and safety programs, and that the contractor has no responsibility for project design as long as the contractual provisions do not specify that there may be delegation of

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[98] S Gandhi, and J R Jupp, "Characteristics of Green BIM: process and information management requirements" (2013). In IFIP International Conference on Product Lifecycle Management (pp. 596-605) (Springer Berlin Heidelberg 2013).

[99] MD Ryall, and RC Sampson, "Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development projects" (2009) 55(6) Management Science, 906-25.

duties and responsibilities with regard to the design and building of the HVAC system.[100] It is also essential for the contractual parties to articulate that the architect is entitled to carry out responsible control over the design in conformity with the laws that regulate the issues of professional registration.

In proceeding further with the critical overhaul of possible contractual issues pertaining to the implementation of the IPD, it is found necessary to mention the issues related to the review and coordination of design services.[101] As the foregoing discussion must suggest, the underlying contract between the architect and the owner, as well as the contract related to the BIM implementation, should provide a clear and unambiguous definition of the parties' responsibility with regard to the review and coordination of any design related services provided by other parties and actors, such as the contractor, subcontractors, and the owner's consultants.

4.1.4 Coordination and review of design services coupled with copyright and use of documents

The practical use of contract documents, as well as the copyright related matters, constitutes the next group of contractual issue that may be encountered by the implementers of the IPD. Similar to the BIM, IPD projects impose on the participants a very critical contractual obligation to provide a clear definition of how the contract documents will be used by the project team and other members, such as the contractor and subcontractors, and

[100] P Lahdenperä, "Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery" (2012) Construction Management and Economics, 57-79.
[101] MD Ryall, and RC Sampson, "Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development projects" (2009) 55(6) Management Science, 906-25.

how the use of the documents will be controlled by the supervising participants of the IPD implementation.

4.1.5 Dispute resolution

Dispute resolution issues are also substantial in terms of the IPD implementation. As a matter of fact, all contractual agreements between the participants of the IPD implementation should contain a thorough and well-elaborated dispute settlement provision whereby the contracting parties undertake to settle controversies and disputes between them either by means of litigation or through alternative dispute resolution schemes, such as negotiation, mediation, conciliation, or arbitration.[102] As a matter of fact, the presence of effective dispute resolution provisions is expected not only to help facilitate the resolution of different controversies, but also ensure that the implementation of the project is being carried out smoothly. It is impossible to predict and prevent all possible problems and controversies originating from or pertaining to the implementation of the IPD.[103] Nevertheless, all contracts between the participants of the IPD should contain at least mediation provisions with possibility of joining all other parties and participants.[104] On the other hand, it is also expected that big projects should be implemented with the possibility of the appointment of a standing review board for the initial review of all controversies and claims. The suggested dispute review board should be created under the principles of neutrality and impartiality.

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[102] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.
[103] JA Cleves, and RG Meyer, "No-Fault Construction's Time Has Arrived" (2011) Constr. Law, 31, 6.
[104] MD Ryall, and RC Sampson, "Formal contracts in the presence of relational enforcement mechanisms: Evidence from technology development projects" (2009) 55(6) Management Science, 906-25.

4.1.6 Insurance, limitations on liability, waivers, and third-party indemnification

In continuing the discussion of various contractual issues, it is also essential to underscore the issues and implications concerning the waivers, third-party indemnification, insurance, and limitation on liability. As the foregoing discussion must suggest, the aforesaid contractual issues and implications manifest themselves in the framework of the BIM implementation.[105] Similarly, the same issues may arise in the context of the IPD implementation. The fact is that the contracts should clearly provide requirements of insurance for all participating parties in order to prevent possible disputes and problems around the uninsured risks. Also, it is essential for the contracting parties to insert mutual waivers of subrogation among participants. The waivers must clearly specify the claims which are covered by insurance.[106] The last but not least, it is vital for the contracting parties to incorporate possible limitations on liability in conjunction with any provisions on consequential damages. On the other hand, the contracting parties may agree to delineate indemnities among the contracting parties concerning the above-captioned issues.

4.1.7 Available contract forms

Aside from the above, the available contract forms constitute a group of most significant contractual issues and implications, because this group directly relates to the form, enforceability and efficacy of the contracts directed at the implementation of the IPD. It

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[105] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

[106] JP Smith, and Z Rybkowski, "Literature review on trust and current construction industry trends" (2012). In 20th Annual Conference of the International Group for Lean Construction. San Diego, USA 2012 Jul (pp. 18-20).

should be recapitulated that the issue of available contract forms has been given due heed and consideration in the foregoing discussion of the BIM implementation.[107] As far as the IPD implementation is concerned, the availability of standard contract forms is dependent upon the AIA activities. The standard contract forms of the AIA are usually derived from its 2007 editions. However, some contracting parties still utilize various pre-2007 standard contract forms. Regardless of the version, the AIA standard contract forms should be made a practical use with the specific purpose in mind – to attain the IPD-related project goals and objectives. This notwithstanding, the most recent set of the IPD-related standard contract forms should be considered the most specific and efficient one. The new set of AIA contract forms is frequently referred to as the "Transitional" IPD documents.[108] The aforesaid contract forms were designed to facilitate more cooperative interactions among various participants of the IPD implementation, such as the architect, owner, and CM. Also, it is extremely interesting to note that the aforementioned set of AIA standard contract forms were conceived to go beyond the standard CM-at-risk operations in terms of cooperation and collaboration among the parties at the initial design stages.[109] The so-called transitional IPD standard contract forms consists of the following standard forms as an owner-CM contract (A195) and an owner-architect contract (B195). All these types of standard form contracts are largely confined to the business and financial terms and conditions. In addition to this, it is also necessary to

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[107] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

[108] P Raisbeck, R Millie, and A Maher, "Assessing integrated project delivery: a comparative analysis of IPD and alliance contracting procurement routes" (2010) Management, 1019:1028.

[109] KE Hedges, AS Denzer, C Livingston, and M Hoistad. Socially responsible collaborative models for green building design (AIA Research for Practice Program Grant 2008).

mention a the Project Conditions standard form contract (A295), which is conceived to be added to both the B195 and A195 agreements in order to supplement them with the detailed phasing and depiction of the scope of duties for both the CM and the architect.[110]

Also, in addition to the higher level of collaboration related to the establishment of a unified group of project conditions the Project Conditions (A295) document makes substantial changes to the presumptions concerning the phasing of design services for both the CM and architect, referring specifically to the up-to-date six-phase framework for IPD created by the California Council of the AIA.[111] Besides, a set of standard form contracts may be derived from the ConsensusDocs 300 Tri-Party Agreement. The Agreement in question is a contract signed by the architect, owner, and contractor. The COnsensusDocs Agreement actually incorporates a cooperative approach towards the construction and design, coupled with the full scale of reward sharing and financial risk devices for the complete implementation of the IPD. In terms of cooperation, the ConsensusDocs 300 standard contract forms tend to go further than the AIA transitional documents in actualizing a uniform group of project conditions for all participants of the IPD implementation. The aforesaid standard contract forms address a wide spectrum of issues, such as copyright, dispute resolution, insurance, and phasing.[112] In the ultimate analysis, there is no exaggeration to say that the ConsensusDocs 300 standard contract forms are efficient in terms

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[110] P Chan, and R Leich, "The role of integrated project delivery elements in adoption of integral innovations". (2014) EPOC 2014 Conference.

[111] BD Ilozor, and DJ Kelly, "Building information modeling and integrated project delivery in the commercial construction industry: A conceptual study" (2012) Journal of Engineering, Project, and Production Management, 2(1), 23.

[112] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

of drafting detailed provisions for collaborative value-engineering and budget-setting process at the stages of design.

4.2 Contractual issues related to the reward and risk sharing in the implementation of the IPD

Above from the general contractual issues, the implementation of the IPD may also be associated with the emergence of a large number of other contractual issues that directly relate to the sharing of risks and rewards. The fact is that the complete implementation of the IPD may be dependent upon the accurate sharing of risks and rewards.[113] In this connection, not only traditional contractual issues and implications, but also specific risk/reward sharing issues and implications need to be addressed by the participants of the IPD implementation.[114] A more detailed discussion of the reward/risk sharing contractual issues and implications is provided below.

4.2.1 Incentive compensation

After a careful deliberation, it is attainable to come to the conclusion that incentive compensation is the first and foremost contractual issue that may arise on the road towards the full implementation of the IPD. Specifically speaking, the issue of incentive implementation may arise where the contracting parties encounter the question of how the contract should define incentive compensation to the contractor and architect in order not

[113] P Pishdad-Bozorgi, EH Moghaddam, and Y Karasulu, "Advancing target price and target value design process in IPD using BIM and risk-sharing approaches". In ASSOCIATED SCHOOLS OF CONSTRUCTION ANNUAL INTERNATION CONFERENCE, 49th, San Luis Obispo 2013.

[114] B Kolarevic, "Towards integrative design" (2009) 7(3) International Journal of Architectural Computing, 335.

only to meet but also to exceed the predefined project goals.[115] Also, the aforesaid contractual issue may arise in the situation when the contracting parties seek to address the problem of how the project mission and goals should be delineated and who should be entrusted to be drafter such goals and the mission objectives.[116] Similarly, the contractual issues and implications of incentive compensation may be given rise in situations when the contracting parties are not sure when and how the incentive compensation should be paid. The last but not least, it is incumbent on the contracting parties to decide how the compensation will be given back in case any mistake has been made or a penalty has been imposed.[117] If the aforementioned issues are not properly regulated in the framework of the contract between the participants of the IPD implementation, it will be difficult to enforce the contractual provisions to settle the related disputes and controversies.

4.2.2 Cost savings and cost overruns

Cost savings and cost overruns constitute the next group of contractual issues related to the risk/reward sharing activities in the framework of the IPD implementation. In encountering the aforesaid group of contractual issues and implications, the contracting parties are required to provide clear answers to the question of whether the contract between them stipulates for sharing of cost savings in case hen the total amount of cost is smaller than the target cost. Also, certain contractual issues may arise when there is not answer in the

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[115] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

[116] OA Akintan, and R Morledge. "Improving the collaboration between main contractors and subcontractors within traditional construction procurement" (2013) Journal of Construction Engineering.

[117] B Franz, and RM Leicht, "Initiating IPD Concepts on Campus Facilities with a" Collaboration Addendum". In Construction Research Congress 2012 (pp. 61-70).

contract on the percentage of gains and who will get a certain share.[118] On the other hand, the contracting parties are likely to encounter the contractual issues of cost savings and cost overruns when they are required to answer the question of whether the contract is to share the burden when the total amount of costs exceeds the target cost. Also, another contractual problem is whether the contract clearly identifies the risks and shares of the architect and CM – whether the contracting parties actually put their profits at risk.

4.2.3 Intra-party claims inside the project group

Not opposed and in addition to the contractual issues and implications discussed above, the contracting parties may be driven into the problem of intra-party claims inside a group of participants who undertook to implement the IPD. In case when there is a 3-party contract, the contract at issue should incorporate either a complete or partial waiver of intra-party claims among the participants of the project group, such as the architect, owner, and CM.[119] If the waiver appears to be partial in its nature, it is essential for the contract to provide a viable definition of a restriction of liability – that may be tied to the existent insurance.

4.2.4 Claims against members of the project team by third parties

Another painful contractual issue is the probability of claims and demands from third parties directed against the participants of the IPD implementation. In order to avoid or mitigate possible predicaments and outcomes related to the third-party claims, it is essential

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[118] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.
[119] C Thomsen, J Darrington, D Dunne, and W Lichtig, Managing integrated project delivery (Construction Management Association of America (CMAA), McLean, VA. 2009) 105.

for the contract between the IPD implementers to clearly define how the contracting parties are about to share the risk of third-party claims against them.[120] One possible solution in this field may be related to the creation and operation of a special fund in conformity with the project policy.[121] As an alternative, the participants of the IPD implementation may decide to draft specific contractual clauses that will indemnify them for third-party claims to the degree of their personal negligence or breach of duty.

4.2.5 Available contract forms related to the risk/reward sharing activities in the framework of the IPD implementation

The next set of contractual issues and implications may be derived from the utilization of available contract forms related to the risk/reward sharing activities in the framework of the IPD implementation. In addition to the cooperative contract provisions discussed above, the ConsensusDocs 300 Tri-Party standard form agreements offer the full spectrum of financial reward/risk sharing mechanisms related to the entire implementation of the IPD. These mechanisms should be discussed with particularity. Thus, the aforesaid standard form contracts offer a provision that the initial compensation for both CM and architect will consist of their direct employment expenses and costs. [122] However, a separate fee should also be paid in case the expected incentive objectives are fulfilled. The next standard provision may concern the definition of performance benchmarks for the project at

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[120] H Xie, JM Tramel, and W Shi, "Building Information Modeling and simulation for the mechanical, electrical, and plumbing systems. InComputer Science and Automation Engineering (CSAE)" (2011) IEEE International Conference on 2011 Jun 10 (Vol. 3, pp. 77-80).

[121] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

[122] W Jung, G Ballard, Y Kim, and SH Han, "Understanding of Target Value Design for Integrated Project Delivery with the Context of Game Theory" (2012). In Construction Research Congress (p. 556Y563).

issue, especially in the domains of quality, cost, schedule, safety, reliability, planning system, construction processes, innovative design, and teamwork. This provision stipulates that the CM or the architect will gain incentive compensation in case the benchmark objectives are fulfilled or exceeded.[123] In continuing the analysis, the next standard contract provision prescribes that, in case the actual project cost is smaller than the consented-upon budget objective, the contract will effectuate two possible options: either the owner will embrace the burden of the risk of additional costs, or the contracting parties will split the risks in specific shares.[124] As far as the latter option is concerned, the risks of the CM and architect may be confined to their existent fees, such as the profit and overhead. The next suggested provision to be inserted into the contracts for the IPD implementation articulates that the parties to the contract may mutually waive all claims and demands against each other for cooperatively attained and mutually arrived upon project decisions, for unforeseen circumstances and events that lie outside the control of any contracting party, as well as for consequential damages. Additionally, the contracting parties may come into an agreement concerning the mutual waiver of all demands and claims against each other for other good-faith actions, such as the breach of contract, negligence, unless the action passes the threshold of willful default.

In a nutshell, according to the suggested provisions of the available standard contract forms, the contractor and the architect should share with the owner all financial risks and

[123] M Mathews, "BIM collaboration in student architectural technologist learning" (2013) Journal of Engineering, Design and Technology,11(2), 190-206.

[124] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.

burdens related to the delivery of the contracted project on budget and on time.[125] In return, all parties to the contractual relationships undertake not to file suits or submit other claims against each other (explicitly meaning that the owner is likely to bear the majority of the risks and costs for the contractor's and architect's personal negligence, as long as the parties act in good faith). Also, it needs to be mentioned that, in May 2008, the AIA published, in addition to its "Transitional IPD documents", an initial series of SPE (special purpose entity) documents. [126] The aforesaid standard documents are intended to provide an separate contractual framework for the wide spectrum of financial rewards/risk sharing mechanisms related to the entire implementation of the IPD. In contrast to the ConsensusDocs 300, which prescribes standard contract forms for three-party agreements, the AIA created a more complex structure, in which the architect, owner, and CM, incorporate into a separate limited liability company.[127] In this limited liability company, all three contracting parties become members. The LLC in question manifests itself as a type of project-specific build/design company. The LLC, on the other hand, is purposed to enter into a new contract under the AIA form C196 with the architect in order to safeguard the performance of design elements of the project at issue.[128] Then, the LLC has to enter into a different contract with the CM to administer the construction, as well as into a bunch of contracts with the trade subcontractors

[125] GP Luth, A Schorer, and Y Turkan. "Lessons from using BIM to increase design-construction integration" (2013) Practice periodical on structural design and construction,19(1),103-10.
[126] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.
[127] DC Kent, and B Becerik-Gerber, "Understanding construction industry experience and attitudes toward integrated project delivery" (2010) 136(8) Journal of construction engineering and management, 815-25.
[128] M Mathews, "BIM collaboration in student architectural technologist learning" (2013) Journal of Engineering, Design and Technology,11(2), 190-206.

to perform the actual construction work in practice. The latter contracts may be drafted under the AIA standard contract form C197. The aforesaid form was published in 2008.

CHAPTER 5 – CONCLUSION AND RECOMMENDATIONS

5.1 Summary

After everything has been given due consideration, it is possible to generalize that building information modeling (BIM), as well as collaborative project delivery (IPD), have many contractual issues to be addressed and settled in the framework of implementation of the aforesaid two systems. In order to highlight the key achievements of this research project, it is essential to generalize its major points and arguments. Thus, as a result of the conducted research, it was ascertained that that the evolution of the R&D efforts focused on commercial instruments and academia making the practical use of the BIM approach. Also, it was found out that a wide spectrum of the software behaviors and functions attributed to the present-day generation of instruments, such as Bentley Building, Autodesk Revit, VectorWorks, and AllPlan, should also be associated with the design objectives of the manufacturers of earlier commercial software. Also, a viable definition of BIM as an operational concept was found in order to better grasp the specificities and significance of BIM.

Besides, the conducted research helped verify that the BIM sets forth a new philosophical paradigm for practice, because it encourages combination and practical actualization of different roles of all participants in a concrete project. The study of salient features and essential characteristics of BIM showed that Building Information Modeling (BIM) could make significant contributions to the development of construction industry, because most of its salient features pertain primarily to a variety of office products, such as

word processing, graphic products, and spreadsheets. Regardless, it was also possible to notice a significant penetration of BIM in other fields of applied knowledge, such as ship-building, aviation, automobile, etc. This is especially because of the prominence of BIM's other essential characteristic – that BIM is an electronic modeling. In other words, most of its processes are carried out electronically.

The conducted study made it apparent that the integration of safety is expected to facilitate safer design and decrease iteration loops. In this connection, the integration of construction safety may provide momentum in the Integrated Project Delivery (IPD). Therefore, the term "integrated project delivery" may be defined as an approach to project delivery that joins business practices, business systems, people and structures into a single process that collaboratively fasten together the insights as well as talents of all actors to provide more optimized results, reduce waste, raise value by means of all phases of fabrication, construction, and design.

The Integrated Project Delivery ("IPD") was found to be an approach in the delivery of big projects to participants, such as the owner, builder, design professional, and possibly lower-tier participants) perform a contract whereby they cooperate in designing agree development process and to a certain extent, the economic risks share related to defective design. IPD is a matter of substantial interest and to create a feeling of promise for builders and Design Professionals.

Another significant finding of research is the clarification of the concept of partial uses of BIM. The concept of partial uses of BIM was found to include the following types of uses: a) assistance with scoping during purchasing and bidding; b) review of the scope for

value engineering; c) coordination of construction sequencing; and d) demonstration of project approaches in the framework of marketing presentations.

As the foregoing discussion must suggest, in every situation of partial uses of BIM, only part or elements of the scope and merely particular trades may be created. The “partial uses”, in contrast to entire project models, are to constitute the means whereby many contractors are likely to facilitate gaining benefit from utilizing the BIM. The “partial uses” can be much less difficult to adopt, and the benefit of utilizing them is much more tangible to everybody.

In evaluating the barriers to implementation and utilization of BIM, it was verified that the fundamental question is whether the fears and other barriers legitimate and prudent. The legitimacy and prudence of the barriers are often dependent upon the easiness and practicability of BIM as an up-to-date technology.

A set of barriers in the use of BIM should be deduced from a variety of commercial issues. The overall purpose of BIM was found to lie in the promotion and facilitation of trade and commerce. In this connection, the inability to achieve the overall purpose of BIM was found to be detrimental to its viability as a modeling system. Aside from the above, commercial issues in the use of BIM were also found to be associated with such barriers as the lack of standard BIM contract documentation. In elaborating on this commercial issue, it needs to be pointed out that the absence of standard contract documents which regulate BIM handicaps the development of BIM in the ultimate analysis. From the commercial perspective, standard contract documents help fulfill three major objectives: (1) provide legal framework for the practical implementation of BIM; (2) give birth to consensus allocation of

risks and the interplay between dispute resolution, insurance, and risk assumed; and (3) diminish efforts taken in formalizing the roles and duties of the project participant by means of documentation.

Another substantial finding of research was that, after having discussed the commercial issues in detail, it was ascertained that the majority of the legal concerns rotated around the issues of risk allocation, such as responsibility or collaboration, duty of care, privity, third-party reliance, economic loss, etc. In a nutshell, each possible legal issue and concern deserves attention and immediate response, because, it contrast to commercial issues and concerns, the former may entail not merely economic consequences for the implementer of BIM, but also legal outcomes, such as legal liability and legal ramifications.

However, it was explored that the implementation of BIM is not deprived of changes and alterations to design and components of BIM, such as electrical, structural, architectural, and mechanical changes. The fact is that, upon the utilization of the model, supplier and contractor information is integrated in BIM, expanding upon its design and elements. Another possible technical issue may be linked to the phenomenon of interoperability. Moreover, professionals confess that neither issues nor processes of BIM can be completely comprehended outside the context of interoperability. Specifically speaking, the Structural Engineering Institute unravel that the most popular complaint is insufficient operability of parametric modeling (BIM) software in various vendors.

Equally important, it was pointed out that the legal conflict usually relates to the question of who is responsible and who is not responsible. Among other things, the conflict

in question may also impede the actualization of the rights and entitlements of the contracting parties, especially in terms of who has the right to utilize design documents.

This operation is usually considered the implied warranty of the owner with regard to the adequacy of the specifications and plans. In order to better understand the rationale underlying the *Spearin* doctrine, it is essential to scrutinize the original source of the doctrine – *United States v Spearin* (1918).

Analysis of the Spearin doctrine was essential for the validity and reliability of this study. The Spearin doctrine was followed by the court as a defense to an owner's allegation of a non-conforming and defective work. The doctrine provides the implied warranty that consists of two major parts. First, the warranty provided that the data and other information delineated in the specifications and plans would be precise and accurate. Second, the warranty provides that the specifications and plans, if actualized, would be consistent enough to complete the objective of the project.

The second issue in question concerning the *Spearin* doctrine related to the question of whether the cooperation enabled by BIM at the time the traditional protection of designers from responsibility for contractor instruments and methods was absent. If the answers to the aforesaid questions are found, it will be possible to accurately define the role of the parties and execute the appropriate control over the cooperative process. As a matter of fact, it is significant to accentuate on that no new legal issue exists in this domain.

Actually, BIM was deprived of established protocols for determining responsibility when something happens incorrectly with the product, into which may participates have already contributed significant amount of data. The original concerns over ownership usually

deal with the complexity in tracking the genesis of a problem after it emerges, particularly when the appropriate data may have been entered into the model weeks, months, years, or days prior to the manifestations of the problem.

The allocation of risks was found to be another legal concern that has capacity to create barriers and inconsistencies on the road towards the comprehension and utilization of BIM. Briefly speaking, risk allocation is important, because the utilization of BIM inevitably changes the correlation between parties by blending their roles and responsibilities. Therefore, a BIM legal framework usually favors less cooperative environment with clearer defined responsibility.

Similarly, privity of contract constituted a group of interrelated legal issues that should be significant in terms of barriers of BIM and means of overcoming the barriers at issue. In analyzing the scope within which third parties may utilize a designer's project, it is deemed wise to assert that the extent is a highly contested legal issue.

The Second Restatement of Torts provided that the person who negligently supplies information is liable if the information at issue is intended for the plaintiff to rely upon. Hence, it follows that the Second Restatement of Torts establishes responsibility and obligations before third parties, because third parties may be those individuals who rely upon the information provided to them. Under the Second Restatement of Torts, the provision of liability is required only if there is a definite intention to affect and approach a class or group of individuals.

5.2 Conclusion and recommendations

The conducted research answered all research questions. Thus, the main concept of a building information modeling was explored. Also, it was the major legal matters connected with building information modeling were ascertained. The last but not least question answered in the framework of this project was the question of means and methods of addressing different legal matters related to building information modeling. The aforesaid question was also answered completely. In the ultimate analysis, it is found necessary to offer a set of recommendations and suggestions on how to facilitate the implementation of BIM and IPD by way of resolving or mitigating the major contractual issues. The recommendations and suggestions are the following:

To ensure better organization of the participants of the implementation. In the framework of big projects, it is especially essential to organize the direction of word towards project objectives and milestones and then go on updating the plan as the design alters. By means of the aforesaid exercise, it will possible for the participants of the implementation to reveal the “system of commitments” between each other whereby they will realize who relies on whom for procedure or information.

To develop a virtual entity. Incorporating big project groups into a virtual organization should be deemed an extremely significant factor towards the success of a genuinely outstanding project. With the lack of shared goals and a shared vision, it will be impossible for the participants of the implementation to cooperate, share knowledge or work in the like ways. A virtual entity principles is required buy-in from all participants; every

contracting party working on the project must be committed to the implementation, integration, and comprehension of the benefits and the challenges.

To comprehend the relationship between customers and suppliers. Team members must grasp how to view their relationships from the perspective of "customer-supplier". When the individual aims at receiving the information or task objectives, he should be treated as the customer. When the individual is requested to provide information or task objectives, the individual is the provider.

To ascertain how and why the BIM will be used. It is also important that the BIM is viewed as a significant communication tool, supplying another source to assist in ensuring that everyone acting accurately. Frequently, what one individual requests and another individual perceives is not the same issue. The correct implementation of the BIM assists in eliminating certain variables in the cross-disciplinary interaction by helping the owners comprehend how their contributions might be realized, as well as by enabling the owners to make informed decisions.

In conclusion, it needs to be added that BIM sets forth a new philosophical paradigm for practice, because it encourages combination and practical actualization of different roles of all participants in a concrete project. Building Information Modeling (BIM) makes significant contributions to the development of construction industry, because most of its salient features pertain primarily to a variety of office products, such as word processing, graphic products, and spreadsheets. A significant penetration of BIM in other fields of applied knowledge, such as ship-building, aviation, automobile, etc., will continue. This is

especially because of the prominence of BIM's essential characteristic – that BIM is an electronic modeling - most of its processes are carried out electronically.

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