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Constructive and Destructive Leadership Behaviors, Skills, Styles and Traits in BIM-Based Construction Projects

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Abstract: Building information modeling (BIM) implementation is expanding over time, and collaboration is becoming more critical in construction projects. Leadership characteristics may contribute to or hinder the effectiveness of these collaborations in BIM-based construction projects. However, the current body of knowledge lacks information on the leadership characteristics that can be constructive or destructive for BIM-based construction projects. Therefore, this study aims to determine the constructive and destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects. An explorative qualitative study was conducted by interviewing twenty architecture, engineering, and construction (AEC) professionals. Then, the thematic analysis approach was used to analyze the interview data. The study findings suggest that common constructive leadership behaviors are tolerant and committed. Furthermore, the common constructive leadership trait and style is reliability. On the contrary, the common destructive leadership behavior is intolerant. This study provides the literature with a novel list of constructive and destructive leadership characteristics for BIM-based construction projects. Understanding these characteristics would assist industry professionals and policymakers in increasing the performance of BIM-based construction projects.

Keywords: leadership skills; leadership behavior; leadership traits; building information modeling; construction projects



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1. Introduction

Building information modeling (BIM) is a new technology and process that provides new roles and alternatives for works in the architecture, engineering, and construction (AEC) industry. BIM significantly enhances project performance and obtains greater variety for industry benefits [1]. Additionally, BIM implementation enhances project productivity and efficiency [2]. Therefore, using BIM throughout the project life cycle can improve the success of the AEC industry.

In several countries, BIM was introduced as early as in school, as it is an essential part of civil engineering, improves intellectual skills, and changes students' attitudes [3]. Besides, proving awareness of BIM to individuals is necessary to understand the history, principles, and strategies underlying BIM itself and the functions and limitations of BIM [4–6]. Furthermore, BIM is suggested to become mainstream in the AEC industry, and the demand for skilled BIM professionals will continue to increase steadily and dramatically [1,7].

An efficient and successful project depends on the efficiency, behaviors, and skills of project members throughout the life cycle of the project, and BIM-based construction projects are not excluded [4,8]. BIM professionals must adapt and possess competencies such as technological and soft skills [9–11]. According to the authors in ref. [12,13], the AEC industry's inefficiency is due to a lack of soft skills and poor cultural integration of education and skills. As a result, there are skillsets and knowledge guidelines to ease students or fresh graduates to be BIM-ready graduates [3,14].

An individual with many skills and knowledge can do various works, even if they are BIM specialists, but this is limited [15,16]. To expand BIM competencies, one needs leadership skills, which many tend to forget [17]. Leadership is a significant skill and a success factor across different industries, especially in AEC [17,18]. Every competent BIM leader should have this skill to implement BIM and teach project members the skill sets required for BIM.

Leadership skills are crucial in understanding a project life cycle and information based on design, construction, and operation [19–22]. Somehow, the skills and characteristics of an individual are out of our hands. Every individual has a unique characteristic, which can be an advantage toward BIM or vice versa. Hence, understanding the constructive and destructive leadership characteristics in BIM-based construction projects is important.

This study aims to determine the constructive and destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects. In this regard, the research questions are: (1) what are the constructive and destructive leadership behaviors, styles, skills, and traits in BIM-based construction projects? Additionally—(2) how can the leadership characteristics affect project performance?

2. Literature Review

2.1. Building Information Modeling

BIM can be defined as a digitalized technology for creating, overseeing, arranging, trading, and sharing building-related information in an interoperable and reusable way [23]. BIM includes several essential functions that analyze building behaviors, making it easier to investigate its design sustainability. The authors claimed that BIM has the potential to (1) increase productivity, efficiency, infrastructural value, quality, and sustainability; (2) decrease life-cycle costs, lead times, and duplications; (3) minimize waste; and (4) enhance coordination between design disciplines.

BIM has gained traction worldwide, and many countries have established standards and guidelines for implementing BIM [24,25]. Additionally, BIM can be defined as a digital representation of an asset, and there are many understandings of BIM [24,26,27]. Authors in ref. [28,29] used BIM in their projects and presented their team goals in several documents. It is presented by identifying their purposes and objectives.

In ref. [30], the authors studied BIM applications for existing road infrastructure and explained that BIM is the computerized modeling of generic building construction. It is an advanced system that eases the design method, data, charts, or any technical documents relating to construction and not only a three-dimensional representation. It is also a shared model that is the first step in developing the global AEC industry.

BIM is defined as the three-dimensional modeling, virtual model, or virtual prototyping technology as a collaborative platform to process, produce and analyze construction projects using digital information models throughout the life cycle [2]. BIM has been proven since the 2000s to improve productivity and efficiency by minimizing errors, enhancing constructability, and saving time and cost [31]. Therefore, the authors in ref. [32] defined BIM as a methodology with technological, agential, and managerial components.

The authors in ref. [33,34] defined BIM as a modeling technology and associated processes to produce, communicate, and analyze building models. BIM provides a platform to facilitate information sharing for a specific model simulation and project management to reduce miscommunication and errors among construction players.

In ref. [35], the authors explained that BIM is primarily a process where the project's life cycle is generated and managed through data. It typically uses three-dimensional, real-time, dynamic building-modeling software to improve productivity in construction. The process produces information based on the building model, which extracts all relevant data relating to the geometry of the building, spatial relationships, geographic information, and quantities and properties of the building components [36,37].

2.2. Leadership in Construction

2.2.1. Leadership Impact on Safety in Construction

Leadership is a key factor that could impact the safety of researchers and practitioners during proactive approaches to preventing workplace injuries [38]. Construction is one of the most dangerous industries worldwide, with high fatalities and construction accidents [39]. Therefore, it is suggested that the unsafe conditions cause misalignment of management commitment and lack of safety leadership. It is claimed that effective leadership plays an important role in ensuring the success of the construction process and the organization on-site. For countries in which industries are facing significant safety challenges, the leadership skills of safety are one of the keys to enhancing construction safety performance.

2.2.2. Leadership and Construction Industry Development

In ref. [40], the authors claimed that leadership is essential in all fields of human endeavor. Leadership is even more important for the features of the construction process and construction projects, as they are expensive and technically demanding, and they require huge project teams and diversity [41]. Effective leadership in construction can be the solution to poor performance on projects. Leadership and construction are crucial to each other. Generally, leadership is a key factor for success in any activity involving collaboration among a group [42,43]. A supportive environment for the project participants came from the leader's importance in creating it [44]. As a result, the success or failure of project management highly depends on the project leader's leadership skills in managing the team [45]. The authors in ref. [46] also suggested that construction project goals tend to be achieved faster and create a harmonious working environment when leadership skills are adequate.

2.3. Research Gap

In the summary of the previous literature, the stakeholders in the construction sector are suffering from the inability to increase the efficiency of the construction process. Additionally, the prior works have not stated the determination of constructive and destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects. In addition, the literature needs to include how behaviors, skills, styles, and traits can affect project performance. In this regard, the study covers that gap by achieving the study objectives to increase the efficiency of BIM-based construction projects.

3. Methodology

3.1. Data Collection

Qualitative data collection methods were employed to achieve the study's objective. Figure 1 presents the methodology used in this study. The qualitative data were collected through open-ended interviews with AEC professionals. The interviews were conducted physically or remotely. The respondents were given a certain time, and they could choose their free time to answer the questions during the interview session.

Respondents were selected among AEC professionals with experience in BIM and basic leadership skills in or outside the construction site. The targeted population for the sampling is BIM managers, assistant BIM managers, BIM coordinators, BIM modelers, BIM engineers, and architects. All respondents were selected using the purposive sampling method [47]. It is a non-probability sampling method in which researchers rely on their judgment when choosing population members to participate in the study.

Open-ended questions were used during the interviews. Open-ended questions create an atmosphere where respondents are encouraged to answer with unstructured inquiry unrelated to the topic. As a result, the session is more open, allowing the respondents to explain their understanding and opinions toward the questions freely.

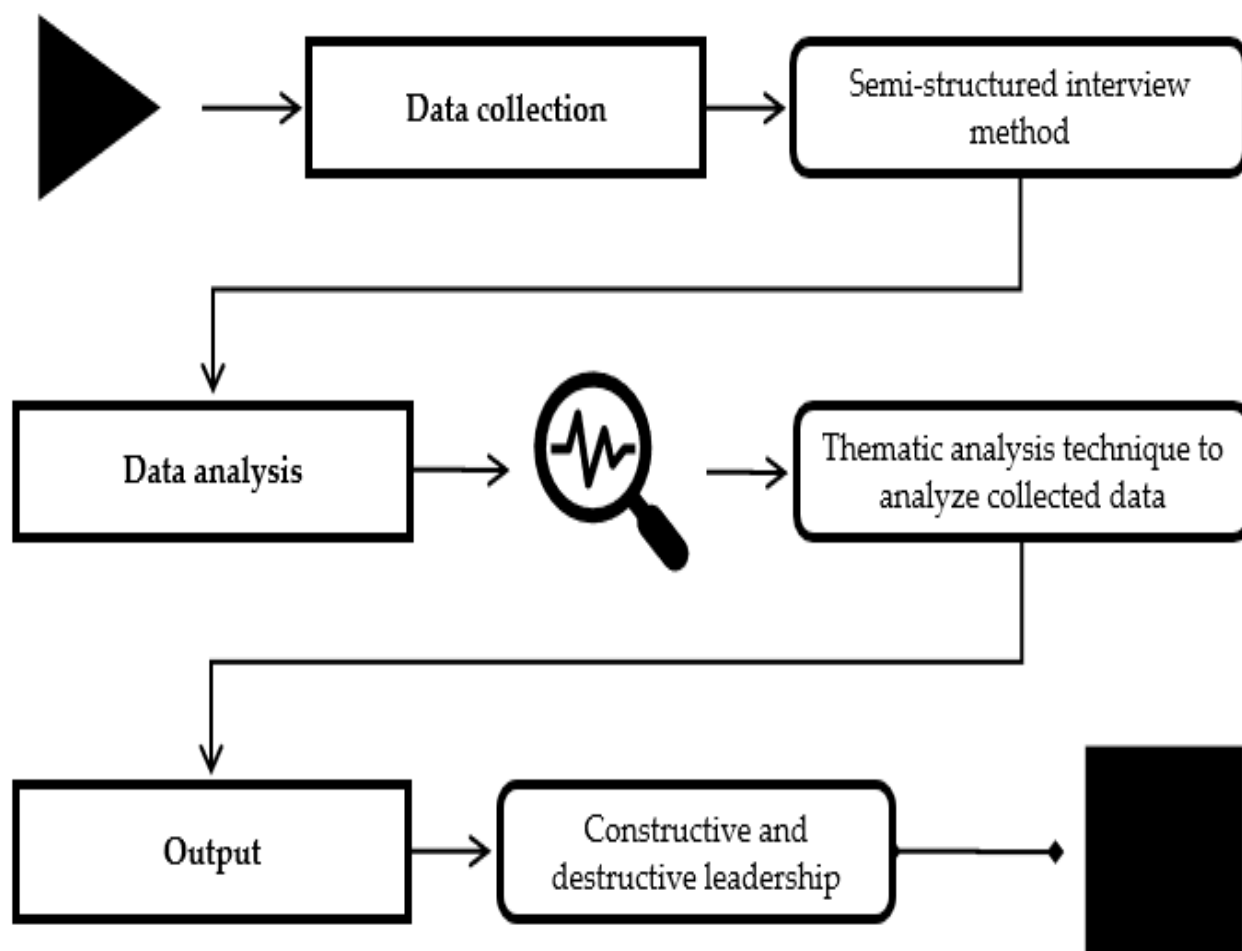


Figure 1. Overview of the methodology for this study.

The interview session began with a brief introduction to the study topic and proceeded by providing open-ended questions. The questions were related to BIM-based construction projects and how leadership affects project performance. To achieve valid data, each respondent was given the same main questions to be answered:

- What leadership behaviors, skills, traits, and styles can be constructive and contribute to a better performance of BIM-based construction projects?
- What leadership behaviors, skills, traits, and styles can be destructive and contribute to reduced performance of BIM-based construction projects?

After the main questions, follow-up questions were provided. The purpose of the follow-up questions is to elaborate and unfold a more detailed understanding of the answer to ensure the data is accurate and researchers understand participants' statements. All answers from respondents were included in the data collection.

In this study, a total of twenty interviewees were attained. For a qualitative study on a consistent population, a sample size of five to twenty-five participants suffices [48]. Prior works by the authors in ref. [49,50] interviewed seven and twenty participants. Additionally, the authors in ref. [51,52] interviewed twenty-two and ten participants to reach saturation. Therefore, this study sufficed with twenty interviews because it reached a saturation point where no new information emerged at the twentieth interview.

3.2. Data Analysis

The data obtained from respondents were changed into interview transcripts for analysis. Thematic analysis was used for analyzing the transcripts to recognize, examine, and describe data in patterns. In ref. [53], the author defined thematic analysis as a method

for identifying, analyzing, and reporting patterns within data. This method is often used for primary research and systematic reviews. It is claimed that this method consists of three stages. Firstly, the line-by-line coding of the text leads to the second stage, where the generation of descriptive themes is linked closely to this study. The third stage is the development of the final analytical themes, where authors can develop new interpretations, explanations, or hypotheses regarding the study [54]. In other words, the thematic analysis provides a clear understanding where the respondents can give their opinion on the topic and link it with the study situation. As a result, the transcripts can be turned into relevant and manageable data as subject themes.

4. Results and Discussion

4.1. Respondent Profile

The interview questions conducted are highly dependent on the responses made by each respondent. Therefore, this section describes each respondent's roles and position in their companies and proves their qualification to answer the interview questions related to the topic to verify that the interview content is accurate to be analyzed.

Within the time frame of March 2022 until May 2022, a total of twenty interviewees were attained in this study, both in virtual and face-to-face sessions, with each lasting no more than fifteen minutes. Participants were invited via email and voice call and then given full study details through the interview protocol. The interviews included questions about: (1) demographic information (e.g., academic level, profession) and (2) interview content questions that are shown in (Table A1 in Appendix A).

Table 1 shows the details of the participant's designation in their organization to prove their qualification to attend the interview and give their opinion and explanation regarding the study topic and how it is vital to BIM-based construction projects.

Table 1. Respondent profile.

No.	Designation	Stakeholder
1	Civil Engineer	Consultant
2	3D Modeler	Consultant
3	Project Manager	Contractor
4	Senior Engineer	Contractor
5	Senior Engineer	Consultant
6	Civil/Site Engineer	Contractor
7	Junior Engineer	Consultant
8	Project Manager	Consultant
9	Technical Engineer	Client
10	BIM Modeler	Contractor
11	Project Engineer	Client
12	Asst. Service Engineer	Consultant
13	C and S Engineer	Consultant
14	Project Engineer	Contractor
15	BIM Modeler	Consultant
16	BIM Modeler	Consultant
17	Site Engineer	Contractor
18	BIM Manager	Consultant
19	C and S Engineer	Consultant
20	Field Engineer	Client

4.2. Constructive Leadership Characteristics

This section elaborates on the leadership behaviors that can contribute to better BIM-based construction projects. The first and second elements observed in this study are leadership behaviors and skills and the way a person or a leader acts that can contribute to the progress of a project. The third and fourth elements are leadership styles and traits, combined into one element for better understanding. Finally, three tables are constructed

to illustrate the total number of hits on the behaviors, skills, styles, and traits that affect the performance of BIM-based construction projects.

Based on Table 2, it is shown that the highest hits for constructive leadership behavior are tolerant under the pro-social theme and committed under the self-discipline section. These behaviors are followed by liberality, determination, coping mechanisms, and concern. The highest hit on the constructive leadership skill shown in Table 3 is communication. This skill is critical for every leader to possess to ensure the project can operate smoothly [11]. The constructive traits essential in BIM-based construction projects are illustrated in Table 4. The highest hit on the trait is reliable.

Table 2. Constructive leadership behaviors in BIM-based construction projects.

Respondents	Pro-Social			Self-Discipline			Total	
	Liberality	Tolerant	Concern	Understanding	Committed	Determined		Coping Mechanism
Respondent 1	✓	—	—	—	✓	—	—	2
Respondent 2	✓	—	—	—	✓	—	—	2
Respondent 3	—	✓	—	✓	✓	—	—	3
Respondent 4	✓	✓	—	—	—	—	✓	3
Respondent 5	—	—	✓	✓	—	—	—	2
Respondent 6	—	✓	—	✓	✓	—	✓	4
Respondent 7	✓	✓	—	—	—	—	—	2
Respondent 8	—	✓	✓	—	✓	—	—	3
Respondent 9	—	✓	—	✓	—	—	✓	3
Respondent 10	—	✓	—	—	✓	—	—	2
Respondent 11	—	✓	—	—	—	—	—	1
Respondent 12	—	—	—	—	✓	✓	—	2
Respondent 13	✓	—	✓	—	✓	✓	—	4
Respondent 14	—	✓	—	—	✓	—	✓	3
Respondent 15	✓	✓	—	—	—	✓	—	3
Respondent 16	✓	✓	—	✓	—	✓	✓	5
Respondent 17	—	—	—	—	✓	✓	—	2
Respondent 18	—	—	—	✓	✓	✓	—	3
Respondent 19	—	✓	—	—	✓	✓	—	3
Respondent 20	✓	—	—	—	—	—	✓	2
Total	8	12	3	6	12	7	6	54

Table 3. Constructive leadership skills in BIM-based construction projects.

Respondents	Soft Skills			Hard Skills		Total
	Project Management	Communication	Problem-Solving	Software	Technical	
Respondent 1	✓	✓	—	—	✓	3
Respondent 2	✓	✓	—	✓	✓	4
Respondent 3	—	—	—	✓	—	1
Respondent 4	—	✓	—	—	—	1
Respondent 5	—	✓	—	—	—	1
Respondent 6	✓	—	✓	—	✓	3
Respondent 7	—	✓	✓	✓	—	3
Respondent 8	—	✓	—	✓	✓	3
Respondent 9	✓	✓	✓	—	—	3
Respondent 10	✓	✓	—	✓	✓	4
Respondent 11	✓	—	✓	—	—	2
Respondent 12	—	✓	✓	—	—	2
Respondent 13	—	✓	—	✓	✓	3
Respondent 14	✓	—	✓	—	✓	3
Respondent 15	—	✓	—	✓	—	2

Table 3. Cont.

Respondents	Soft Skills			Hard Skills		Total
	Project Management	Communication	Problem-Solving	Software	Technical	
Respondent 16	✓	—	—	—	—	1
Respondent 17	—	✓	—	—	✓	2
Respondent 18	✓	—	—	✓	✓	3
Respondent 19	—	✓	—	✓	—	2
Respondent 20	—	✓	✓	✓	—	3
Total	9	14	7	10	9	49

Table 4. Constructive leadership traits in BIM-based construction projects.

Respondents	Openness		Responsible		Conscientiousness			Passionate	Total
	Patience	Calm	Reliable	Fair	Resilience	Awareness	Detail-Oriented	Focused	
Respondent 1	✓	—	—	✓	—	✓	✓	—	4
Respondent 2	—	—	✓	—	—	—	—	—	1
Respondent 3	✓	✓	✓	—	—	—	—	✓	4
Respondent 4	✓	—	✓	—	✓	—	—	—	3
Respondent 5	—	—	✓	—	✓	—	—	—	2
Respondent 6	—	✓	—	✓	—	✓	✓	✓	5
Respondent 7	—	—	✓	—	—	—	✓	✓	3
Respondent 8	—	—	—	✓	✓	✓	—	—	3
Respondent 9	—	✓	—	—	—	—	✓	✓	3
Respondent 10	—	—	—	—	—	—	—	✓	1
Respondent 11	✓	—	—	—	✓	—	—	—	2
Respondent 12	—	—	✓	—	—	✓	✓	—	3
Respondent 13	—	✓	—	—	—	—	—	✓	2
Respondent 14	✓	—	—	—	—	—	—	✓	2
Respondent 15	—	—	—	—	—	—	✓	—	1
Respondent 16	—	—	✓	✓	—	✓	—	—	3
Respondent 17	—	—	—	—	✓	✓	—	—	2
Respondent 18	—	—	✓	✓	✓	—	—	—	3
Respondent 19	✓	—	—	—	—	✓	✓	✓	4
Respondent 20	—	✓	✓	—	—	✓	✓	—	4
Total	6	5	9	5	6	8	8	8	55

4.2.1. Constructive Leadership Behavior

Figure 2 illustrates the leadership behavior that can contribute to better BIM-based construction projects. The analysis divides the behavior into two sections: pro-social and self-discipline behavior. These two main themes are essential to ensure better project performance. The sub-themes are then divided into several categories, which are further elaborated.

There are four subthemes under pro-social behavior. Pro-social behavior is defined as the act of a person who intends to help others; this behavior includes a wide range of actions, ranging from helping, sharing, comforting, and cooperating. The results show four sub-themes for the pro-social: liberality, tolerant, concern, and understanding. The second theme is self-discipline of a leader. It is the ability of a person to control and motivate themselves toward something. The sub-themes of self-discipline are committed, determination, and coping mechanisms.

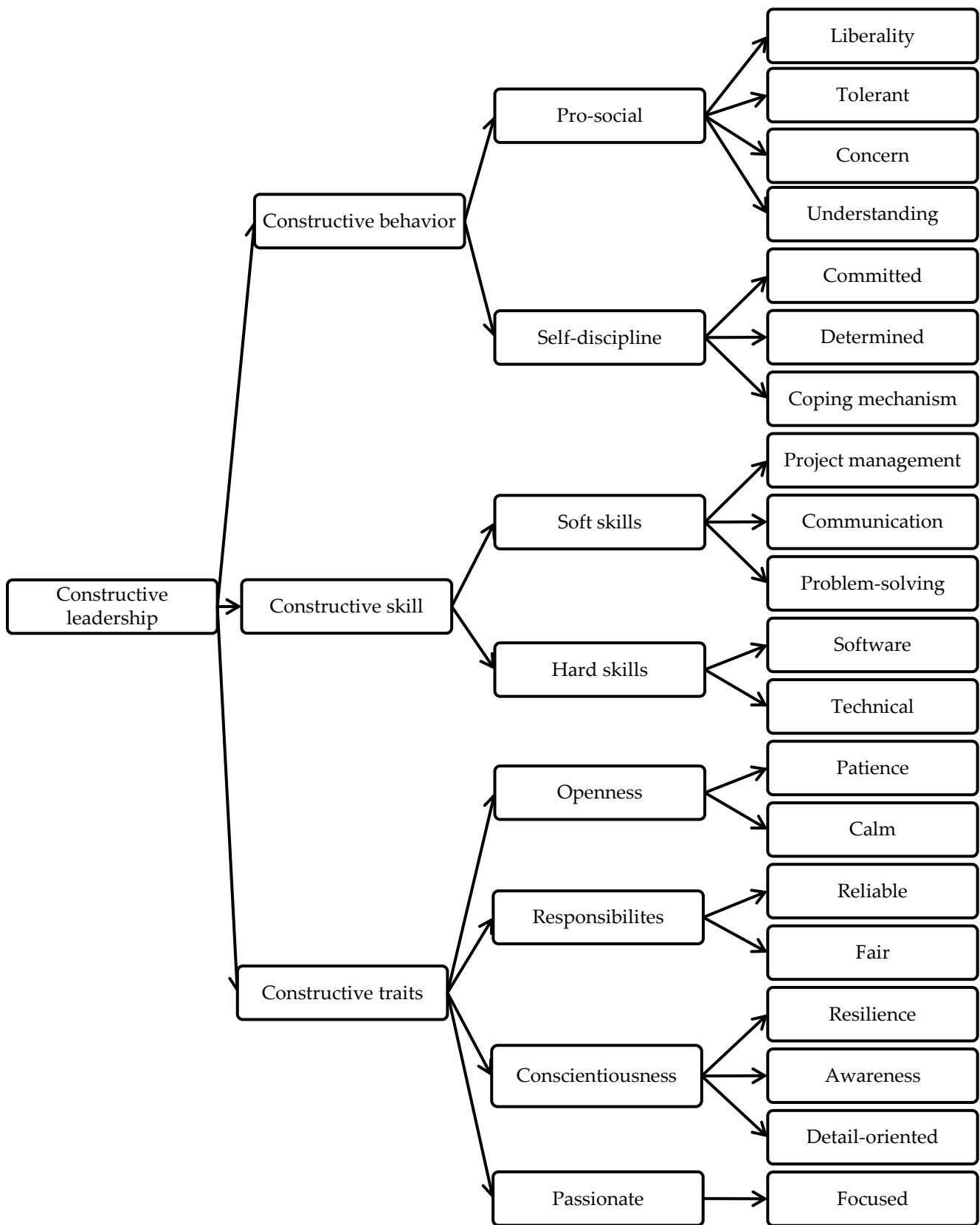


Figure 2. Constructive leadership behaviors, skills, and traits in BIM-based construction projects.

Liberality

The first necessary behavior is liberality toward opinion. It is defined as the quality of not being opposed to ideas, absence of narrowness, or prejudice in thinking. A leader with liberality behavior has broad-minded and can contribute to better construction. Leaders with liberality are open-minded and always open to opinions. They allow their project members to share their insights. This situation enables project members to be more flexible and create a better working environment. A few respondents claimed that this behavior is crucial for better project performance. The respondents' responses are as follows:

A leader should be open to the opinions of other project members so they can share each other's insight toward the issues that occurred and feel free to give their opinion regarding every task. This behavior makes project members feel more comfortable with their work. (Respondent 1)

A leader that is open to new ideas is usually the one that is helpful with their project members because they know what it feels like to be a beginner. As a result, the leader and project members will often interact with each other to gain more ideas and help to resolve any issues if they occur. (Respondent 13)

A good leader behavior, in my opinion, is a leader who is always open to ideas from their project member. This behavior creates a comfortable feeling among project members and a great work environment. BIM requires team works between all departments, including structural, mechanical, electrical, and water supplies. (Respondent 16)

From the quotes from respondents, it can be concluded that liberality behavior or openness to new ideas creates a better work environment for project members and helps them feel more comfortable conducting their work. Other benefits from this behavior are that it can help improve the interaction between each other, improve the relationship between project members, and help resolve any issues by discussing them together as a team.

Tolerant

Tolerant is another behavior that could contribute to better BIM-based construction projects. Tolerant is defined as a behavior of a person who allows the existence of opinion and can bear something unpleasant or go through some difficulties. For example, in BIM-based construction projects, a leader should lead and mentor newbies or fresh graduates who still do not have any experience. There is different software, and it is not easy to learn and seize the skill to understand the software entirely. Hence, a leader needs to have tolerant behavior toward another person. Being tolerant of others is broad-scoped, ranging from being patient, willing to teach, giving another person a chance to express themselves, and tolerating all the pressure upon themselves. These are the respondents' quotes on the importance of tolerant behavior in BIM-based construction projects:

The required behavior of a leader, or project engineer, as a leader in a project team, needs to have a high level of patience and the ability to tolerate all the stress toward them. (Respondent 14)

The leader needs to be able to be patient with others because, in a consultant firm, practitioners are always assigned to do design work. Therefore, the leader must lead the newbies in the company and teach them about the software and all the important information related to all the work. (Respondent 8)

A leader that is easy going with staff with the task but committed to achieving the target and objectives of the project, this behavior can lead to a positive work environment. (Respondent 3)

A participative leader who always communicates and asks for team members' input helps team members feel more confident about having a say on any topic or giving an idea regarding the construction project. (Respondent 10)

In other words, tolerant behavior is crucial, as it can benefit many parties. A leader that always goes easy and does not pressure project members contributes to a better workplace environment. The efficiency of work also increases when project members are more optimistic. Respondent eight claimed that a leader must lead the newbies regarding software knowledge or other essential elements in BIM-based construction projects. This patient behavior of a leader develops a mutual trust relationship between project members. Teaching or mentoring is crucial and challenging. Therefore, a leader should have tolerant behavior to ensure better project success. Another tolerant behavior is the leader who always gives a chance for their team members to provide their opinion or input towards the task without giving any critics; this is an excellent behavior to create mutual respect. This elaboration is based on respondent 10, who claimed that allowing team members to give input makes them feel more confident about having a say and more confident to provide any ideas regarding the project.

Concern

Concern behavior is a feeling of worry or cares about a person or thing. The concern is escalated, as behavior that can affect the well-being of people's surroundings. Employee concerns are crucial in ensuring that project members' mental and physical health is adequate. There are many ways for leaders to show their concern for their project members. From the interviews, these are some opinions regarding the behavior:

One concerning behavior is a leader who focuses and always listens to their staff. It shows how a leader is sensitive to the need of their followers and focuses on their idea instead of giving out instructions and waiting for results only. (Respondent 8)

Being a good listener is one of the effective behaviors. Always trying to spend time to hear their problems or expression creates a positive bond between project leaders and members. (Respondent 8)

A friendly and concern leader is important because it helps me to communicate more with them, especially when I need help for support and coordinate the drawing or any technical issues. (Respondent 15)

The relationship between a leader and the staff needs to be respectful to each other. The important element in these constructions is the communication between the leader and staff. The leader must always be concerned and communicate with them to ensure a positive environment is created among them at the workplace. (Respondent 11)

Respondent eight claimed that a leader who always tries to find time to spend in engaging with their followers would develop a great relationship with project members. A leader who focuses and is always sensitive to their needs is highly motivating for project members. For example, during the COVID-19 pandemic, between 2020 and 2022, many project members had financial problems. Therefore, leaders need to connect with their project members and assist with any help possible. This behavior makes project members feel important, and this builds more trust in the leader. Being a good listener is also a concerning behavior; this is also one of the efficient behaviors that can motivate project members. In BIM-based construction projects, the progress can be puzzling, and project members can feel strained and exhausted. This stressful situation faced by the project members can be minimized when the leader themselves listens to their project members and tries to help them with their situation.

Being a concerned leader also helps project members feel more open and comfortable when communicating. Respondent 15 works as a junior BIM modeler. The respondent claimed that when a leader is concerned and friendly, he can ask them for help and better understand the task because the leader tries their best to help. Respondent 11 claimed that concern behavior is crucial to ensure that the relationship between a leader and their project members and other related parties is always respectful toward each other. Mutual respect and trust between leader and follower need to exist to ensure better BIM implementation and project performance.

Understanding

Understanding is a form of communication and a coping strategy in certain situations. It is closely related to the concern behavior. Below are some of the responses from the interviews for this behavior:

As BIM modelers, we must work with the architects and engineers to develop designs for clients' needs. Mutual understanding between each party is crucial to ensure the project outcome is as perfect as possible. (Respondent 15)

A leader needs to be understanding of the situation. Instead of commenting or critics the work, they can give good words to help project members to feel more comfortable with their work. (Respondent 8)

A leader needs to be strict in conducting work and ensure progress running accordingly to schedule but also flexible with the situation if any issues occur and have teamwork to solve any issues regarding the project. (Respondent 9)

From the respondents' point of view, it can be observed that understanding behavior is essential to developing understanding between each party because BIM requires teamwork to ensure smooth progress and an outcome that meets all the specifications and requirements set by the client. Respondent eight claimed that leaders need to understand a situation where project members could face difficulties and hardships with the assigned task. Therefore, the leader can be supportive and helpful instead of critical of the work.

Respondent nine said in the interview that every leader needs to be strict but flexible; this means leaders need to understand the condition and situation of project members on-site or off-site. Mutual understanding between leaders and project members can help avoid any problems and help resolve any issues related to the project.

Committed

Previous subsections explain how pro-social behaviors could contribute to better BIM-based construction projects. Next, this subsection describes the self-discipline behaviors identified in this study. The first self-discipline behavior is committed behavior. A committed person is someone who pledges or binds to a particular course or policy. In this context, it is someone who gives their commitment to work. Commitment to work is the behavior of a leader with a level of enthusiasm for the task assigned to them. Commitment is crucial in ensuring that every project runs smoothly. For example, during a meeting, a discussion has been conducted, and the final decision should be followed by every person, regardless of whether they agree or disagree with it. This committed behavior is vital because it helps to organize better project performance.

A leader with committed behavior can influence their followers to follow in their footsteps to commit to every task and strive for a better result. These BIM-based projects require teamwork, and teamwork requires trust among project members. Confidence among project members can be developed when everyone in the team can commit to their task. The requirements for team members to be properly committed to a decision are:

1. A leader must clearly explain the decision made to the followers and what it means to them.
2. Leaders must motivate and help their followers understand and ensure they buy into the decision and are willing to support it regardless of whether they agree or disagree with it.

Based on the interview conducted with the respondents, the respondents mainly focused on self-discipline, commitment toward the work, and dedication to achieving the target. Some of the responses are:

A focused leader, someone who always gives their full attention and focuses on the details of the project, can contribute to a better judgment. (Respondent 7)

A committed leader is crucial to ensure every work and all information follows the requirements and specifications made by a client because a committed leader strives to achieve the target and commit to each task that is given to them. (Respondent 19)

A leader should be able to interact with all departments and ensure that all departments have good teamwork to achieve the project goals and fulfill each client's needs. (Respondent 13)

Determination

Determination is essential for a leader to ensure a better outcome for each project. In psychology, self-determination is an important concept that refers to individuals' ability to make choices and decisions to manage their lives. Determined people often feel that they have control over their choices and lives. Self-determination behavior can bring success in many different domains of life. In this context, a determined leader can influence and develop a better version of themselves and help their followers improve.

In BIM-based construction projects, a self-determination leader is vital because determined people often strive to be a better version of themselves. In addition, in construction projects, schedule often becomes a critical issue because the timeline can be tight to be followed, and progress needs to be on time. So, determined leaders can challenge themselves to give their best to ensure each project is delivered on time with an excellent quality of work.

Curiosity-driven behavior is also one of the determined behaviors of a leader. This characteristic is also important in this construction, as BIM is considered modern technology, and sometimes there is multiple software. It takes determination and curious behavior for a person to discover all new things. This behavior benefits numerous parties, themselves, companies, and clients because it improves the quality of work by a better understanding of the software and knowing how to use the features available in the software to its fullest. The responses from the interview conducted regarding the determined behavior are as follows:

Every leader should be determined and willing to learn new knowledge with a desire for hard work and success. (Respondent 13)

A leader should easily adapt to situations and handle immediate changes during progress regardless of the difficulties. (Respondent 5)

Determining and being eager to learn new things from a leader is beneficial to both company and its employees because the BIM system/software covers numerous major focuses, including mechanical, electrical, civil, and architecture. It all has different software for each focus. (Respondent 10)

From the respondents' point of view, it is shown that BIM-based construction projects' scope is wide, ranging from the design phase, civil and structural works, and electrical and mechanical works. Respondent 10 claimed that the determination of a leader is essential because they need to be passionate about their task and work. It is also vital for a leader to be eager to learn new things and possess knowledge of each critical element of the structure, mechanical and electrical, to ensure the project's execution is excellent and no significant issues occur in the long term. A leader must have the desire for hard work regardless of the complicatedness faced to make sure that every project has a favorable outcome.

A determined leader is also important because construction projects can have last-minute decision changes. Therefore, a leader cannot be faint-hearted. They should have the ability and strength to break habits, challenge themselves to change, and strive to improve. This behavior is essential for a leader because every work can be challenging. All followers look up to their leaders in every task conducted. Therefore, leaders should be determined to ensure followers follow in their footsteps and always put one hundred percent effort into the work given.

Coping Mechanism

An efficient leader must have a significant coping mechanism when facing a difficult situation. A coping mechanism is a person's strategy or ability to meet stressful situations

and adapt to them. For example, much information and details for a BIM-based construction project can be stressful for any individual. Handling stress is crucial to ensure that every decision is based on skills and knowledge, not emotion.

BIM contractor shall highlight or issue a non-conformance report (NCR) to the lead consultant if any problems arise that involve different trades. (Respondent 6)

A leader should be able to work under high-pressure situations, especially regarding BIM, because a lot of communication and issues may occur during the project progress. (Respondent 6)

A good leader should take responsibility for any mistakes done by their staff. This behavior boosts the motivation of the project members. (Respondent 3)

Respondent six highlights that a leader must be able to work under high-pressure situations because the possibility for issues to occur is high. Therefore, having the ability to cooperate with the conditions can be helpful in this construction. The respondent also claimed that each project member should highlight and report every problem during construction and try to resolve the issues with the best solution possible. The statement shows that a leader should be able to cooperate with immediate changes or last-minute decision changes because there are possibilities that the situation may occur during the preliminary and design phases.

Respondent three highlights that a good leader should be the one who takes responsibility for the project members' mistakes; this is closely related to the coping mechanism. A leader who takes responsibility for their underlying mistakes shows the ability of a leader to face stress and handle it calmly. This behavior not only improves project performance, but also boosts project member confidence and, at the same time, increases the quality of work conducted.

4.2.2. Constructive Leadership Skills

This subsection explains the second element observed in this study: leadership skills. Skill is a person's talent or ability from training or practice that developed through time. Figure 2 shows that constructive skills are divided into two categories: hard skills and soft skills. Each key point is elaborated on in the next subsections.

Project Management

The first leadership skill for a leader in BIM-based construction projects is project management skill. It is essential to bring direction to projects to ensure everything runs smoothly and according to plan [1,11]. Project management is not just important for construction. It is also important in business, marketing, and other industries. Project management helps every part of the work run smoothly [7,26,37]. From the interview transcripts, these are some of the responses acquired:

Project management skills are important. The project management skill includes the technical understanding of the Gantt Chart to the S-curve, including the shop drawing. As project engineers, we provide solutions to obtain the best cost-saving construction and record all the progress, including the inventory and the machinery. All these things require excellent and proper management skills. (Respondent 14)

The management skills of a leader in handling their team, project, and project timeline, these three items are the major important thing in ensuring a project runs smoothly. (Respondent 2)

The important skill is management regarding the scope of work, either in software work or on-site work. For example, the project is not always constant in Malaysia's Public Work Department (PWD). Sometimes the project is overloaded, and there are not enough project members to handle the project. The number of projects and the number of project members are not on the same path, which could lead to a project delay. The government sector has very limited employment, and sometimes there is an insufficient number of project

members to handle the project on-site. Therefore, a leader's management skills are important.
(Respondent 11)

From the respondents' answers, project management must ensure that every project follows the client's requirements and meets the legal specification set by Malaysia's Public Work Department (PWD). Project management scope ranges widely from understanding software data specification virtually to handling on-site construction [7,26,37].

Respondent two claimed that this skill is vital to ensure the three major important things ensure that every construction project runs according to plan and follows the schedules. It is the method of a leader handling their team, how a leader takes the project and ensures the project follows the timeline set by the clients. These three elements can improve the quality of construction only if the leader possesses excellent project management skills. Respondent 11 claimed that project management is crucial whenever there is task overload. When there is more work than the number of laborers, this situation usually occurs in government projects because the number of project members has limitations in every department. This skill can somehow be improved through experience and time.

Another skill under project management is planning skill. Planning skills are critical, especially in the initial phase [1,11]. The initial phase required excellent planning to ensure the project flow and progress run smoothly. BIM-based construction projects have an extensive scope of information. The most critical part is avoiding clashes between structures, pipes, air conditioning, and electrical systems. These elements can clash without proper planning during the initial phase. Some of the respondents' points of view are as follows:

A leader should have good project planning from the start until the end. BIM Execution Plan (BEP) has information about the project, including the timeline, the specification, the requirements from the client, and how long it takes to complete. All information is there. Hence that is why a leader should have good management skills. (Respondent 2)

Planning is a vital part of the initial phase, which is the key to whether the project is a success or a flop. During the planning phase, the task and objectives must be identified to ensure they fulfill the client's needs. (Respondent 16)

The time-planning management skill is also a part of the project management skill that is very important in ensuring every project runs within the schedule and does not overlap the time set by the clients. Time management is crucial, especially for the contractor, because they have a binding contract that can lead to a partial loss in monetary payment if the project exceeds the deadlines and fails to be completed in the given time.

Every leader must have this exact skill to deliver the project on good terms and always meet deadlines. Therefore, a leader needs to be able to allocate the amount of time wisely and give the task to their followers accordingly through each critical phase. Furthermore, a leader needs to be able to plan schedule management, define the activities and their sequence for every stage, estimate the duration of each activity, develop the schedule, and plan the estimated time to complete the task. Some of the opinions from the respondents regarding time management are as follows:

An important skill is time management. BIM-based construction projects require proper time management, involving more than one party, such as architects, lead consultants, contractors, and developers. BIM contractor shall provide a construction drawing for the main contractor without any delay, as any delays in approval of the construction drawing affect the smooth progress of the construction project. (Respondent 6)

The important skills for a leader in BIM-based construction projects are time management and project management skills. These skills play a role in each other and are crucial to ensure a project runs smoothly. (Respondent 14)

An important skill for a BIM modeler is to have good time management because the task of an engineer or modeler is to do modeling and coordinate the work, every leader needs to manage their time wisely to ensure the construction works run smoothly from the

preliminary to the handover phase, and the most importantly, to ensure the schedule does not overlap or exceed the timeline. (Respondent 10)

Communication

Communication is a critical skill that every leader must possess. Every leader in every organization worldwide must be excellent in communication to ensure that the flow of progress runs smoothly [1,11]. It is shown that almost every participant claimed that this skill is critical, not only for BIM-based construction projects, but also for conventional projects. The respondents' responses are as follows:

A leader needs to have good communication skills and interact with all the team members to motivate them and help them resolve all the issues. This is important because BIM projects need a collaborative process, and many departments are required to ensure that the project runs well. (Respondent 13)

Leaders should have good communication skills with their staff to deliver the information to all parties without any problems. Good communication skills also help improve the project's efficiency because the staff can understand each task more easily. The most important is to avoid miscommunication. (Respondent 4)

The most important skill, in my opinion, is communication skills because every phase of construction in BIM is related and linked to each other. Mechanical, electrical, structure, and plumbing systems can all be related to each other. To avoid any clashes during the outcome, the leader must communicate and encourage the staff to communicate. It also helps to coordinate every task assigned to each project member. (Respondent 5)

Communication skills are important to ensure the progress and the construction phase, starting from the preliminary design stage to the phase design liability phase (DLP) and finally, the Certificate of Making Good Defect (CMGD). (Respondent 9)

A leader also needs good communication skills to interact and do all the learning and teaching because software learning requires 2-way communication to be more effective. (Respondent 10)

The important element in this construction is communication between the leader and staff. The leader must always communicate with the staff, creating positive and comfortable working environments. This way, the information or any issue with the project can be solved together, and at the same time, can smoothen project progress. (Respondent 11)

I would say another important skill is communication skills for a leader. As BIM modelers, we must work with the architects and engineers to develop designs for clients' needs. Mutual understanding between each party is crucial to ensure the project outcome is as perfect as possible. (Respondent 15)

Many significant values can be obtained through communication, and each respondent has a different point of view regarding the benefits of good communication between project members and leaders. However, from the quote by all the respondents, it can be concluded that communication skills are fundamental and play a significant role in BIM-based construction projects.

Communication skills can benefit from many aspects if leaders communicate effectively with their project members [7,26]. This skill develops mutual respect among all colleagues, and good communication creates a positive environment for work. A comfortable environment to do work in increases project members' passion, and this behavior improves the quality of the work. In BIM-based construction projects, the initial and designing phases are critical. Every team needs to communicate with each other regarding material usage, cost, design, strength, and many more elements to ensure that every facility is safe to use. To ensure the facility is secure, all parties need to communicate with each other. Hence, a leader plays a vital role in always communicating with them and leading them to communicate with each other constantly.

There might be a situation where major issues may occur in construction projects. This usually occurs during the design phase; the project members commonly face these issues; they often do not communicate and try to solve them themselves, leading to delays. Sometimes, the problems are not even solved. This situation occurs when project members do not ask for help from their leader. It happens because the leader does not communicate with them. After all, they do not feel comfortable speaking with the leader. So, a leader needs to be friendly and always try to communicate with the project members to make them feel pleased with the leader. This way, discussing and sharing opinions can resolve more issues quickly.

Problem Solving

Problem-solving is an essential skill in construction. This skill is developed through experience and knowledge, making it crucial for every project [1,37]. The ability of a person to identify the problem during construction and find solutions for the issues can lead to a stronger team. A leader needs to have the ability to find the source of the problem, resolve it, and make sure the issue does not occur again.

As in BIM-based construction projects, the most common problem is the clash in BIM, where two elements in the design take up the same space. BIM helps to detect the conflicts where the part interferes. Somehow, a leader needs to know the cause and be able to resolve the issues in the design. Some of the respondents' answers are as follows:

Design clash or the most common issue, drawing did not suit with site condition. When this issue occurs, justification and decisions from a project manager or resident engineer are important. Moreover, the leader's decision must be firm and fair. (Respondent 9)

A good leader needs to be a good decision-maker because, in any construction, either BIM-based or conventional, every project has a problem or obstacle during the progress. Hence, a leader must be competent in solving the issues to ensure the project is not damaged. (Respondent 11)

Problem-Solving skills are important as a construction project involves much trade from civil and structural, architecture, mechanical, and engineering. (Respondent 6)

In a BIM project, the outcome needs to be as good as possible it can get. The challenges are the problem that may occur during the design, especially the clash of structure, the budget costing, and the tight scheduling. These issues require a leader to have the problem-solving skills to make sure the outcome of the project is excellent. (Respondent 20)

Software

Hard skills are a critical element in BIM-based construction projects. The most important skill every leader needs to possess is software skill [7,26]. Every leader in BIM-based construction needs to seize the understanding and ability to use the tools and features of BIM technology. BIM is the foundation of digital transformation in the AEC industry. This skill can be identified as one of the most crucial skills a leader needs to get hands-on training for because BIM does not exist without software. Therefore, leaders need to be able to understand how to use all the tools and be able to have the ability to lead their followers to understand the software.

A leader with excellent software skills can lead to better BIM-based construction projects because the skill can increase project performance. In addition, BIM-based construction projects require project members to work with a database daily. Therefore, if a leader has advanced skills in the software, this can contribute to better progress. Some of the answers related to the software skill are as follows:

A leader should also have strong technical knowledge and professionalism in handling BIM software. (Respondent 1)

Software is the essential key in BIM as it is digital construction. It has the skills to operate different software such as AutoCAD, Navisworks, and Tekla. (Respondent 2)

The most important skills in a BIM project are the knowledge and understanding of the software and details of the project because a leader needs to lead the project members to be able to lead. We first need to understand the information from every software because the objectives of BIM are to ensure the project can be conducted smoothly to ensure there is no issue during the progress. (Respondent 3)

A leader with good data skills and the ability to understand/define data information. Every engineer needs to be capable of handling data in a real-life situation because data is very important in construction, either conventional or BIM-based construction projects. (Respondent 7)

A leader must have lots of technical skills and software knowledge, especially in software, because there are five important BIM tools that every BIM modeler or any BIM specialist needs to understand. Experience in Autodesk Revit MEP, Navisworks, and AutoCAD gives a leader many advantages. It can help smoothen the progress of construction works. (Respondent 10)

For me, the most important skill for a leader in BIM or any general construction is the skills and knowledge in using the software. (Respondent 13)

I would say the crucial skills are software skills and the ability to work with technology. My job scope is almost one hundred percent toward the software as I need to handle the visual plan and determine the proper elements/scale for the buildings. (Respondent 15)

This software is a mandatory skill to be a BIM modeler, manager, or any work related to BIM because we need to have the skills to save the data regarding the building and all other things. (Respondent 18)

Different opinions and ideas come from all the participants regarding why software skills are essential in BIM-based construction projects. However, it can be identified and confirmed that these skills are fundamental. A leader with these skills contributes to better progress for BIM-based construction projects. A leader needs to be able to operate a computer system because, in the millennial era, this skill is needed in almost every workplace, either in construction or non-construction. Having software skills helps to improve the leader's overall knowledge and understanding of the tasks. It also leads to a better experience for their followers.

Workflow efficiency is also the key and the advantage for the leader who possesses this skill. The design phase can be considered the critical phase in every construction, and a leader who leads the team must be able to integrate and coordinate their followers. The documentation for the design in BIM always needs to be updated when any changes are made. The software skill is used during this phase because it leads to better time management and workflow. Better workflows reduce errors and have less oversight of the project.

The ability of a leader to work with BIM software brings a better outcome to the project. It is because the software is used for design and structural purposes; the leader who can use all the available features of the tools improves collaboration and the design data.

Technical

Technical skill is the specialized knowledge and expertise required to perform the task and the ability to use specific tools or programs. These skills are necessary and significant in every field, especially the construction industry [37]. For example, even though BIM is major in software skills and almost a hundred percent software-based, technical skill still plays a significant role in ensuring a project can run smoothly.

A leader should excel at software and construction technical skills to ensure that the project outcome can meet the specifications required by the client. These skills are important for a leader because they need to monitor the progress from the beginning until the handing over phase. Site construction also needs to be monitored even though it is BIM-based.

Technical skills on-site examples are the ability to do measurements using tools, develop blueprints, read drawing plans, know the process of laying the brick wall, milling and cutting metal, concreting and reinforcement skills, and monitoring and testing electrical systems. This skill can contribute to a better result for a construction project. Here are some of the points of view from the participants about the significance of technical skills in a construction project.

A leader should also have strong technical knowledge and professionalism in handling BIM software. (Respondent 1)

The other important skill is that a leader in BIM-based construction projects should have the knowledge and understanding of the technical aspect of the construction, not only based on software, this way. The actual site issues can be avoided. (Respondent 8)

The important skills are the technical skills and knowledge regarding the construction during the preliminary phase until the on-site construction. A leader should know about designing all structural elements for IBS, Concrete, and Steel because all modern buildings use different structural elements. (Respondent 13)

From the respondents' answers, it can be concluded that technical skills and the ability to understand the technical aspect of the construction are essential to avoid issues occurring on site. Furthermore, Respondent 13 claimed that different structural elements are being used in the current year because technology keeps growing. Therefore, being wholly dependent upon the software is inadequate. Hence, leaders should have strong technical skills to lead followers and share their experiences and skills.

4.2.3. Constructive Leadership Styles and Traits

Styles and traits that can contribute to BIM-based construction projects are combined as one element because both characteristics are closely related. Theoretically, traits refer to personal qualities that define an individual. In this context, the qualities of a person as an effective leader are considered. Leadership styles are closely related to a person's traits. The styles of a leader represent their traits of themselves. Figure 2 shows four sub-themes under the constructive traits: openness, responsible, conscientiousness, and passion. All characteristics are elaborated on in the following sub-section.

Openness

Openness traits are best described as open-mindedness and openness to other people's opinions or ideas. Different sources define openness as a person who always embraces new things and fresh ideas and seeks novelty. Leaders with this trait tend to be intellectually curious and creative. There are two subthemes under this category, patience and calm.

In this context, openness focuses on how it can contribute to BIM-based construction projects. A leader with an openness trait usually comes up with liberal behavior in a construction project or during the design phase; a liberal mind is significant because many ideas can be shared and given thought by every person, which can lead to a better relationship between a leader and their followers. Regarding the trait, responses from the interview obtained are as follows:

A patient leader, because a leader needs to interact with staff, and huge numbers of staff come with different attitudes and ethics. This trait improves staff relationship skills and creates a positive work environment, especially in BIM, where everyone needs to cooperate. (Respondent 4)

The leader needs to be patient with their followers because, in a consultant firm, the project members are always assigned to do design work. Hence, a leader must lead the newbies in the company. (Respondent 8)

A good listener is a great personality that represents an open leader who always has time to hear their project members' problems or their expressions and creates a mutual understanding between project members and leader. (Respondent 19)

Calm and patience are the big personalities that represent the openness trait of a leader, and this can be seen in how the leader interacts with their follower and how they handle the situation. There are some critical phases in BIM-based construction projects where project members might cause mistakes. Therefore, a leader needs to be calm and handle the situation professionally instead of blaming the project member directly. Respondents four and eight explained that patience is vital for work because patience creates a positive bonding between the leader and their project members. A good relationship is required to ensure that every project runs well. Respondent 19 claimed leaders should listen to their followers; this act can make project members feel appreciated and important. When the project members trust their leader, the workflow also improves.

Responsible

Every leader in each organization needs to have the trait of a responsible person. These traits are very important, especially in construction, as this industry requires people to decide every critical thing in ensuring the safety of a building being constructed. Therefore, a leader must be responsible for a building project and their followers. In addition, a leader needs to be reliable and fair toward their followers or project members.

For me, a leader should be responsible if they want the company to be successful. Basically, for a BIM project, we need to handle lots of software, and lots of information is saved on the computer. The possibility for errors to occur is high. A good leader should take responsibility for any mistakes done by their staff. This boosts the motivation of the project members. (Respondent 3)

A leader needs always to pay attention to their staff's needs. BIM requires software and, of course, computers. The system must always be up to date for the software to perform efficiently. These essentials are important for a leader to provide for the staff. (Respondent 5)

A leader must lead the newbies in the company and lead them and teach them about the software and all the important information related to all the work. (Respondent 8)

A person with responsibility is often a person that can create a positive environment and provide efficient workplaces because their followers are comfortable with them. In every construction project, there will always be some errors that occur, and there are mistakes. Regardless of how advanced the technology is, there is still a possibility for an error because humans still conduct it. These errors, including design clashes and overestimating, can cause overlapped schedules. A leader should be held accountable and try to resolve the issues instead of blaming the staff. Every problem must be resolved together. Therefore, leaders and followers must have mutual respect and a good relationship.

A leader should be fair with their followers regarding the task upon the execution of the project. Therefore, each project member needs to be treated fairly by the leader, with no overburdened job, pressure, and no exchanging of tasks between project members. This way, they can recognize the high-quality and moderate project members because they are given the task fairly. This can lead to better project performance in BIM-based construction projects.

Conscientiousness

Conscientiousness is defined as the ability of a person to be deliberate about their decisions and act more cautiously regarding every action made. This trait is compulsory in a leader to ensure that every design building is built perfectly following the client's needs. Through the interview and the analysis, there are three sub-categories under conscientiousness: resilience, detail-orientedness, and awareness. The elements are obtained from the respondents' answers during the interview:

Attention to detail and information about the construction needs to be as perfect as possible to avoid problems during actual construction. (Respondent 5)

Always giving their full attention and focusing on the project details can contribute to better judgment. It is essential for a leader always to pay attention to the progress of a project and ensure that the specification and requirements follow the client's needs. (Respondent 7)

The important trait in a leader is keen attention to detail in every work done. This is because the main purpose of BIM itself is to enhance project performance and produce better outcomes. To put it in simple words, it means that the construction on-site can be conducted smoothly. (Respondent 15)

A resilient leader, sometimes clients change their decision randomly may cause problems for the engineers. This situation always occurs. Hence, I said a leader who can adapt easily benefits a party. (Respondent 18)

A leader's resilience is important to ensure their mental health stays balanced even when facing a stressful work environment. Leaders should have high resiliency to face all the difficulties and constantly improve themselves. This trait helps their followers handle stress and hardship because a resilient leader constantly interacts and engages with their followers regarding every issue.

Detail-oriented traits are essential in the design phase and the operational phase. This is because a detail-oriented leader can identify and recognize any problem during the construction, from the preliminary to the finishing phase. Furthermore, the design phase is always critical for any BIM modeler or three-dimensional modeler because every detail is crucial to ensure that the project follows every specification. Therefore, a detail-oriented leader can contribute to the objective because they always give their undivided attention to the task assigned.

Another trait of conscientiousness is awareness. Leaders should be aware of their followers in every aspect of construction, the safety, the details, the cost, and the materials. Safety awareness among project members can be described as moderate. A leader should be aware of the situation and develop a plan to raise awareness of the condition. Awareness traits can contribute to BIM-based construction projects and increase safety awareness among project members in construction industries.

Passionate

A passionate leader is a person who is always focused on achieving their goals and always strives to do their best to create a better result. Every career has challenges and difficulties, and a leader who leads needs to love their profession and enjoy the task they do instead of doing the job financially.

A passionate and eager to learn new traits from a leader are beneficial to both company and its employees because BIM covers numerous systems and software. (Respondent 10)

A passionate leader can lead to better time management and good mental health toward colleagues and surroundings. (Respondent 12)

A good trait in a leader is curiosity and eagerness to learn new things. Every leader should be determined and willing to learn new knowledge with a desire for hard work and success. (Respondent 13)

These traits are crucial in a leader because leaders should thrive at influencing and persuading their followers to have passion in every work conducted. A passionate leader often has an eager character, and they are always keen to learn new things and keen to improve themselves. These traits are beneficial for BIM-based construction projects, as BIM techniques keep updating and have unique features to learn. Therefore, it can help contribute to better construction.

4.3. Destructive Leadership Characteristics

In this subsection, the study determined the leadership behaviors that could worsen BIM-based construction projects. The interview regarding this topic is conducted with the same twenty participants. However, the interview data suggest limited content regarding destructive leadership skills, styles, and traits. Therefore, the data obtained are focused only on destructive behaviors that can contribute to worse BIM-based construction projects.

4.3.1. Destructive Leadership Behavior

The total number of hits and data on the destructive behaviors are shown in Table 5. Two themes are presented regarding destructive behavior: dictatorial, the way a leader interacts with their followers that can lead to worse construction and adverse self-behavior, and the behavior within a leader themselves that could contribute to worse BIM-based construction projects. The highest hits regarding destructive behavior are intolerant, with ten hits, followed by irrationality, irresponsible, uncooperativeness, and inconsistency. The themes are categorized into two groups, as shown in Figure 3. It is shown that five elements can contribute to worse BIM-based construction projects. The dictatorial and adverse self-behavior elaboration is explained in the subsequent subsections.

Table 5. Destructive leadership behaviors in BIM-based construction projects.

Respondents	Dictatorial			Adverse Self-Behavior		Total
	Irrational	Intolerant	Irresponsible	Inconsistent	Uncooperative	
Respondent 1	✓	✓	—	—	—	2
Respondent 2	—	✓	✓	—	—	2
Respondent 3	—	✓	—	✓	—	2
Respondent 4	✓	✓	✓	—	—	3
Respondent 5	✓	✓	—	—	—	2
Respondent 6	✓	—	—	—	—	1
Respondent 7	—	—	✓	—	—	1
Respondent 8	—	✓	—	—	—	1
Respondent 9	—	✓	—	—	—	1
Respondent 10	—	—	—	—	—	0
Respondent 11	—	✓	—	—	—	1
Respondent 12	—	—	—	—	✓	1
Respondent 13	✓	—	—	—	—	1
Respondent 14	—	—	—	—	✓	1
Respondent 15	—	✓	—	—	—	1
Respondent 16	—	—	—	✓	—	1
Respondent 17	—	—	✓	—	—	1
Respondent 18	—	—	—	—	✓	1
Respondent 19	✓	—	—	—	—	1
Respondent 20	—	✓	—	—	—	1
Total	6	10	4	2	3	25

Dictatorial behavior in a person is inclined to dictate or give a command without considering any circumstances. A leader with this behavior often causes project members to feel burdened and stressed over each task. This attitude represents a leader being forceful and unfair toward their followers. The three elements of dictatorial or imperious behavior are irrationality, intolerant, and irresponsible. This behavior usually occurs during engagement between a leader and their followers. It is a communication behavior that requires multiple parties. It contributes to worse project performance and can ruin the relationship between leader and followers.

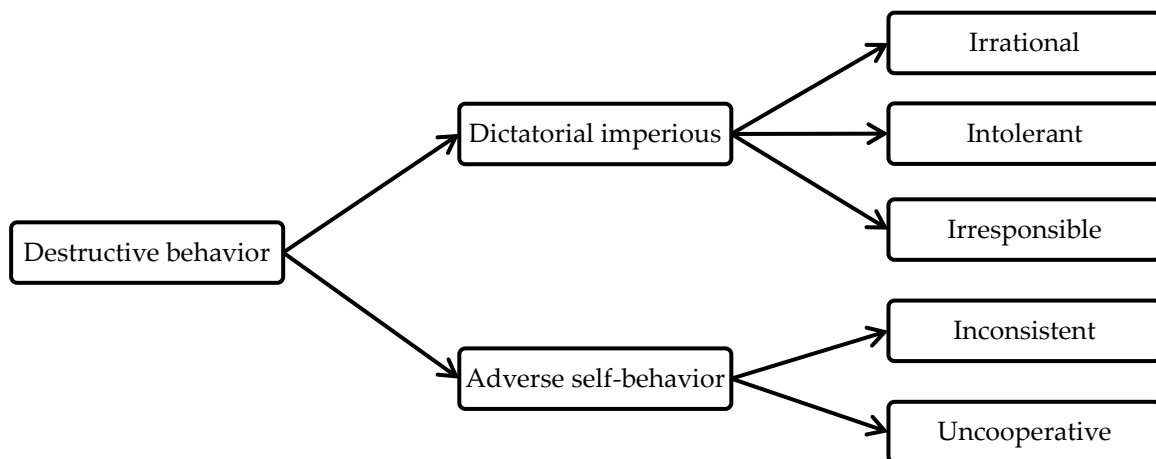


Figure 3. Destructive leadership behaviors in BIM-based construction projects.

Dictatorial

The first element is a leader's irrational behavior; an irrational person usually decides not based on reason or clear thinking. Sometimes, a leader who takes a situation lightly does significantly impact the work in a negative pattern and worsens results. This behavior exaggerates negative emotions toward colleagues. The responses from the interview regarding the irrational behavior are as follows:

A leader that always gives assignments/task overlap and with a short timeline can demotivate project members. (Respondent 1)

A leader's irrational and incomprehensible attitude is a person that is not coordinated; this negatively affects every progress, whether the project is major or minor. No coordination of works within the sub-trade in the project site can cause bad quality in a project. (Respondent 6)

The worst behavior from a leader that can affect others is the boss that is highly demanding and gives tasks without taking any concern toward their staff. (Respondent 13)

A leader that gives a task or assignment without considering the situation their followers face can lead to worse progress in BIM-based construction projects because the project members feel pressure over the tight schedule and task.

The second element is intolerant behavior from a leader, and this intolerant characteristic received the highest hits on the behavior that can lead to worse BIM-based construction projects. An intolerant person does not accept behavior or opinions different from their own.

This behavior commonly happens in construction organizations, especially consultant firms. This situation usually occurs during the design phase because this phase requires communication and multiple ideas to obtain the ideal and effective decision regarding the design. Intolerant behavior in the workplace situation usually happens when leaders engage with their followers. A leader that always sticks to their own opinion and does not accept others' views causes their colleagues to feel demotivated. This causes reduced project performance.

Another intolerant behavior is a leader who does not consider their project members' needs. For example, when project members are packed with tasks and tight schedules, their boss still hands them more assignments without considering their burden. This can lead to emotional damage to project members, cause the work to be ineffective, and may lead to project members resigning due to overstress. The responses from the interviewee regarding intolerant behavior are as follows:

Bad behavior from a leader is not open to other people's opinions and always sticking to their idea. (Respondent 1)

Someone who cannot accept other people's opinions leads to the worst project performance because, as I said before, BIM-based construction projects require interaction. Everyone must communicate and be open to ideas. If that one person, especially if he or she is a leader, and they only stick with their opinion, it might affect the project negatively. (Respondent 2)

A bad leader often has an intolerant attitude. When a leader is intolerant of other project members, this leads to an unhealthy, negative environment in the office or even on-site. (Respondent 3)

Lack of trust leads to problems and increases the failure risk for the project. This behavior causes the employees to feel obligated to one's opinion and cannot roll with changes where they are stuck with the leader's decision without the leader not listening to their opinions. (Respondent 9)

Irresponsible behavior is one of the behaviors that can lead to the worst BIM-based construction. This irresponsible behavior often happens when there are on-site mistakes, regardless of the mistakes made by the project members or leaders. Construction work is supposed to be group work and requires teamwork to solve every issue. Unfortunately, irresponsible leaders often point the finger at others for the mistake instead of stepping up to the problem and solving it. Here are some of the responses on the irresponsible behavior from the interviewee's point of view:

Some leaders let go of things off their hands whenever issues occur, and sometimes project members get blamed for the mistakes. Sometimes mistakes are unavoidable, but the leader should step up instead of leaving the blames on their staff. (Respondent 2)

A leader's bad trait is always pointing fingers at project members regarding any project issue. This trait demotivates the staff. (Respondent 4)

Careless behavior is an absolute negative attitude in any construction and can cause loss to the company's finances. (Respondent 7)

Behavior that could lead to the worst construction is a leader who is not committed and does not obey the rules and regulations. (Respondent 17)

Adverse Self-Behavior

Adverse self-behavior is a leader's characteristic that can contribute to the worst project performance. This sub-section discusses the attitude which does not engage with other people and is somehow the characteristic of a leader that can lead to the worst BIM-based construction projects. There are two elements under the adverse self-behavior, which are inconsistency and uncooperativeness.

Inconsistent behavior from a leader can lead to many negative things in the workplace. An inconsistent leader often confuses their followers and erodes their trust in the leader because they are not committed and not confident with their decisions. In BIM-based construction projects, a leader's inconsistent behavior can delay the project's progress and cause project members to be inefficient. The interviewee's responses regarding the inconsistent behavior are as follows:

Leaders that are inconsistent with their work, inconsistency from a leader, cause their followers to struggle with their work. The schedule for every phase of the project that should be done will be messed up when a party, in this case, the leader. (Respondent 3)

A leader who does not have proper time management skills is bad behavior. Time is a crucial element in BIM-based construction projects. The schedules can be tight, and the task requires much work. If a leader does not have good time management skills, they often pass the minor task to their staff, which can cause their project members to overload work. This hurts the workplace environment and causes the work to be inefficient. (Respondent 18)

Another destructive self-behavior that can contribute to worse BIM-based construction projects is uncooperative behavior. Collaboration among project members is essential in

BIM to ensure every project can run according to schedule on time and does not exceed the deadline. The responses obtained from the interview are as follows:

Individuals who do not collaborate with their colleagues do not survive the construction industry because it requires teamwork and engagement to produce an efficient work environment and first-rate results. (Respondent 12)

In the design phase, maximizing and collaborating with all the project members is the only way to bring the best outcome for the project. This is because all departments (M&E, C&S, Architectural) need to interact with each other to avoid any issues in the future. If the leader does not collaborate with the project members, it may cause problems on-site or even in the design phase. (Respondent 14)

Leaders who do not collaborate with project members often provide tasks or assignments without clear instructions and cause the project members to have problems executing every task because the leader does not engage with them daily. (Respondent 18)

It is ineffective when a person works alone and makes decisions without considering other alternatives or other people's ideas. This can lead to lousy relationships in workplaces. Moreover, when a leader lacks collaboration, the workflow can be affected because, sometimes, instructions are unclear, and the task is not informative to the project members because they do not communicate.

5. Conclusions

This study aimed to identify the constructive and destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects. To achieve that objective, this study conducted interview sessions with twenty professionals from the AEC industry. The interview data were analyzed using thematic analysis. As a result, this study has determined the leadership behaviors, skills, styles, and traits that can be constructive or destructive for BIM-based construction projects. The study also discovered the effects of having those leadership characteristics. From this study, it is possible to develop a better mutual relationship between a leader and followers in a workplace environment by recognizing the construction and destructive leadership characteristics.

5.1. Summary of Results

The analysis has been conducted to identify the behavior that can be constructive and destructive. The result from the thematic analysis is simplified and shown in Figure 4 for a better understanding of which constructive and destructive characteristics are common.

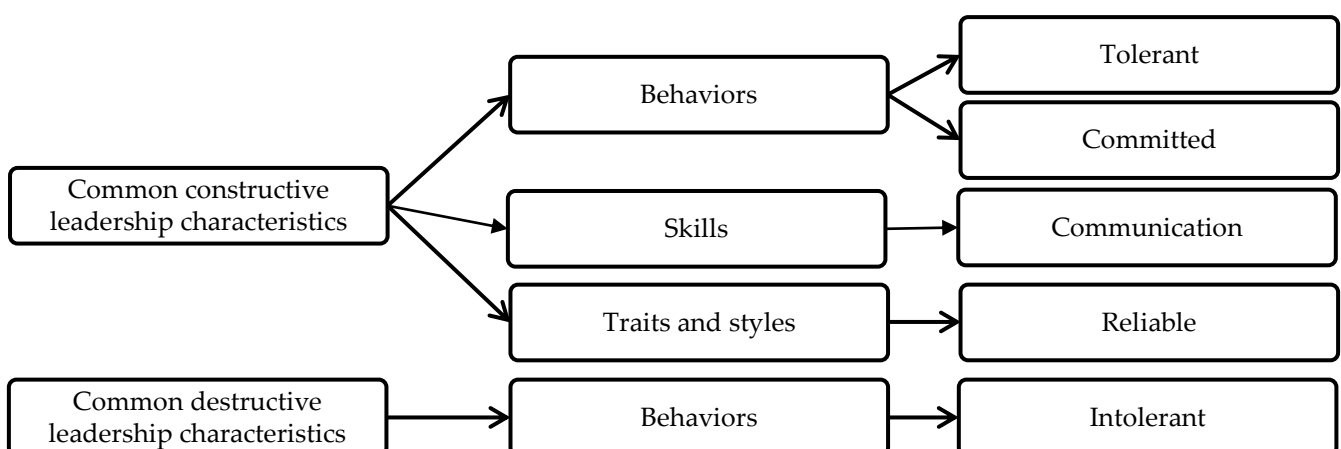


Figure 4. The common constructive and destructive characteristics in BIM-based construction projects.

5.2. Study Implications

This study mainly contributes to understanding constructive or destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects. Additionally, it contributes to a better understanding of how those characteristics can affect project performance. This understanding assists professionals in increasing the efficiency of BIM-based construction projects. For example, the common constructive characteristics (as shown in Figure 4) improve the performance of BIM-based construction projects. In addition, the study provides the literature a source with a novel list of constructive or destructive leadership behaviors, skills, styles, and traits in BIM-based construction projects.

5.3. Limitations and Recommendations

While conducting the study, the researcher faced critical challenges in obtaining twenty respondents for the interview session. Some respondents are busy with their schedules for an in-person interview. Therefore, the interview sessions were conducted remotely through video or phone.

Another challenge was acquiring an accurate answer to the interview questions. Respondent answers often do not meet all the criteria that are needed. For example, most participants did not answer the question regarding constructive styles and mainly focused on behavior and skills. The answer by the interviewee on a particular subject only caused limited data and content on constructive leadership styles. Another limited content is destructive leadership skills, styles, and traits. Some participants claimed there are no destructive leadership skills and traits because leadership is supposed to bring benefits instead of worsening the construction work.

There are a few improvements that future research can explore. As for the data collection, it can be collected through questionnaire surveys. Surveys can be distributed easily and receive more data to be analyzed. Another improvement that can be made if the interview still conducts the data collection is increasing the number of respondents. The higher number of respondents contributes to an incrementing number of data, and more accurate data can be obtained. Finally, the target population improvement can be improved by widening the target population from different project members in the AEC industry.

As for BIM-based construction project improvement, this paper suggests that the AEC industry needs to enhance awareness regarding the characteristic that every leader needs to have within themselves to improve project performance. It is founded that constructive characteristics can improve project performance and build trust, respect, and mutual understanding between leaders and project members.

Based on the findings, this study recommends that every sector, either private or public, spread awareness regarding the significance of leadership toward the progress of BIM-based construction projects. In addition, better project performance can be achieved by conducting courses to develop self-personality or characteristics focused on individual leadership.

5.4. Final Remarks

This study has discovered the leadership behaviors, skills, styles, and traits that can be constructive or destructive in BIM-based construction projects. The study also identifies the effects and outcomes of practicing the specific characteristics. The analysis of twenty respondents has enhanced the understanding and a better view of how a leader's personality can affect work performance and become a factor in ensuring every construction project is delivered accordingly.

The study findings summarize that constructive leadership characteristics can be divided into three: behaviors, skills, and traits. On the contrary, destructive leadership characteristics are solely focused on behavior. The common constructive behaviors are being committed and tolerant. In addition, a leader should have communication skills to ensure that every important detail and information is delivered to project members. An important trait for a leader is conscientiousness because it is critical to ensure every detail of the project is according to specification. As for the destructive characteristics, it has been

discovered that intolerant behavior is the common destructive characteristic in reducing project and work performance.

These findings are beneficial in improving the performance of BIM-based construction projects by boosting every individual's characteristics in the construction work. In addition, recognizing the importance of leadership behaviors, skills, styles, and traits improve the follower–leader relationship in construction projects and work and project performance.

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Appendix A

Table A1. The main questions for the open-ended interviews with AEC professionals involved in BIM-based construction projects.

No.	Main Interview Questions
Question 1	What leadership behaviors, skills, traits, and styles can be constructive and contribute to a better performance of BIM-based construction projects?
Question 2	What leadership behaviors, skills, traits, and styles can be destructive and contribute to reduced performance of BIM-based construction projects?

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