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DEVELOPING A FRAMEWORK FOR ASSESSING TEAM ALIGNMENT IN CONSTRUCTION USING TVD

Nazanin Najafizadeh[1] and Farook Hamzeh[2]

ABSTRACT

Customers' value is crucial to the success of a construction project, and team alignment is required to steer projects toward their intended value. Alignment is when the right people work together on a project to generate and achieve values that are consistently communicated and accepted. In the architecture, engineering, and building industry, teamwork challenges are inevitable. The existence of a team does not guarantee the success of the project, and a dysfunctional team might result in project failure, wasting resources such as time, money, and energy. Target value design (TVD) is a lean approach that leads the design and construction phases to meet project objectives while adhering to team and project limits. Based on their values, each project has different conditions, facts, or impacts that help strengthen team alignment (factors). Additionally, a team that is aligned has particular qualities that are recognized as attributes. Measuring and assessing team performance based on TVD using factors is complex. This research fills the gap in the literature review concerning the measurement and assessment of team alignment. The process and its results could help construction project leaders regularly assess and identify team strengths and weaknesses to improve team alignment. A case study is also presented to apply the proposed framework to measure team alignment on a construction project, to improve team performance.

KEYWORDS

Lean construction, target value design, collaboration, and team alignment.

INTRODUCTION

The architectural engineering and construction (AEC) sectors require a cooperative effort that has become more multi-disciplinary, complex, and interconnected (Ashcraft, 2016). There are various challenges in setting up a virtual organization for building projects. The AEC industry's long history of individualism and hostility is the first obstacle. Instead of working in teams, people have worked together on projects in groups. Furthermore, due to the casual usage of the term "team" many individuals mistakenly assume they have participated in teamwork (Ashcraft, 2011). In order to transform groups into teams, there must be a substantial shift in how people collaborate and in how work and hierarchy are organized. In a software environment, it is said that "successful deployment of multifunctional teams involves a radical rethink of the whole firm" (Larman, 2008). The lack of collaboration between designers, subcontractors, and other specialized groups as well as the unpredictability of costs, timelines, and quality standards during the design phase reports that typically come after those from the construction phase are

[1] MSc graduate, Civil and Environmental Engineering Dept, University of Alberta, 116 St. and 85 Ave., Edmonton, AB, Canada T6G 2R3, nnajafiz@ualberta.ca, orcid.org/0009-0009-5835-1851

[2] Associate Professor, Hole School of Construction Engineering, University of Alberta, Edmonton, Canada, hamzeh@ualberta.ca, orcid.org/0000-0002-3986-9534

the causes of disappointments. The result is costly rework, change orders, and repricing, which is off-target for clients (De Melo et al., 2016).

Target value design (TVD), a lean approach technique for creating value in projects with favorable features, has also been acknowledged by Miron et al. (2015). The cornerstones of effective TVD implementation are team alignment (TA) and value alignment (VA) (Ashcraft, 2016). By leveraging the client's perceived value as a design engineer and attempting to minimize waste, or at least surpassing the client's expectations, TVD is also used to improve cooperation (Kim & Lee, 2010). When TVD is not used, poor team alignment (TA) creates several obstacles and problems that ultimately cause projects to fail (Griffith, 2001). According to the literature study, little to no research has been done on utilizing TVD to measure and evaluate TA.

Based on the ideas from TVD, this study aims to propose a framework to measure team alignment in construction projects. The measuring technique used to assess the framework through relationships and correlations between team alignment attributes and factors is a quantifiable variable that is influenced by these interactions. This study's industrial contributions include showing how to employ a team alignment measurement tool to assess team performance in AEC projects and offering analyses with a roadmap for identifying team weaknesses and improvement possibilities. Pearson's correlation coefficient test and the Fuzzy Inference System (FIS) are two approaches used in the experiment to simulate correlation and measurement. Participants completed the prepared survey, and data analysis techniques were then applied to the survey findings. Based on the findings, suggestions are made for improving team alignment.

PREVIOUS RESEARCH

Lean project delivery system is a form of integrated project delivery (Mossman et al., 2013). Lean construction or lean project delivery is the process of applying lean thinking to the conception and execution of capital projects, or the delivery of projects in general (de Melo et al., 2016). Lean projects are arbitrary production processes that offer products with the highest possible value and the least amount of waste. The main differences between standard and lean project delivery are the stages, interactions between phases, and participation in each phase (Ballard & Howell, 2003).

The goal of target value design (TVD), a Lean management practice and design methodology, is to provide customer value while adhering to a project's restrictions (Kaushik & Koskela, 2015; de Melo et al., 2016). TVD was developed based on the principles of target costing used in the manufacturing industry, but with modifications to its ideas, methods, and implementations. This approach is an upgraded version of target costing that emphasizes the creation of stakeholder value as a driver for design and construction. While target pricing concentrates on setting "cost" goals, target value design extends this concept to include targets for time, quality, and value, among other factors. Since its inception in 2002, TVD has gained popularity and acceptance among construction firms in the United States, according to Do et al. (2014). TVD successfully minimizes cost overruns and maintains predictable project costs, delivering projects for up to 20% less than market value without compromising quality or schedule; ensures early participation of key stakeholders; and promotes collaboration (Do et al., 2014).

Team alignment and value alignment are prerequisites of TVD. "Organizations develop alliances, often termed networks or constellations, to match their own goals with stakeholders' interests and to decrease environmental uncertainty," according to Barringer and Harrison (2000). The condition in which team members collaborate within acceptable bounds to create and realize consistently specified and accepted project values can be characterized as the alignment between appropriate project participants (Griffith, 2001). Even if groups operate

differently, they can still align if they share the same objective. The project's outcomes are directly impacted by the project team's alignment. These direct ties also looked into the possibility that alignment mediates the connections between the project's antecedents and outcomes (Griffith, 2001). According to Frey et al., 2006, three primary categories for partnerships categorized based on the level of alignment, which ranges from low to elevated are misaligned (networking and cooperation), poorly aligned (coordination and coalition), and aligned (collaboration and alignment).

The fragmentation of the company's specialized teams causes a lack of alignment between team members and project stakeholders, as noted by Ashcraft (2011). This misalignment can result in leaders wasting time pursuing productive ideas that are not the most important goals at the time, according to Kochhar (2013). Moreover, if the company's culture is unclear to operational employees, they may lose trust in its vision, objectives, and value proposition, which can impede their willingness to give their best to the project, leading to a negative impact on the company's culture and bottom line. In contrast, strategically linked firms are more effective and deliver better results because team members work together to achieve common goals and objectives (Ashcraft, 2011). When people are not strategically linked, they may become confused about their priorities, make fewer effective decisions, and engage in conflicts, which can lead to a lack of excitement and motivation to do their best work. Therefore, people want to be part of something meaningful.

The current study aims to evaluate team alignment and its impact on project success by examining several factors such as the level of commitment to the team and project value, morale among team members, ability to overcome challenges, and providing timely and creative knowledge and information. Table 1 presents the research studies focusing on implementing TVD, team alignment, and influential factors for promoting team alignment. However, none of them have proposed a method and framework to measure team alignment based on TVD.

Table 1: Implementing TVD to Evaluate Team Collaboration

Researcher	Research topic
Musa, 2019	A framework for implementing target value delivery to enhance value creation in the construction industry
Griffith, A. F, 2001	Team alignment during pre-project planning of capital facilities
Do et al., 2014	Alignment and misalignment of commercial incentives in IPD and TVD
Ismail et al., 2014	Developing a framework of metrics to assess collaboration in IPD
Che Ibrahim et al., 2013	Development of a conceptual team integration performance index for alliance projects

METHODOLOGY

Design science research (DSR) is the approach followed in this study. According to Hevner et al. (2007), DSR strives to learn about and comprehend a problem area by developing and deploying a designed artifact. The basis for adopting design science as a research method is the purpose of DSR, which has been stated as creating trustworthy information to be utilized in

designing solutions to problems and significantly advancing the practice and theory of the subject in which it is employed (De Melo, 2015).

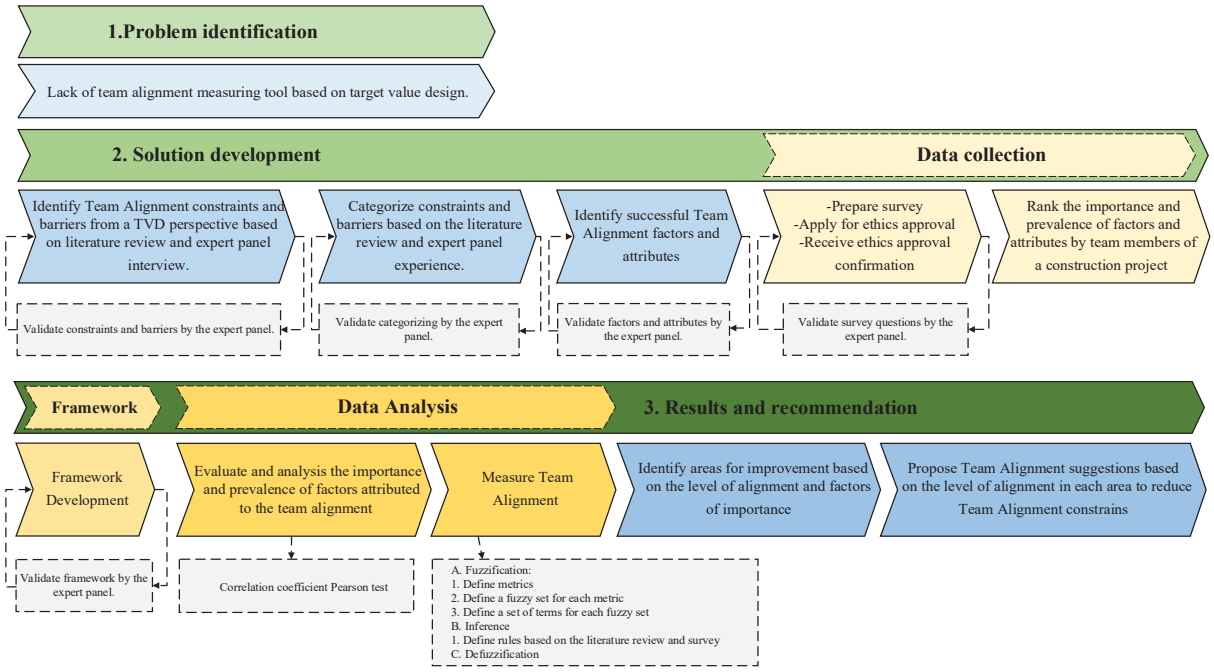

Figure 1: Research Methodology

The three major phases of this research are problem identification, solution development, results, and recommendation. Figure 1 illustrates the approach employed in the study.

Problem Identification

Project failures will result from any issues or deficiencies in the catching value during project phases. Consequently, delivering value will be aided by a regular review of the team's TVD performance. Understanding team alignment drivers and impediments can help project leaders improve and prepare for new challenges. According to the literature study, a team alignment tool built on the target value design principles is required. Leaders can discover the team's strengths and shortcomings by continuously analyzing and measuring team alignment.

Solution Development

The three stages of solution development are as follows. Starting with the TVD principles, it identifies team alignment limitations, impediments, factors, and attributes. The creation of a framework is the second step. Data gathering is the next stage of the solution creation process. The following sections provide explanations of the steps listed.

Team alignment challenges from a TVD perspective

The first step in bridging a gap is to thoroughly understand it from all angles. TA difficulties are known in the solution development phase based on the literature study and are confirmed by the expert panel. This research was developed based on the TA challenges in the literature review. The fishbone diagram (Figure 2) presents a root cause analysis and five main categories of challenges that hinder team alignment in TVD implementation. The major groups include personal characteristics, training, management, culture, and environment.

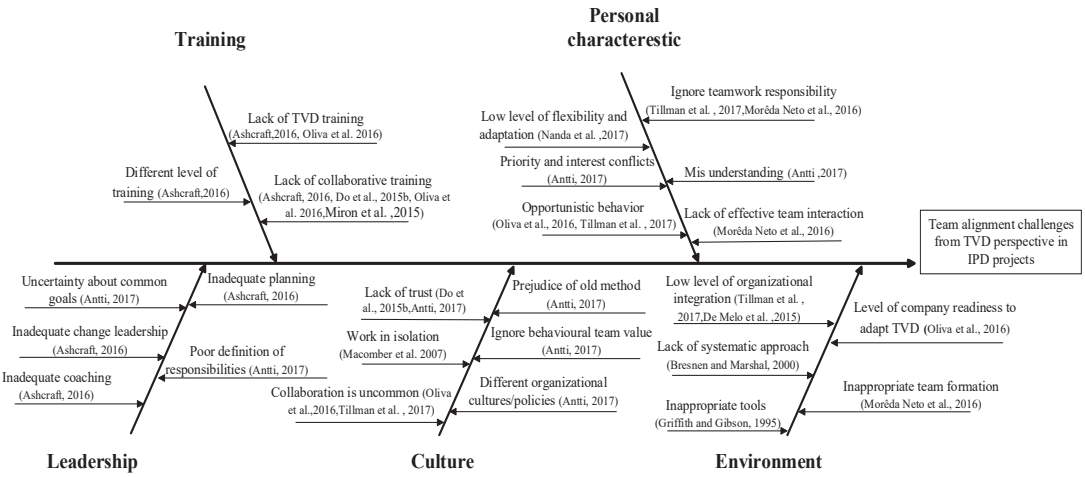

Figure 2: Team Alignment Challenges from TVD Perspective in Construction Projects

IDENTIFY SUCCESSFUL TEAM ALIGNMENT FACTORS AND ATTRIBUTES IN TVD

Being a qualitatively abstract concept, alignment means different things to different teams and projects. The attributes of an aligned team will be what distinguish it. Team leaders and members determine these traits based on the values of the team and the project. To meet the demands of the available cross-functional and multidisciplinary construction teams, these features are multifaceted in the building project. Based on the TVD principles from the literature, this research has compiled a list of factors and attributes for effective team alignment which 24 factors and 5 attributes were verified by the case study team lead. The values, knowledge, or circumstances that support team alignment are contained in factors. The most influential factors may be improved by construction team leaders by being aware of them, assessing them, and investing time and resources into improving them (Table 2).

Table 2: Research Successful Team Alignment Proposed Factors

No.	Factors descriptions	No.	Factors description
F1	Team members have good problem-solving and decision-making skills.	**F13**	Leaders assign tasks that fit team members' strengths and capabilities.
F2	Team members listen effectively and empathize with each other. They share constructive feedback transparently.	**F14**	The team members' strengths and weaknesses are regularly assessed by management.
F3	Team members trust each other to speak up-phycological safety.	**F15**	The project scope and value are clearly defined by team leaders and communicated visually.
F4	The team learns about each other's past professional project collaboration experience.	**F16**	Leaders and team members know and understand the risks and rewards of the project on which they are working.
F5	Team members are encouraged to work on the project.	**F17**	A collaborative culture exists among team members.
F6	The team focuses on the project's goals and objectives.	**F18**	Members respect the teams' diversity; accept and treat each other fairly and equally. Diversity, Equity, and Inclusion (DEI).
F7	Team members are knowledgeable and are constantly trained to work on IPD projects and use Lean techniques and TVD.	**F19**	Leaders and team members express and apply innovative ideas to projects.
F8	Team members benefit from training approaches and methods.	**F20**	Team members attend face-to-face meetings in the big room.
F9	Team members are trained in effective and frequent communication.	**F21**	Members come from different educational and professional backgrounds.
F10	Team leaders ensure that members have equal access to information, equipment, and technology.	**F22**	Leaders size their teams properly according to the project's workload, size, and nature.
F11	Lean mentors are available to guide and train team leaders.	**F23**	Leaders and team members are satisfied with their collaboration and hope to continue it.
F12	Team leaders collaborate with other cross-functional teams and provide cross-disciplinary expertise for successful communication.	**F24**	Key participants are involved early in the project.

Team alignment attributes are qualities or characteristics that are thought to be a component of the alignment (Table 3). Factors are the causes and conditions that enable team alignment, while attributes are the characteristics of an aligned team. Therefore, team alignment factors and attributes are distinct concepts.

Table 3: Successful Team Alignment Attributes

Attribute no.	Attribute description
AT1	Level of commitment to the team and project value
AT2	Level of morale among team members
AT3	Ability to overcome challenges
AT4	Provide the right knowledge and information at the right time
AT5	Level of creativity

DATA COLLECTION

The purpose of the survey is to assess the validity of team alignment factors and attributes as well as their importance and prevalence. Prevalence is the present degree of evaluation of factors and qualities in the team project, whereas importance indicates the priority of factors and attributes as well as the predicted value for the team. Prevalence might fluctuate often with each update or new evaluation, although importance can have a more or less constant value in this context. The Likert scale, a non-comparative, one-dimensional scaling method consisting of 5 points, was utilized in this study, with 1 representing the least prevalent or important factor and 5 representing the most prevalent and significant factor. The expert panel employed the Likert scale in this study's validation phase to rate various factors and attributes.

RESULTS AND RECOMMENDATIONS

The last phase is results and recommendations that start with the framework (Figure 3) development, continue with data analysis, and end with the team performance improvement proposal.

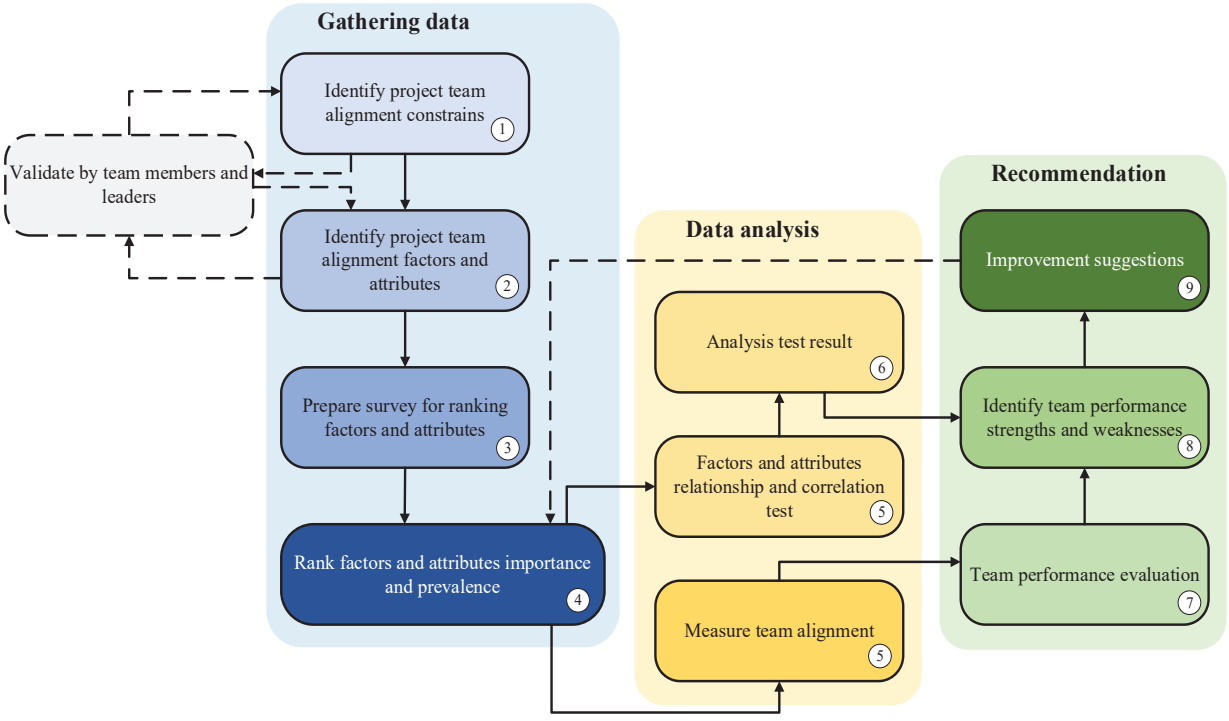

Figure 3: Team Alignment Measuring Framework

The method of developing the framework is innovative and is based on current scientific understanding and real-world experience with construction projects. The proposed framework consists of three phases which are gathering data, data analysis, and recommendation. The concept is built on the connection and correlation between team alignment, factors, and attributes (Figure 4). The Correlation coefficient Pearson's test is used to identify the correlations and coefficients between factors and attributes.

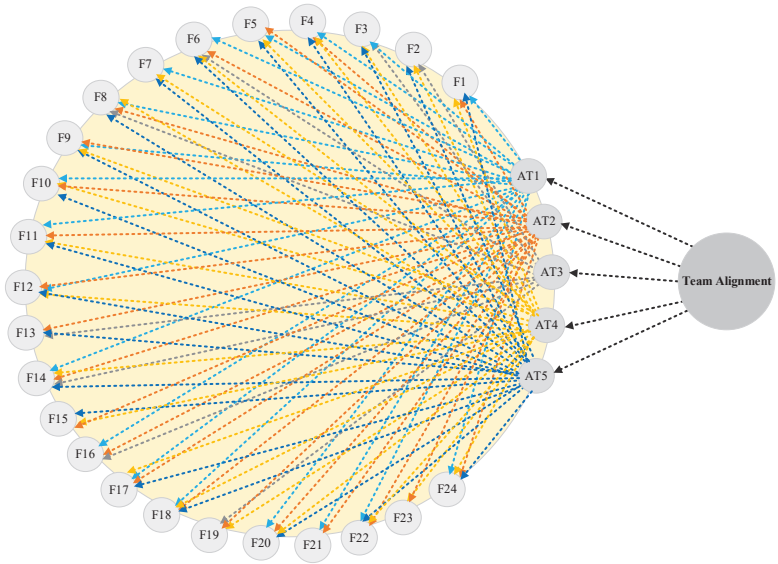

Figure 4: Research Assumptions

Team alignment is a qualitative quality that is subjective and cannot be quantified using quantitative techniques. To address this, our study models the interactions between factors and attributes using fuzzy inference systems (FIS). As mentioned in the data collection section, we ranked the team alignment attributes prevalence in the team project, and the ranking results were used in the FIS to convert a qualitative ranking to a quantitative measure. After measuring each attribute in the FIS, we identified the related factors based on the Pearson correlation coefficient test results. The comparison between attribute prevalence and importance measures helps team leaders identify critical attributes that need improvement. The value of attribute importance represents attribute vitality, and the gap between attribute importance and prevalence indicates the attribute's critical situation. Reaching the level of attribute importance should be the team's feature goal. The correlation test results identify the factors related to these critical attributes for improvement so that team members can focus on them. The recommendation section will provide guidelines based on the effective factors related to critical attributes.

RESULTS AND DISCUSSION

This research offers a method for assessing team performance and keeping track of team alignment on construction projects. This framework attempts to monitor team members' advancement and performance in accordance with the team, project, and corporate values. The method may be used for construction projects, and depending on the project value, influential elements, and aligned team qualities can be identified for each project. It will help team leaders pinpoint the group's strengths and weaknesses and establish monthly and yearly objectives to boost output. A case study of an IPD project at a construction business is used in this study to evaluate the framework.

The survey questions were created, validated with the project manager for the case study, and approved by the University of Alberta's ethics committee before being sent to the project

team. The case study is a New Mechanical Wastewater Treatment Plant that is located in Lloydminster, Alberta, Canada. The research required data collected from case study project team members. Out of the 20 members of the project team, 18 participated in the survey to rate the prevalence and relevance of various elements and traits using a Likert scale.

According to FIS's analysis of the attribute's prevalence rating, the case study's team alignment measurement will be 81.2 percent. Although the team is cohesive, there is still potential for development. When team members set the target value too low, they will not be able to increase team performance and will not benefit from this framework. This number fluctuates from project to project depending on the relevance of the characteristic that team members specify by their rating. Team members likely require additional training on lean principles, target value delivery, and team alignment if they give the team alignment traits a low-priority ranking.

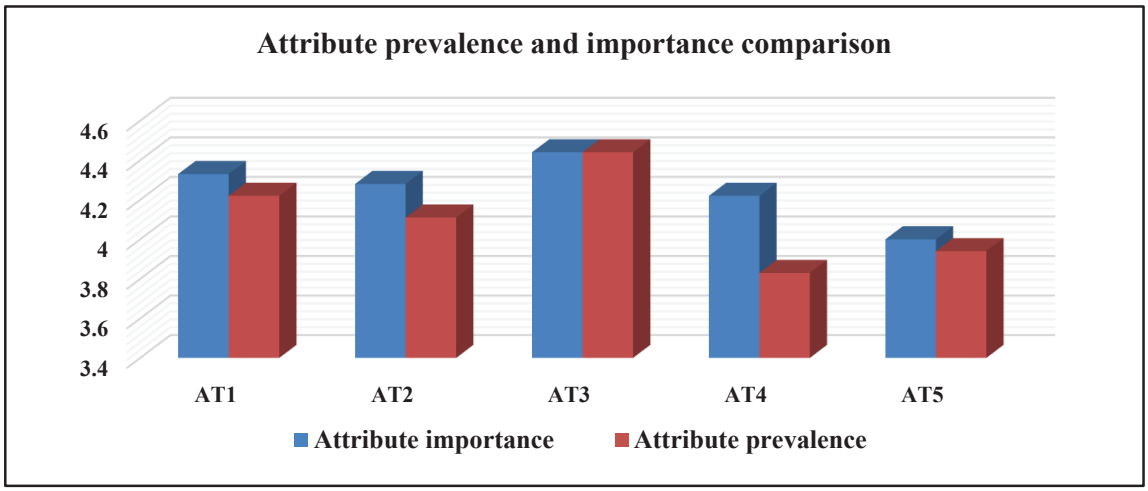

Figure 5: Factors Correlate Values Based on Attributes for Survey Result

Figure 5 compares the mean importance and prevalence of the qualities. Except for attribute four (providing the appropriate knowledge and information at the appropriate time), the mean difference between the importance and prevalence of each attribute is less than 0.2. A larger disparity between importance and prevalence indicates a critical situation for the attribute.

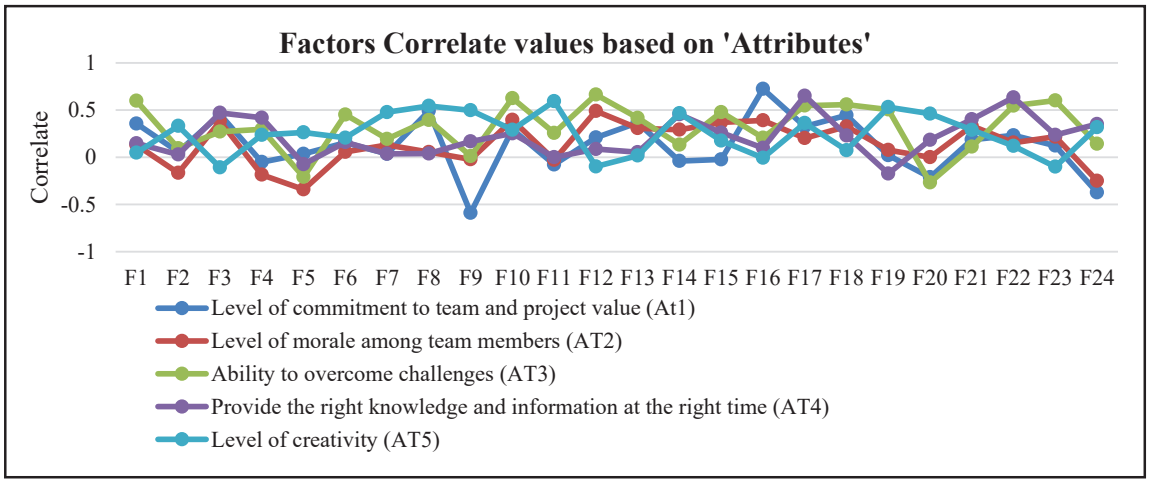

Figure 6: Factors Correlate Values Based on Attributes for Survey Result

Figure 6 presents the results of Pearson's test, which shows the correlations between factors and attributes based on their mean prevalence values. This helps to identify the factors that have

a negative impact on team alignment. Positive factors are those that can enhance an attribute by improving the related factors. If the negative factors are improved, there can be a considerable change in the attribute. For example, in attribute four, which is the most critical attribute, the influential factors are F19 and F5. In attribute two, the most influential factors are F5 and F24. In other words, improving these four factors will significantly affect the level of team alignment.

This research presents a method for assessing team performance and maintaining team alignment throughout construction projects, based on the team, project, and corporate values. The framework allows for monitoring team members' progress and performance in relation to these values, identifying influential factors and aligned team traits for each project depending on its value. This will help team leaders identify strengths and weaknesses and set monthly and yearly objectives to improve output. The framework is evaluated through a case study of an IPD project at a construction business.

To create a quantitative approach for a qualitative characteristic, the developed instrument and methodology may benefit both academics and industry, especially in assessing team performance using the TVD. The main contributions of this study are:

Emphasizing the importance of team alignment for the successful use of TVD and establishing a correlation between factors, attributes, and the degree of team alignment.

Providing a system for assessing team performance, establishing a framework for evaluating multiple correlation types, and creating a connection map to assess the degree of team alignment.

The results of Pearson’s test show that the degree of correlation between factors and attributes is important to the value of team alignment, and the connection is dynamic, and changes based on the expert panel's rating.

Outlining how a team alignment tool can be used to assess a team’s performance in the AEC industry or any other team-based context, such as in the medical and commercial industries.

Addressing team alignment issues in construction projects can result in project failure due to collaboration restrictions and impediments at every stage of the building process.

CONCLUSION

This paper aims to address the challenges of team alignment in construction projects, which are often plagued by teamwork constraints and barriers that can lead to project failures. By drawing lessons from these constraints, team leaders can establish appropriate factors and attributes to monitor and evaluate team performance using the proposed methodology and framework. The case study presented in this paper demonstrates how project leaders can identify and improve team weaknesses and leverage team strengths to improve project productivity. In team-based industries, the team alignment framework can be used to evaluate team performance, outcomes, and risks, as well as to identify process improvements. To enhance the efficiency of this framework, future research should explore ways to automate it and develop a simulation tool.

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