Identification of Factors Affecting Building Information Modelling (BIM) Adaptation for the Turkish Construction Industry

The construction industry is of great importance for both human life and the national economy. Although the quality and efficiency of the buildings produced with the developing technology have increased, it is frequently stated in the literature that the construction industry remains in the lower ranks in terms of digitalization and technology adaptation compared to other sectors. Building Information Modeling (BIM) is seen as a new opportunity that can move the construction industry forward in this race. However, BIM adaptation in Turkey is not at the desired level taken into the account of BIM use benefits for construction industry. In this context, the aim of the study is to determine the factors affecting BIM adaptation in the Turkish construction industry and to identify importance level of these factors on the BIM adaptation level in the Turkish construction industry respectively. Within the scope of the study, a total number of 59 factors that affect BIM adaptation were found under ten categories (organizational factors, personal factors, technology quality, financial factors, environmental factors, perceived ease of use, consensus on BIM use, perceived benefit, personal intention, and organizational intention). Interviews were carried out with BIM experts from construction industry to validate identified factors. Gathered data from expert evaluation was then analyzed with Relative Importance Index (RII) method to identify the significance of identified factors on the BIM adaptation level in the Turkish construction industry. According to the findings, the most important factors show similarity with the developing countries in terms of ranks. The study is of vital importance in terms of revealing factors affecting BIM adaptation for the Turkish construction industry. In addition, the findings of the study will provide industry professionals a perspective on which factors should be considered to improve BIM adoption.

Keywords: *Building Information Modelling (BIM), Construction Industry, Digitalization, Relative Important Index (RII), Technology Adaptation.*

Introduction

Although it is often stated that the Architecture, Engineering, and Construction (AEC) sectors are technologically backward compared to other sectors, Building Information Modeling (BIM) is one of the new developments that can play a role in closing this gap and its importance is increasing. By providing a more integrated and coordinated project management process compared to classical methods, BIM ensures that the information that emerges throughout the life cycle of the building can be shared and accessed more effectively without being lost or diminished. BIM, which is used in all stages of a construction project from its planning to its demolition; provides significant advantages in design, construction, and facility management stages (Yan and Damian, 2008). Despite this, BIM adaptation has not reached the desired levels

in various countries due to the resistance of some professionals in the industry, the lack of personnel with sufficient technical capacity, the inability to fully understand the benefits of BIM, and the lack of guidelines for the use of BIM by which companies can determine their needs (Erdik, 2018).

With increasing urbanization and smart cities gaining momentum, all the major countries around the globe have started paying attention to BIM (Ahuja et al., 2020). Public sector organizations in growing number of European countries have initiatives to promote the wider adoption of BIM at a national, regional or public estate level. UK, France, Scandinavia (Norway, Denmark, Finland, and Sweden), and Singapore are listed as the leading countries with BIM adoption whereas countries such as Germany, UAE, China, and Australia are highlighted as the major countries with significate BIM adaptation (Ahuja et al., 2020). However, BIM is still away from reaching its potential in Europe; and is progressing at different speeds in European countries (Bouhmoud and Loudyi, 2022). While it is actively employed by most of the developed countries, BIM is not as advanced in most countries such as India, Malaysia, Indonesia, and Thailand (İsmail et al., 2017). This situation reveals that BIM adaptation and BIM usage level may be different in each country depending on parameters such as government mandate, software usage, policies and standards, education, initiatives. Therefore, it is necessary to investigate the factors that will affect the difference in BIM adaptation and their effects on adaptation.

Although there are many studies investigating the benefits of using BIM for the construction industry and the difficulties of BIM implementation, the number of studies conducted on a national basis to determine the factors affecting the BIM adaptation level is quite limited. When the studies in the literature on BIM adaptation and implementation are examined; Lee et al. (2015) mentioned the slowness of BIM adaptation in South Korea and presented a BIM adaptation model to increase BIM adaptation in the industry. Kim et al. (2016), on the other hand, aimed to contribute to the creation of strategies that will facilitate the adoption of BIM by investigating the differences in the intentions and attitudes of project stakeholders in AEC industry in South Korea. In another study by Lee and Yu (2017), BIM adaptation models prepared for South Korea and the United States were compared. John et al. (2017), investigated the current status of BIM adoption in 224 Taiwanese architectural firms and evaluated the readiness of architectural firms to implement BIM. Yang et al. (2018) emphasized that although BIM has many potential benefits, its adoption by the Chinese construction industry is not high. To increase BIM adaptation in Chinese construction industry, a Technology Adaptation Model (TAM) was created and then tested by using the Structural Equation Model. Acquah and Eyiah (2018) tested the acceptance level of BIM in Ghana construction industry using the technology acceptance model. In the study by Hochscheid and Halin (2018), they aimed to facilitate the implementation of BIM by providing a BIM implementation guide and directive for design firms. Studies have focused on organizational and managerial issues rather than technical aspects. In their study, it is aimed to

create a comprehensive view of the factors that may affect the success or failure of BIM adoption, especially during the implementation phase. In the study of Elshafey (2020), four developing countries such as Turkey, Malaysia, Egypt, Saudi Arabia were examined to investigate the acceptance of BIM and augmented reality integration. For the desired level of technology acceptance, an adaptation model based on TAM is considered. Lee and Yu (2012), (2020) stated in their studies that although the BIM awareness rate is high, user competence is low. Therefore, the authors proposed a BIM adaptation model for use by construction firms.to predict changes in factors affecting BIM acceptance attitudes and the mechanism of relationships between factors over time spent using technology.

Taken into account that core factors that can affect the acceptance of emerging information technologies such as BIM can differentiate in different countries, the literature review shows that although there are studies to determine the necessary actions to accelerate the sectoral adaptation of BIM, the number of these studies is also very limited. In addition, there is no target to determine the factors that will make this adaptation possible in any of these studies on the use of BIM in the Turkish construction sector.

In this context, in the light of the necessity of determining the adaptation level of BIM in the Turkish construction industry and determining the necessary actions to accelerate the adaptation of BIM to the sector, the aim of this study is to determine the factors affecting BIM adaptation in the Turkish construction industry and to identify importance level of these factors on the BIM adaptation level in the Turkish construction industry respectively.

Use of Building Information Modeling in the Turkish Construction Industry

The use of BIM in the Turkish construction industry is increasing, but the lack of sufficient knowledge, experience and guiding regulations makes the process slower than other countries in the world (Kalfa, 2018). In this respect, the use of BIM in Turkey is at the initial level when compared to other countries in the world (Erdik, 2018). Although nevertheless, domestic construction companies have started to increase the use of BIM technology in line with the demands of employers in projects tendered in the international arena (Erdik and Tülünçbaş, 2020); factors such as resistance on not to give up on traditional methods and habits, not fully understand BIM technology affects the transition processes and BIM adaptations of Turkish construction companies (Erdik and Tülünçbaş, 2020). In addition, unlike the countries in the world, which are at the top in the use of BIM, the lack of standards that companies in Turkey can refer to manage the BIM transition process, to determine their needs and to make the right decisions in this process is one of the key factors affecting the use and adaptation of BIM (Erdik and Tülünçbaş, 2020). When we look at the countries with high BIM adaptation, another striking feature is that certain policies and strategies have been determined by the government, especially in public projects, to encourage the use of BIM in

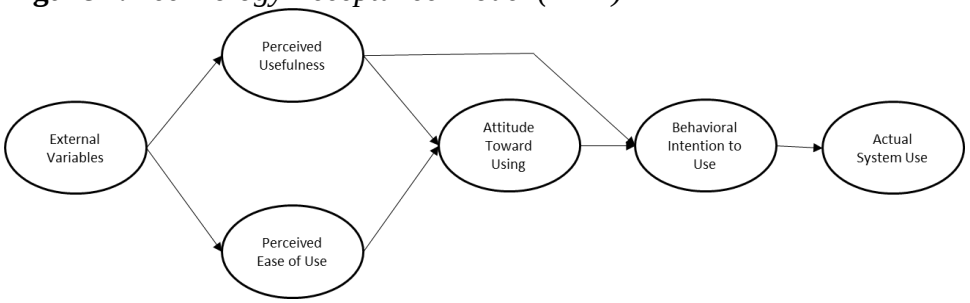
these countries. Some of these policies and strategies have been developed to enforce the use of BIM. The transition to BIM at the sectoral level consists of three main categories as government factor, internal organizational factors, and human factor (Sarıçiçek, 2019). All the factors in the transition phase at the sectoral level affect the transition processes at the organizational level (Sarıçiçek, 2019).

Even though the sectoral awareness of the benefits of using BIM for the Turkish construction industry is high, it is necessary to increase the level of BIM adaptation due to its low adequacy in its implementation (Kalfa, 2018). In order to increase the mentioned adaptation level, it is necessary to examine the factors that will affect the BIM adaptation in the Turkish construction industry and their effects on the BIM adaptation.

Determination of Factors Affecting BIM Adaptation and Their Importance Levels for the Turkish Construction Industry

The Technology Acceptance Model (TAM), developed by Davis (1989), is a model especially used for demonstrating the adaptation of information systems (Yang et al., 2018). The purpose of this model is to better understand user acceptance as well as to provide theoretical guidelines for developing a new technology system. It is also envisaged that the model may provide a method for testing user acceptance. In the construction industry, TAM is a common model often used as a theoretical basis for developing models to evaluate the acceptance or disapproval of newly introduced technologies and paradigms and the reasons behind them. In studies carried out to determine BIM adaptation, it is observed that TAM is a common model that was used to determine BIM adaptation (Takim et al., 2013; Xu et al., 2014; Lai et al., 2020). The usage behavior of new information technology consists of a five-stage process (Figure-1). In the first stage, “exogenous variables” are found. The second stage consists of “perceived ease of use” and “perceived usefulness” whereas the third stage consists of “attitude towards use”. In the fourth stage, there is “behavioral intention”, followed by the “actual system use” in the fifth and final stage (Akca and Özer, 2012). The acceptance of the new technology by the individual or society develops through these five stages in the Technology Acceptance Model. For this reason, in the studies on the BIM adaptation model, TAM was taken as the basis while creating the models.

Figure 1. *Technology Acceptance Model (TAM)*



Source: Yang et al. 2018

As the BIM paradigm began to develop widely in the construction industry, the actual adoption and application of BIM varied in different countries and regions. In this context, TAM, which is widely used in studies for determining the BIM adaptation of different countries, has been adopted as a base within the scope of this study.

In the light of determined aim and scope, a comprehensive literature review was conducted and a total number of 59 factors that affect BIM adaptation were found (Lee et al., 2015; Lee and Yu, 2017; Howard et al., 2017; Ozorhon and Karahan, 2017; Ahmed and Kassem, 2018; Acquah et al. 2018; Addy et al., 2018; Son et al., 2015; Ma et al., 2019; Hong et al., 2019; Chan et al., 2019; Hilal et. al., 2019; Hong et. al., 2019; Yuan et al., 2019; Ahuja et al., 2020; Lee and Yu, 2020; Okakpu et al., 2020; Jaaron et. al., 2021; Ademci and Gundes, 2021; Villena-Manzanares et. al., 2021; Murguia, 2021). Those factors were then grouped into ten main categories due to the stages of TAM. 1) Organizational factors, 2) personal factors, 3) technology quality, 4) financial factors and 5) environmental factors were grouped under the external variables whereas 1) ease of use, 2) consensus on BIM use, and 3) perceived benefit were considered as internal variables. In addition, 1) perceived benefit, 2) personal intention, and 3) organizational intention were considered as behavioral variables.

Lastly, interviews were carried out with a total number of ten BIM experts from Turkish construction industry to validate the suitability of identified factors for the Turkish construction industry. BIM experts participating in the study were selected from among experts with 5-10 years of industry experience, both in terms of BIM and industry experience. The participants were first asked to evaluate the suitability of 59 factors determined as a result of the literature review, and then they were asked to evaluate the effect of these factors on BIM adaptation in the Turkish construction sector by using 1-7 Likert Scale. Gathered data from expert evaluation was then analyzed with Relative Importance Index (RII) method for identifying the importance level of each factor on the BIM adaptation level for the Turkish construction industry. The formulas used within the scope of the method to analyze the data are given below:

$$RII = \frac{\sum w}{AxN} \qquad (1)$$

$$0 < RII < 1 \qquad (2)$$

The W value is the weight given to each observed variable by the participants. The value of A represents 7, which is the highest weight value for the 1-7 Likert scale, and the value of N represents the total number of participants, that is, 10 people who participated in the survey. The RII value that is found according to the result of the equations should be between zero and one. If the RII value of any factor is higher than any other factors, this shows that this factor has the higher importance compared to others.

The factors affecting the BIM adaptation in the Turkish construction industry and the importance of these factors on the BIM adaptation were presented in Table-1.

Table 1. *Factors affecting BIM adaptation in the Turkish construction industry and their importance levels*

EXTERNAL VARIABLES		**RII**	**Rank**
Organizational Factors	1. Organizational culture	0.886	3
	2. Organizational leadership	0.900	2
	3. Organizational resistance to the use of BIM	0.886	3
	4. Organizational familiarity with using BIM	0.814	4
	5. Organizational awareness of BIM benefits	0.914	1
	6. Organizational demand for the use of Information Technology	0.871	4
	7. The technical and innovation competence of the organization in the use of new technology	0.743	7
	8. BIM training provided by the organization	0.800	5
	9. Appreciation of the use of BIM within the organization	0.671	10
	10. Recruitment of experienced employees in BIM	0.771	6
	11. Availability of support person/center for overcoming BIM usage difficulties within the organization	0.743	7
	12. Establishing standardized working procedures for BIM in-house	0.700	9
	13. Creation of R&D plan for BIM use	0.743	7
	14. Demographic characteristics of employees	0.314	11
Organizational Factors	15. Mimicking behaviors by imitating successful practices/competitors	0.729	8
	16. Improvement with BIM usage performance metrics within the organization	0.729	8
Personal Factors	1. Personal resistance to the use of BIM	0.829	1
	2. Personal familiarity with the use of BIM	0.786	3

	3. Personal awareness of BIM benefits	0.829	1
	4. Personal technical and innovation competence in the use of new technology	0.800	2
Technology Quality	1. Ease of data transfer from/to BIM	0.757	4
	2. Ease of use of the BIM interface	0.871	1
	3. BIM provides adequate insight into the project lifecycle	0.771	3
	4. The accuracy and level of detail of the information in BIM	0.800	2
	5. Appropriateness of BIM technology for the enterprise	0.714	5
	6. Information system functionality	0.757	4
Financial Factors	1. The cost of BIM technology	0.786	2
	2. Value for Money	0.814	1
	3. BIM technology is at an investment grade level at the current exchange rate	0.743	3
Environmental Factors	1. Legal drivers/requirements	0.800	2
	2. Sectoral conditions	0.686	5
	3. Conditions arising from the contract-project delivery system	0.729	4
	4. Stakeholder interaction	0.857	1
	5. Effective information flows (Communication behavior)	0.786	3
INTERNAL VARIABLES		**RII**	**Rank**
Perceived Ease of Use	1. Perceived ease of use of BIM	0.643	4
	2. Perceived ease of use regarding information exchange among stakeholders	0.800	1
	3. Perception of BIM's ease of use in tasks	0.714	3
	4. User's perception of protection/maintaining BIM tools and files	0.743	2
	5. Perception of getting the expected result easily from using BIM	0.800	1
	6. Perceived ease by the user in gaining the ability to use BIM	0.743	2
INTERNAL VARIABLES		**RII**	**Rank**
Perceived Usefulness	1. Perception of the benefit of using BIM in terms of interoperability	0.771	5
	2. Perception of the benefit of using BIM in terms of improving decision-making processes	0.857	2
	3. Perception of the benefits of using BIM in terms of improving information management processes throughout its lifecycle	0.814	4
	4. Perception of the benefit of using BIM in terms of improving project success	0.829	3

	5. Perception of the benefits of using BIM in terms of productivity and job performance improvement	0.900	1
	6. The perceived usefulness of the use of BIM as appropriate to one's work behavior	0.700	6
	7. The perceived usefulness of using BIM to suit personal tasks	0.671	7
	8. Perception of the benefits of using BIM in terms of increasing job satisfaction	0.614	8
Consensus	1. Suitability of BIM to implementing tasks	0.814	3
	2. Consensus on how to implement BIM among organization members	0.843	2
	3. Consensus on how to implement BIM among stakeholders	0.900	1
BEHAVIORAL VARIABLES		**RII**	**Rank**
Individual Intention	1. Hedonic motivation	0.857	2
	2. Recommending the use of BIM to others	0.771	3
	3. Continuing to use BIM	0.886	1
Organizational Intention	1. Activity of the organization to use BIM	0.900	2
	2. Recommending another organization to use BIM	0.729	5
	3. Expenses for BIM usage/adaptation within financial budgets	0.886	3
	4. Availability of professional support within the organization to assist in the selection of BIM tools	0.914	1
	5. Information sharing and collaborative platform presence in the industry	0.814	4

Discussion

This research aims to determine the factors affecting BIM adaptation in the Turkish construction industry and to identify importance level of these factors on the BIM adaptation level in the Turkish construction industry respectively. Therefore, the literature review was performed to identify the variables affecting BIM adaptation. As a result of literature review, 59 variables were found out. After identification of factors and their categorization, the importance levels of BIM adaptation factors were analyzed with RII method. As a result of analysis, the findings showed that "Organizational awareness of BIM benefits" and "Organizational leadership" were found as the most important factors under organization factors category. Even though BIM is not a new technology with more than 20 years history, the benefits and effectiveness of BIM technology are newly understood (Doumbouya et al., 2016). The study that was applied in Jordan showed that lack of BIM awareness is one of the preventive factors for BIM implementation (Maternah

and Hamed, 2017). Moreover, Keskin et al. (2019) found out that organizational awareness is a challenging factor in Istanbul Grand Airport (IGA) project which was one of the leading construction projects that BIM was implemented. The authors stated that this issue was overcame with the use of facilitated workshops. Therefore, the finding shows parallelism with available studies.

In personal factors, "Personal awareness of BIM benefits" and "Personal technical and innovation competence in the use of new technology" were found as the most important two factors for Turkish construction industry. According to the study which was conducted in the Kingdom of Saudi Arabia (KSA), personal related lack of appropriate awareness about BIM plays an important role to deter BIM implementation (Elhendawi et al., 2019). Moreover, the issues related to personal awareness of BIM benefits hinders BIM adoption and implementation in developing countries (Bouhmoud and Loudyi, 2021). Taken into account that Turkey is a developing country, the RII analysis results show parallelism with the results of studies conducted in KSA and other developing countries. Zhao et al. (2015) stated that construction industry's expectations today are that graduates should have a mixture of expertise in both technical and non-technical competencies. These competencies involve construction engineering, building science, design, computer science, communication, leadership, management practice and team collaboration. Parallel to industry expectations, personal technical and innovation competence was found as important to embrace BIM.

"Ease of use of the BIM interface" and "The accuracy and level of detail of the information in BIM" were found as the most important two factors under technology quality category as a result of RII analysis. Kovacic and Filzmoser (2014) identified that lower ease of use is one of the issues to use BIM in interdisciplinary working environment. Olawumi and Chan (2018) stated that the user-friendliness of BIM software's interfaces has an influence on usability and the level of user exploring BIM functionalities. Therefore, the authors stated that the user interface should be more user-friendly to increase BIM adoption in developing countries. Parallel to Olawumi and Chan (2018) study, the experts believed that "Ease of use of the BIM interface" factor is important for Turkish construction industry.

Under Financial factors, "Value for money", "The cost of BIM technology", and "BIM technology is at an investment grade level at the current exchange rate" were found as the most important factors respectively. However, the study performed by Addy et al. (2018) showed that financial factors didn't support the intention to use BIM amongst quantity surveyors. Even though the factor did not support BIM use, "value for money" variable was found the second most important variable in the factor analysis. While "BIM technology is at an investment grade level at the current exchange rate" variable was found as the least important variable for the Turkish construction industry, this variable was found out as the most important variable for the Ghana quantity surveyor industry in factor analysis. In other words, the results show parallelism with Addy et al.'s (2018) study in terms of factor analysis. The findings showed that the awareness of Turkish construction industry about

BIM benefits is high. Therefore, the current exchange rate related issues are lower than other variables, although the weight of factor related to cost of BIM is significant (>0.7).

"Interaction between stakeholders" under environmental category was found as the most important factor. The construction projects are complex, and they are constructed with the involvement of many stakeholders (Hong et al., 2019). Therefore, the interaction management between stakeholders is important for the BIM adaptation.

"Perceived ease of use regarding information exchange among stakeholders" was found as the most important factor under perceived ease of use category. The construction industry has been criticized due to the lack of effective collaboration. Within this context, BIM software is helpful to enable data transfer between different disciplines (structural, architectural, MEP). In other words, BIM helps to exchange data in different teams in digital formats during building life cycle. This factor was found as the fourth most important variable in Lee et al.'s (2015) study that was conducted in South Korea. Against to Lee et al. (2015) study, "Perceived ease of use regarding information exchange among stakeholders" variable was found out the most important factor for Turkish construction industry. However, the difference between ranks can cause of the difference between factor structures. Moreover, the highest value of "Perceived ease of use regarding information exchange among stakeholders" factor in the adaptation of BIM may be related to data transfer issues between stakeholders in Turkish AEC industry.

"Perception of the benefits of using BIM in terms of productivity and job performance improvement" factor was found as the most important factors under perceived usefulness category. The development of IT and the use of IT gain momentum to improve productivity. Depending on the effect of IT on productivity improvements, Acquah et al. (2018) used this factor in a survey which is conducted to find out the level of acceptance of BIM in Ghana construction industry. This factor was also found as important for Ghana construction industry. Moreover, parallel to Addy et al.'s (2018) study, "Perception of the benefits of using BIM in terms of productivity and job performance improvement" factor was found as the most important factor in Ghana and Turkey case.

"Consensus on how to implement BIM among stakeholders" factor was found as the most important factor under consensus category. "Consensus on how to implement BIM among organization members" and "Suitability of BIM to implementing tasks" factors were followed by "Consensus on how to implement BIM among stakeholders" factor respectively. The consensus on implementation among both organization members and stakeholders is important to identify how tasks are performed by organization members and which information needs to be delivered to other stakeholders and how stakeholders will perform BIM related tasks. Generally, the input and output data flow related to BIM uses and responsible parties must be identified in BIM Execution Plans. "Consensus on how to implement BIM among stakeholders" wasn't considered in Lee and Yu's (2017) study. Instead of this factor,

Consensus on how to implement BIM among organization members" factor was only considered in the study and study findings revealed that consensus on appropriation is one of the most important factors.

The BIM use can be performed as habitual activity, since the use of BIM benefits can convince individuals to continue to use BIM (Addy et al., 2018). As being in "financial category", the study performed by Addy et al. (2018) showed that the individual intention factor did not support the intention to use BIM amongst quantity surveyors. However, factor analysis indicated that "Continuing to use BIM" variable has a moderate impact in the factor. Therefore, the analysis results show dissimilarity between Turkey and Ghana. However, these differences can be associated to the narrow scope of Addy et al.'s (2018) study since their study was focusing on quantity surveyors. Additionally, the factor structure considered in Addy et al.'s study differentiates from this study.

Availability of professional support within the organization to assist in the selection of BIM tools was found as the most important factor under Organizational intention category. In the organizations, the selection of convenient BIM tools can be challenging due to the lack of technical support. The same factor was considered in Hong et al.'s (2019) study. In the study, data was collected and analyzed according to organizations' main activities (infrastructure and building construction organizations) and the size of organizations (large organizations and SMEs). The analysis results in Hong et al. showed parallelism with this study. In other words, "Availability of professional support within the organization to assist in the selection of BIM tools" factor was found the most important factor for infrastructure and building project type. The same rank was valid for large organization. However, the data collected from SMEs showed that this factor has relatively low importance compared to other variables. It can be concluded that there is a similarity between Turkish and Chinese construction industry in terms of need for technical support in the selection of BIM tools.

Conclusions

Nowadays, the adaptation of new technologies into the construction processes and activities becomes unignorable necessity, due to the complex structure of projects. BIM is one of the most known and beneficial technology implemented in AEC industry. As well as benefits of BIM use, the policies/mandates ruled by governments play an important role to adapt BIM implementation into the AEC industry.

Although BIM technology has more than 20 years history, the adaptation level into the organization is not at the intended level. In the literature, many studies were performed to develop technology acceptance model specific to different countries, since every country has own regulations and working procedures that differentiate countries from each other. The literature review showed that BIM adaptation variable and their importance have not been investigated for Turkish construction industry yet. Therefore, this study aims to

determine the factors affecting BIM adaptation in the Turkish construction industry and to identify the importance levels of these variables under factors respectively.

To achieve these aims, a comprehensive literature review was conducted firstly. The literature review showed that identified variables were handled differently in each study. In other words, any study did not consider all identified factors together. As a result of literature review, a total number of 59 factors under 10 categories were found. Within the aim of identifying the importance levels of these variables, those identified factors under were evaluated by a total number of ten BIM experts that had a 5-10 years of industry experience, both in terms of BIM and industry experience. After data collection process, RII method was applied to determine the importance level of each BIM adaptation factor.

RII analysis results showed that the most important factors under each factor showed similarity with Ghana, KSA, and Chinese AEC industries. However, in some conditions they can differentiate from Turkey case. However, as stated above, the factors considered under factors were handled differently from this study. Depending on this difference, the differentiations in the importance levels were observed. Additionally, the similarities are observed between Turkish and Ghana construction industry can be associated to being of developing countries of two countries.

Another important inference from the literature review is that the data analysis results can show difference according to project type, organization size, and organization type (such as construction, design-based organization). As a further study, the study that focuses on the rank of different organization types and their significance as a statistical analysis can be carried out specific to Turkish construction industry.

It is believed that the findings under this study will be helpful for Turkish construction companies who want to adopt BIM into their organizations. In theoretical perspective, these factors that weren't considered in the existing literature totally, will pave the way to perform and develop BIM adaptation analysis by considering all aspects. Moreover, the variables that were found in this study are crucial for the researchers that have an aim of developing BIM Adaptation Model for Turkish construction industry in their further studies.

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