# Examining Technology Orientation Constructs: A Validation Study

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**Abstract**

***This study validates technology orientation (TO) constructs in the Malaysian construction industry context. Using a well-structured online-administered questionnaire, the data was collected from one hundred and eighty-five representatives of Grade 7 (G7) construction firms comprises of top or middle management level who are involved in the day-to-day running of the firm as well as taking strategic decisions about how the firms are been run like CEO, Executive Director, Managing Director, Construction Managers, and Project Managers). The data was analyzed using Smart-PLS 3 software. Results of this analysis revealed that all the technology orientation's dimensions namely, technology capability, top management capability, learning (commitment to learning), and unlearning (commitment to change) were highly applicable. Acceptable level of internal consistency, reliability, discriminant validity, and convergent validity for each of the constructs of the technology orientation was established. Based on the outcome of the analysis, it is therefore recommended that the TO instrument are suitable for measuring all the constructs of TO to study how Malaysian construction firms can combine their capabilities to build the assets of the organization and allow them to be utilized in a well-organized and efficient way.***

**Keywords:** Technology Orientation; Technology Capability; Top management Capability; Unlearning and Learning.

## Introduction

As a consequence of technological development and the shortening lifespan of products and services, businesses have been compelled to boost their technical capability to compete in their

industries [43], [19]. Technology orientation is described "as one where firms have an R&D focus and emphasize on acquiring and incorporating new technologies in product development" [6]. It can also be described as the ingenuousness of a firm to new ideas and its preference to embrace technological innovation during the buildout of products [6]. The technological orientation which is frequently referred to as innovation orientation is present when firms execute new concepts, products, and practices. This is done by managing the firm's framework, system, and resources with technology and using these technical resources as a competitive advantage [30], [7].

Moreover, technology orientation in terms of technical capabilities, R&D resources, and technical base is believed to be crucial for developing new, better-conceived products into the market. The technology-oriented firms are thus bringing the initiative in developing novel technologies as well as utilizing the up-to-date technologies to enhance their products/services [6], [9]. Novelty has a positive influence on the enduring success of the firm as it affects suppleness, unlearning, and launch of a new product while reducing organizational unwillingness [44]. Hence, technology-oriented firms devote their strength to advancing and improving better products rather than exploring clients' needs [34]. This is because the client's worth and the enduring accomplishment of the organization can be conceived through inventions, technical solutions, products, services, or production procedures [34], thereby making technological orientation an important part of tactical orientation.

The construction industry in Malaysia has undergone accelerated evolution, propelled by technology and innovation. Several factors are considered in the industry - ways to construct faster and better while improving cost efficiency and sustainability [17]. CIDB's proactive measures resulted in identifying and promoting proven systems - Industrialized Building System (IBS) and Building Information Modelling (BIM) [17]. Hence, keeping in view the main importance of the phenomenon, this study explores the technology orientation of the Malaysian construction industry's top and middle management level considering their massive stride in technology advancement [8], [10]. Therefore, in this study, TO is conceptualized as technological capability, top management capability, learning, and unlearning following Seçkin-Halaç [34].

## Literature Review

### *Dimensions and Operationalization of Technology Orientation (TO)*

TO is a "culture-based, firm-specific and consisting of complex capabilities*"* built on a resource-based view of the organization [34] in which a "firm-level culture-based" tactical orientation which is comprised of difficult to reproduce and substitute, rare, and treasured competencies which lead to rivalrous and greater accomplishment as anticipated from a tactical orientation [27], [11]. To remain competitive and produce returns that are above average, a firm requires a broad array of capabilities [18]. Nevertheless, setting priority and the appropriate blend of resources that are

similar to tactical direction can offer a sustainable competitive advantage. Consequently, a blend of skills and capabilities is considered as components of a TO. This way, technological capability, top management capability, commitment to learning (learning), and commitment to change (unlearning) are conceptualized as the dimensions of TO following Seçkin-Halaç [34].

**Top Management Capability**

These skills and capabilities are undeniably interrelated with one another. A technology-oriented organization is required to be consistent with the vision and mission of the organization. Hence, top management in line with the strategic direction should resolve on whether to come up with their technology within the organization or developed from the outside the organization; to what level to spend on R&D; to strive or to collaborate with the competitors; which other means is the most suitable now and in future for the firm [26]. Additionally, guaranteeing the operations of the firm are carried out with the latest technologies and decisive on R&D financing and guidelines, bearing in mind the likely future anticipations are also management's responsibilities [13], [12], [5].

*Technological Capability*

Reichert, et al. [33] described technological capability "as a set of functional abilities, reflected in the firm's performance through various technological activities and whose ultimate purpose is firm-level value management by developing difficult-to-copy organizational abilities." Technological competencies or resources are in the epicentre of competitive advantage since the combinations of certain technological resources tend to be difficult to replicate and rare positions [34], [41]. The depth of technological capabilities hinges on how efficient the combinations of the resource capacity have been packaged.

*Commitment to Learning (Learning)*

Commitment to learning or otherwise known as learning is the apparatus that turns resources or competencies into "*valuable, rare, inimitable, and non-substitutable"* competencies or capabilities through skills and replication [32], [34]. Coming up with a strategic direction will not lead to superior accomplishment as an alternative to a belief and value system which is needed to be entrenched all over the firm [32], [2]. They opined that diffusion and acknowledgement of such value and a robust belief system may have been the result of an efficient mechanism that is organizational learning.

*Commitment to Change (Unlearning)*

Commitment to change which is also referred to as unlearning is a vital procedure that enables new knowledge which is deliberately getting rid of something that is well entrenched in a firms' memory, beliefs, and practices [21]. Unlearning is getting rid of old practices and techniques when needed, to give way for new things just in case there is any [21]. About Reichert, et al. 's [33] definition of capabilities, TO may be viewed as a multifaceted blend of competencies that are combined with learning and unlearning to assemble all organization resources and allow them to be organized efficiently and effectively.

Therefore, way from the present literature, this study, following Seçkin-Halaç [34], conceptualized TO as technological capability, top management capability, commitment to learning (learning), and commitment to change (unlearning).

## Methodology

This study was designed to target the top and middle management levels of Malaysian G7 construction firms as respondents. According to the information gathered from the website of the Construction Industry Development Board (CIDB), a total of 7,358 G7 construction firms were available as of January 2020. Regarding the sample size, Iacobucci [29] strongly recommended as "bigger is always better". It is generally accepted that a larger sample size enhances the power and reduces the estimation error [39]. In this context, GPower 3.1 was deployed to acquire a better sample size [22]. From the outcome of GPower statistics, a suitable sample size of 146 was measured having power (1-b err prob. = 0.999). Following the recommendation of Waris et al. [42] and Bamgbade et al. [8], that construction firms in Malaysia are known with a low rate of response and to manage this particular trend and also reduce sampling error, recommendations of Hair, that the sample size is doubled or tripled, is followed. Thus, a sample size of 438 is adhered to which is also in line with Sekaran & Bougie [35], that the ideal sample should be between 30 and 500. In light of the above-mentioned discussion, this study managed to get a response from 185 respondent, meanwhile, the survey was administered online because of the current pandemic ravaging the whole world.

While taking care of important elements of "homogeneity of the sample, variables used in the study and statistical tools to be deployed for the data analysis [35], [16], this study opted proportionate cluster random sampling. Bearing in mind the total numbers of eligible respondents in every cluster, i.e. each of the state of Peninsular Malaysia, the sample was randomly chosen. Using a well-structured online administered questionnaire, the data was duly collected from one hundred and eighty-five representatives of construction firms ranging from top to middle management staff. To validate the TO in the Malaysian construction industry's context, this study deployed PLS path modelling to investigate the data by using Smart-PLS 3.0 [25] which is a well-

known second-generation structural equation modelling technique appropriate and useful in analyzing real-time applications and complex models [28], [20].

## Analysis & Results

*Demographic profile*

The demographic characteristics observed in this study comprise positions in the company, years of experience, and gender. The study found that 14.6% (27), 18.9% (35), 21.1% (39), 13.5% (25), 21.1% (39), and 10.8% (20) of the 185 respondents were Chief Executive Officer, Executive Officers, Managing Directors, Construction Managers, Project Managers, and others, respectively. Similarly, as for the working experience, where the highest percentage (47.0%) recorded was those whose experience was between 1 to 5 years, followed closely by respondents with experience of over 10 years (28.6%), and 6-10 years (24.3%) in that sequence. Also, male respondents constituted 68.1% (126) and females 31.9% of the sample size, as shown in table 1.

**Table 1.** Demographic Characteristics of Respondents and Firms

| **Respondents** | **Frequency** | **%** |
|---|---|---|
| **Position in the company** | | |
| Chief Executive Officer | 27 | 14.6 |
| Executive Director | 35 | 18.9 |
| Managing Director | 39 | 21.1 |
| Construction Manager | 25 | 13.5 |
| Project Manager | 39 | 21.1 |
| Others | **20** | **10.8** |
| **Gender** | | |
| Male | 126 | 68.1 |
| Female | 59 | 31.9 |
| **Work experience** | | |
| 1 to 5 years | 87 | 47.0 |
| 6 to 10 years | 45 | 24.3 |
| Over 10 years | 53 | 28.6 |
| | | |
| **Parameters** | **Frequency** | **%** |
| **Company Age** | | |
| 1 to 5 years | 39 | 21.1 |
| 6 to 10 years | 29 | 15.7 |
| Over 10 years | 117 | 63.2 |
| **Location of Operation** | | |
| Local market | 41 | 22.2 |
| Within a few states | 46 | 24.9 |
| Regional | 19 | 10.3 |
| Across entire Malaysia | 71 | 38.4 |
| International market | 8 | 4.3 |
| **Company Ownership** | | |
| Local | 156 | 84.3 |
| Foreign-invested enterprise | 29 | 15.7 |

| | | |
|---|---|---|
| Joint Venture | - | - |
| **Workforce** | | |
| <100 | 126 | 68.1 |
| 101-250 | 17 | 9.2 |
| 251-500 | 9 | 4.9 |
| >500 | 31 | 16.8 |
| **Specialization** | | |
| Residential apartment | 83 | 44.9 |
| Non-residential apartment | 75 | 40.5 |
| Social amenities | 31 | 16.8 |
| Infrastructure | 83 | 44.9 |
| Others | 25 | 13.5 |

Furthermore, the firms' studied specializations were in residential buildings, nonresidential buildings, social amenities, infrastructure, and others with 44.9%, 40.5%, 16.8%, 44.9%, and 13.3% respectively.

The company ownership type is majorly local and foreign-invested enterprise with 84.3.0%, and 15.7% respectively while the location of the business was local market areas, within a few states, regional, across Malaysia, and international markets with 22.2%, 24.9%, 10.3%, 38.4%, and 4.3% respectively while the company's employees strength range from <100 (68.1%), 101 – 250 (9.2%), 251 – 500 (4.9%) and > 500 (16.8%) within the sample framework.

*Measurement Model*

In respect of the objectives and analysis mood, which is to validate TO constructs, this study utilizes the measurement model approach (Figure 1). It validates items' internal consistency, reliability, convergent validity, and discriminant validity by looking at three values: outer loading, average variance extracted (AVE), and the composite reliability (CR) [25]. They suggest that the value of AVE and outer loadings should be greater than 0.5 and 0.708 respectively for each of the constructs. Likewise, CR, according to them should be above 0.7. Although, it is recommended that items' loading between 0.5 and 0.7 should be kept if AVE and CR meet their necessary thresholds level and keeping them does not significantly hinder model integrity. Nevertheless, form Figure 1 below, all measurement items loaded higher than the recommended minimum threshold of 0.708 [25], [37], which shows that all individual items' measurement adds considerable significance to their studied constructs and sufficiently met the acceptable criterion set for individual item reliability [1], [15].

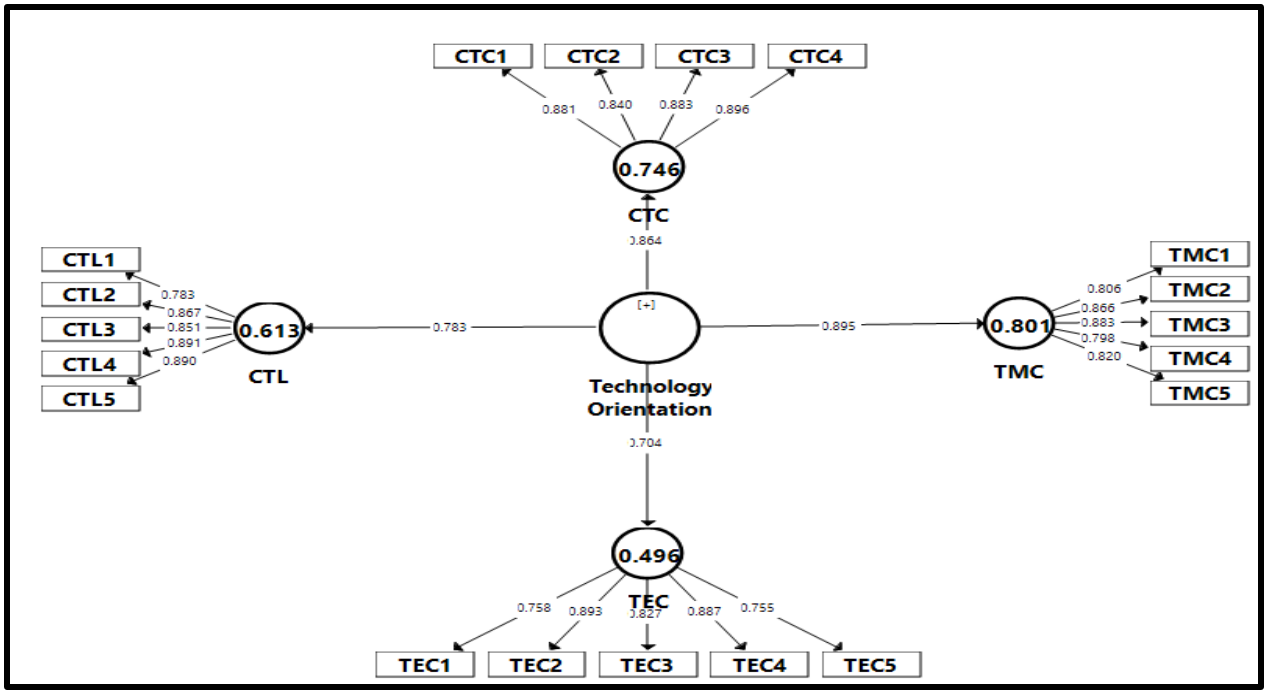


**Figure 1.** Measurement Model

**Table 2.** Results of the confirmatory factor analysis for Technology orientation

| Construct Dimension | Items | TEC | TMC | CTL | CTC |
|---|---|---|---|---|---|
| **Technology Capability** | TEC1 | 0.758 | | | |
| | TEC2 | 0.893 | | | |
| | TEC3 | 0.827 | | | |
| | TEC4 | 0.887 | | | |
| | TEC5 | 0.755 | | | |
| **Top Management Capability** | TMC1 | | 0.806 | | |
| | TMC2 | | 0.866 | | |
| | TMC3 | | 0.883 | | |
| | TMC4 | | 0.798 | | |
| | TMC5 | | 0.820 | | |
| **Commitment to Learning (Learning)** | CTL1 | | | 0.783 | |
| | CTL2 | | | 0.867 | |
| | CTL3 | | | 0.851 | |
| | CTL4 | | | 0.891 | |
| | CTL5 | | | 0.890 | |
| **Commitment to Change (Unlearning)** | CTC1 | | | | 0.881 |
| | CTC2 | | | | 0.840 |
| | CTC3 | | | | 0.883 |
| | CTC4 | | | | 0.896 |
| **Average Variance Extracted (AVE)** | | 0.682 | 0.698 | 0.735 | 0.766 |
| **Composite Reliability (CR)** | | 0.914 | 0.920 | 0.933 | 0.929 |

*Internal Consistency of Reliability*

Internal consistency of reliability is the degree to which all elements of a given scale measure a concept [31]. Cronbach's alpha and CR coefficient are frequently used index in organizational research in assessing the internal consistency of reliability of a scale, particularly those containing multiple items [31]. Following the recommendations of Hair, Ringle & Sarstedt [24], this study utilized a composite reliability coefficient for the assessment of internal consistency reliability of TO. In this study, composite reliability (CR) as provided in Table 2 ranged from 0.914 to 0.933 for all the constructs which exceeded the minimum requirement of 0.7 [25], thereby validating the constructs' internal consistency and reliability [38].

*Convergent Validity*

Convergent validity according to Hair et al [23] and Adeleke et al. [3], describes the degree to which indicators of the latent construct correlate with each other and perfectly embody the construct they are meant for. To determine this, and in line with Hair et al. [24]'s suggestion, the loadings factor, CR and AVE are taken into consideration in the evaluation of convergence validity. The AVE loadings for each of the latent constructs according to Chin [14], should not be below 0.5. Table 2 above shows that the AVE obtained for all the constructs were found to be greater than the standard requirement. This is another hint that convergent validity for this study has been proven for all the constructs.

*Discriminant Validity (DV)*

According to Vinzi [40], DV is the degree by which a latent construct differs from others in a model. To examine this, the Heterotrait-Monotrait Ratio (HTMT) which was recommended by Henseler et al. [40] as an alternative to Fornell and Larcker's method was been applied. The HTMT is advocated to be a superior boundary measure for assessing discriminant validity. As an evaluation for factor correlation, the HTMT should be considerably smaller than 1 (ideally<0.850) to distinguish between two factors [25], [4]. From Table 3 below, the results show a range between 0.342 and 0.792 which drop beneath the threshold level of 0.90, thus implying all constructs are independent of each other and that the benchmark for discriminant validity are been met.

**Table 3.** Discriminant Validity (HTMT)

| Latent Variable | CTC | CTL | TEC | TMC |
|---|---|---|---|---|
| **CTC** | | | | |
| **CTL** | **0.643** | | | |
| **TEC** | **0.560** | **0.342** | | |
| **TMC** | **0.792** | **0.670** | **0.609** | |

## Discussion and Conclusion

This study validated TO constructs in the Malaysian construction industry's context. Generally, this study's results showed that all the constructs have met the requirement and demonstrated that the technology orientation constructs are suitable in measuring TO in the Malaysian construction industry by their parameter assessments. The findings also revealed that all the measuring items are both reliable and good measures in describing their respective constructs. This was demonstrated by the high items' loadings, CR, and AVE for all the constructs which indicated the appropriateness of TO dimension i.e. technology capability, top management capability, learning, and unlearning.

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