# Using text analytics to discover organizational congruences: A study of the Thai IT industry

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## ABSTRACT

Organizational congruence is a leading indicator for organizational adaptation and increasing relevant in technological disruptive environments. However, the congruence perspective is often investigated through another lens. Information technology (IT) literature is less familiar with this perspective. This study aims to raise awareness of the perspective among IT literature by strictly investigating constructs under the perspective. It postulated an investigation akin to a measure development under the congruence perspective. Data was collected from Thai IT industry and a combination of computer-aided text analysis and traditional measure development were implemented. The data was preprocessed to ensure high quality and entered to measure modeling techniques. The results unveil four organizational congruence constructs. Three are first-level constructs: strategy consensus, operational congruence, and competitive congruence. One is second-level construct: organizational ambidexterity. Implications of this discovery are discussed. Limitations and future directions are recognized in the last section.

*Keywords*:  Congruence perspective, computer-aided text analysis (CATA), strategic consensus, ambidexterity.

## INTRODUCTION

Congruence perspective for organization theorizes that organizational performance is the result of close interrelationships among structural and environmental variables (Randolph & Dess, 1984). The closer the relationships align, the higher the performance becomes. This perspective is often demonstrated by contingency studies. Variables are modeled to "fit" according to their theoretical relationships. This "fitting" is used to justify as the demonstration of congruence. As a result, congruence and contingency are often interchangeably used (Sarta et al., 2021). However, Fry & Smith (1987) point out that both are different concepts, and they should be recognized as such. Congruence concerns the nature of co-occurrence of variables within a defined system. Contingency concerns a particular configuration of the variables at certain state of the system. "Congruence is a necessary but not sufficient condition for contingency" (Fry & Smith, 1987, p. 123). A group of variables may always occur together in a defined system, but their configuration depends on a state of the system. Information technology (IT) literature at organizational level is mostly familiar with contingency perspective. IT adoption in organization studies theorize match between the artifact adoption and particular organizational features (e.g., Zapadka et al., 2022). IT alignment studies posit fit between IT related strategic choice and set of organizational characteristics (e.g., Feng et al., 2021). IT implementation studies focus on close alignment between the implementation and organizational process variables (e.g., Yang et al., 2019). These studies are all based on the contingency perspective.

The current study aims to raise awareness of the congruence perspective among IT literature. It plans to discover organizational congruence emerged from co-occurrence and intercorrelate of variables without contingency theorization. The emergence of the congruence is independent of organization states. This discovery of organizational congruence advances congruence perspective in IT literature in many ways. First, the organizational congruence can be used in organizational adaptation studies. The adaptation is centered on minimization of incongruence (Sarta et al., 2021). IT organizations operate in highly volatile environment. They need constant adjustments to stay relevant. Therefore, congruence can be examined and understood its effects on the adaptation. As a result, IT organization can appropriately adjust its structure and resources according to the effects. Second, the congruence captures multidimension and recognizes multi-constraints at organizational level (Larsen et al., 2013). IT alignment studies through the lens of contingency may limit their implications because of the transitory nature of business states. Congruence perspective offers a less restricted view of the alignment. Therefore, its implications are arguably more generalizable. Last, IT organization must innovate to stay competitive. Contingency-based IT innovation studies largely postulate exploration and exploitation activities in terms of resource competition. However, exploration and exploitation are not mutually exclusive. IT organization can and should simultaneously exercise them (Hevner & Gregor, 2022). Congruence perspective can potentially offer more parsimonious solutions to IT innovation studies.

To accomplish its aim, this study conceptualizes the discovery of organizational congruence as a measure development. It, therefore, follows general steps for measure development and layouts each section according to the steps. Immediate next section is theoretical background with the focus to give theoretical underpinning the congruence and its measure. The following section layout details of data collection, preparation, and congruence indicator calculations. Then, the indicators are used in exploratory factor analysis and confirmatory factor analysis. This section discusses the emergence of the congruence constructs from the analyses. This study ends with the discussion, limitation, and future direction.

## THEORY DEVELOPMENT

**Organizational congruence**

Organizational congruence is pattern of co-interrelationship among organizational variables (Sarta et al., 2021). It can be classified into internal and external. Internal congruence is the pattern among variables under organization management (Farjoun & Fiss, 2022). The internal congruence is also known as internal consensus, internal fit, and internal alignment. Internal management pays close attention to this type of congruence. Activities under human resource management should be designed to achieve high congruence to benefit the organization (Delery & Gupta, 2016). These activities included recruitment, enrolment, and retention. Individual activity did not significantly lead to organizational performance by itself. However, they holistically helped improve the performance. Huesch (2013) found that resources and their deployment capabilities could individually affect the organizational performance in a highly specialized industry. This finding highlights the congruence perspective that the present of variables were more important that the states among variables. Benlian (2013) showed that perceptual congruence between internal IT service professionals and organization IT users was key to service's satisfaction. This result makes IT managers aware of the importance of service dimensions beyond the implementation of IT functional requirements.

External congruence happens among within and beyond organizational managed variables. External fit is also recognized as environmental fit, and external alignment. This type of congruence is vital to organization survival. Candi and Beltagui (2019) unveiled that the congruence between the adoption of high-technology equipment and external condition could result in higher innovation performance. Possessing the equipment and having implementation capabilities were important to the organization performance by themselves but to be successful among peers takes more than the equipment and implementation. Organization must take external condition into consideration. Yu et al. (2018) revealed that organizational capabilities should be co-evolution with the organizational environment. Sophisticated capabilities are less relevant when the environment is not complex. On the other hand, sophisticated capabilities are meaningful for organizational performance in complex environments. Therefore, organization do not have to over invest in its capabilities. Yamakawaa et al. (2011) presented evidence that co-alignment between organizational strategy and interorganizational relationships placed the organizational into a better performance category. Prior interorganizational studies mostly recognize the relationships as transactional fit. However, the interorganizational relationships were akin to organizational environment. Therefore, a holistic approach to the matter was more appropriated (Yamakawaa et al., 2011).

Both types of the congruence are essential to organizational adaptations. External congruence can be used as the metric for business model evolution (Climent & Haftor, 2021) and an appropriate amount of internal congruence help firm's ability to mobilize changes (Khanagha et al., 2018). Furthermore, the two types of congruence do not contradict each other (Miller, 1992; Climent & Haftor, 2021) This study finds no theoretical reason to limit itself to a particular type of congruence. Therefore, it pursues the discovery of both types of organizational congruence.

**Discovering congruence**

To discover congruence is to measure its manifestation. This study takes the stock from concept of "fit" as the beginning. Venkatraman (1989) proposed six types of fits. The types were classified using two axes. One axis was anchoring, and another was form-specificity. The first axis expressed degree of criterion dependence ranged from highly dependent to independent. The second axis spanned the degree of specificity among the variables from high to low. The most restricted type was "fit as moderation" and the most relaxed type was "fit as gestalts". The research suggested that number of variables under investigation tend to increase from the most restricted type to the most relaxed type. Zigurs & Buckland (1998) brought the six types of fit to the IT literature. They suggested that organizational congruence is "fit as gestalts" because this type of fit simultaneously takes multiple variables into account without specific criterion and across multiple organizational configurations. Lin (2014) demonstrated congruence through series of regression models. The researcher measured multiple stages of organizations and configurations. Multiple interaction terms were used to cover a variety of fits across 8 models. The fittings across multiple stages and configurations well expressed the concept of congruence. A recent study by Chatterjee et al. (2021) explored organizational congruence related to IT in terms of fit as covariation. The researchers argued that this type of fit is appropriate because all interested variables are observable within the organizations. They also proposed second-order congruence-based construct, which was emerged from the first-order constructs relationships. Confirmatory factor analysis evidenced congruences at both levels.

This study continues the line established by Chatterjee et al. (2021). Its interest is in discovering organizational congruence from co-interrelationships among targeted organizational observable variables. As a result, the congruence in this study is conceptualized as "fit as covariation". This study adopts computer-aided text analysis (CATA) in helping with the variable formulation. Chatterjee et al. (2021) gathered data from survey. It is argued that gathering survey data is more time and resource intensive than using CATA. The use of CATA in theoretical construct development is not recent. Short et al. (2010) revealed, at the time, that CATA has been used in the development for more than 25 years across areas in organizational study. CATA is superior to traditional survey-based measures that it is not suffered from subject participation rate and subject reliability. This superiority reduces random response error and transient error (McKenny et al., 2018). CATA work with data at its source and is ability to process high degree of sources (Short et al., 2010). However, CATA has its weakness in automated content selection. This study attempts to mitigate this weakness by getting humans to involve in the content selection. Therefore, the selection process is not entirely automated but semi-automated with human guidance.

**Dimensions**

This study chose to explore five organizational dimensions: organizational mission, organizational operation, competition, product and service, and organizational risk. The close interrelationships among these dimensions were used to formulate organizational congruence. These dimensions are selected to capture the three primary structural linkages of congruence perspective proposed by Randolph and Dess (1984). They are technology-structure, environment-structure, and environment-technology. Since this proposal, these linkages have been expanded and popularized in the congruence for organization literature.

The first dimension is the organizational mission. It sets strategic course for the organization. The mission gives reasons for an organization to exist in its competitive market. Management team carries out strategic planning to fulfill the mission statement. Organizational strategy resulted from the planning encapsulates all the primary structural linkages (Lin, 2014). An empirical investigation of high-technology organizations by Berbegal-Mirabent et al. (2020) revealed insights into the importance of mission statement for the organizational performance. The statement acted as the guide for strategic decision making. However, the guidance was not generally made obvious because it did not directly and specifically apply to a certain part of the organization. On the contrary, the positive effects on performance were created from holistic applications of the guidance throughout the organization. Everyone in every part of the organization was required to make aware and to appreciate the mission statement. This holistic view is akin to congruence.

The second dimension is organizational operation. This dimension is the engine of organization and touches the whole organization. Efficiency and effectiveness are the core focus of the dimension. This focus leads to organization's superior performance. Congruence between organizational operation and various organizational characteristics is behind the performance (David et al., 2002). The congruence does not naturally occur in the operation. Organization must be purposefully designed to accommodate the congruence. The result is the efficiency and effectiveness of the operation. Furthermore, congruence between organizational operation and environment was the fundamental for organizational dynamic capabilities in technology-oriented organization (Wheeler, 2002). Congruence perspective helps managers to see an integrated view of internal processes and external environment. This holistic view enables organization to stay adaptive in changing environment.

Competition is the third dimension. It interfaces an organization with its environment. Two basic tenants of competition are competitors and competitive market. The competitor is realized and clarified in the five-force framework (Porter, 1979). Competitors may involve an organization as current rivals or as market entrants. Either way could mean product alternatives, competitive barriers, or changes in organization's value chain. The result is an altered environment, which requires the organization to adapt. Competitive market drives strategic direction and decision makings. Based on congruence perspective, Roberts & Grover (2012) identify that IT oriented organizations are particularly vulnerable to the changes in competitive market. The changes signal shift in customer preference or emergence of new opportunity. Innovations are often needed to address the changes. Furthermore, competition involves an organization beyond the two tenants. Competitive activities define the industry where the organization belongs to. Traditional identity establishment by activities in certain industry becomes less than concrete. Industry boundary becomes less obvious. Especially, identity arose from interorganizational relationships may create appearance of multiple industries (Castañer & Oliveira, 2020). Congruence perspective offers a comprehensive view of competition.

The fourth dimension is products and services. This dimension connects not only to the organization but also to the environment. The congruence between product strategy and organizational characteristics is prerequisite to the performance (David et al., 2002). The researchers further revealed that effectiveness of the strategy depends on the organizational orientation to its environment. Products and services are also associated with technological innovation. Modern organization must actively strengthen both exploration and exploitation activities (Maclean et al., 2021). The exploration is for products and services innovations. The exploitation helps with technological solutions in production of products and services. These interrelationships with products and services characterize the congruence perspective.

Risk is the last dimension. Risks can be classified into internal and external. Both types can be managed to mitigate unfavorable consequences (Kaplan & Mikes, 2012). Nonetheless, they remain concerns for organizations because risk mitigations have never been perfect. Accounting for all threads is inconceivable. Having high degree of organizational congruence helps organization to navigate the future (Marinkovic et al., 2022). The congruence enables everyone in an organization to have common vision. Activities are synchronized and synergetic. The results are complementary. However, absence of risks in technology related organizations is undesirable. Risks encourage systematic feedback and innovation investment (Lucas et al., 2018). The feedback leads to organizational adaptation. Investment in innovation helps increase strategic options for the organization. Based-on the congruence perspective, risk introduces inconsistencies (Sillince, 2005). Organizational congruence is threatened by the inconsistencies. Organization adapts and invests to absorb the inconsistencies to be successful. Hence, risk is inseparable from the congruence perspective.

## METHODOLOGY

This study adopted general natural language processing (NLP) pipeline for data preparation (Vajjala et al., 2020) and measure development for solution discovery (Heo & Kim, 2017; Tourky et al., 2020). NLP has the advantage that it can reliably process large volume of data. The raw data is annual reports of organizations in Thailand IT industry and was acquired from reputable

and reliable source, the Thai government agency website. This data was preprocessed to ensure quality. Content extraction and validation were among the preprocessing. The high-quality content was transformed into a suitable format for main processing. Term frequency-inverse document frequency (TF-IDF) feature extraction and cosine similarity calculations processed the data into a data matrix. This matrix was entered into exploratory factor analysis (EFA) to discover latent constructs. This discovery was used to specify confirmatory factor analysis (CFA). The emergent statistical parameters guided the CFA modeling and solution identification.

## Sample and data collection

The primary purpose of this step is to acquire raw data from a reliable source. This study collected data from annual reports of listed Thai IT organizations. The list of 40 organizations was obtained from the technology sector of The Stock Exchange of Thailand. This sector includes electronic components and information & communication technology organizations. Annual reports of these organizations were downloaded from The Securities and Exchange Commission of Thailand website. There are many standardized versions of the annual reports. This study adopted the most recent version (i.e., 56-1), which has begun since 2013. This version is the most comprehensive with strategy and execution information. At the time of download in early 2022, a total number of 288 reports from 2013 to 2020 were available on the website. Less than 10% of the 2021 reports were available. The number of downloaded reports was amount to 90% of the expected number (i.e., 288/320). There were 222 PDF and 66 MS-Word files.

## Data preparation

This step focuses on the preparation of high-quality text data. Visual examination of content inside the documents revealed that the content was written in Thai language. A small number of English words were occasionally used with their Thai counterparts when the English words were borrowed into the Thai language. This revelation is not out of the ordinary because all organizations were Thai, and the reports were done according to the standard of Securities and Exchange Commission of Thailand.

The goal of preparation is to have access to text data as its publisher's intended. The sixty-six MS-Word files allowed unrestricted access to their contents via MS-Word program. Therefore, the contents of these files were considered high quality. No future processing was needed. The two hundred twenty-two PDF files presented challenges. The contents were accessible in read-only mode. To freely access text contents of the PDF files, a pipeline of text processing was performed. This pipeline consists of 3 stages: extraction, transformation, and validation. In first stage, a custom Python program was created to extract Thai words from each PDF file utilizing pdfplumber package version 0.6.0 and save the words in UTF-8 text format. Visual examination of all extracted files discovered that 32 PDF files were unsuccessfully extracted. The contents of these files were not intellectually legible. The extracted contents of the other 190 PDF files could be further processed to increase quality.

The transformation stage involved dictionary-based spell checking and correction. This study used Thai word tokenizer and Thai dictionary from PyThaiNLP version 3.0.0 package (Phatthiyaphaibun et al., 2022). PyThaiNLP is the de facto Python Thai natural language processing package. Its tokenizer is matured, and its dictionary contains more than 62,000 words. This study applied a combination of heuristic-based and dictionary-based tokenizer because heuristic was well complemented by the comprehensive dictionary. Tokenized words were spell checked against the dictionary. The program in this stage kept the statistics of misspelling words (i.e., heuristic-based) across the 190 files and listed top-100 most frequent misspelled words. This list showed two types of misspellings. First type, the most common, words were genuinely misspelled by the PDF extraction process. The Thai language encoding complexity in PDF was beyond pdfplumber capability. To aid this type, a targeted spelling correction routine was crafted using the knowledge from the top-100 misspelled words. Second type, the tokenizer incorrectly separated words because these words were n-grams. There were possibilities of having unusual sets of words (i.e., n-grams) beyond the dictionary (e.g., firm name, and product name). N-grams routine was created to discover the unusual sets across the 190 extracted contents. The routine was instructed to list top-100 most common n-grams from the content. Intellectually legible n-grams were selected and used to extend the existing dictionary.

Transformation stage was iterative. Spelling correction and n-grams enhanced dictionary were iterated according to criteria set forth in the validation stage. This study realized that the efforts to get the last incorrect word would out weight the benefits. This study set a goal to have less than 1% misspelling words in the contents across the 190 UTF-8 text files. This number of misspellings does not jeopardize the validity and reliability of this study due to the reasons presented during similarity calculation. Ultimately, there were more than 300 targeted spelling corrections, and 197 n-grams were included into the dictionary.

## Content categorization and annotation

The data preparation yielded 256 source files of freely accessible text contents (i.e., 66 MS-Word files and 190 PDF extracted UTF-8 text files). The content in each file was to be categorized according to the five dimensions covered in the theoretical development and each category was annotated with extensible markup language (XML). The procedure consisted of two steps.

The first step was content categorization. To fully understand this step, one had to understand the content arrangement of the annual report. This study adopted the most recent standard of annual report specified by The Securities and Exchange Commission of Thailand. The specification is 56-1 and has two revisions. Both revisions are compatible with some differences

in subtopics arrangement. The report is divided into 3 sections and each section covers certain area of the business. The areas are operations, management, and financial respectively. Each area is specified to cover several main topics. One main topic includes many subtopics. These subtopics are the primary concern of this study. Quick semantic examination of subtopics across several reports revealed that there were several ways in phasing a shared meaning of subtopics in Thai language. Direct mapping could not be carried out because the variation is numerous. Therefore, each subtopic was read and assessed its meaning by human. If its meaning agreed with one of the five organizational dimensions, discussed in the previous session, its content was consequentially classified as data of the dimension. This study established meaning of each dimension consistence with the literature. The mission statement was the direct capture from content of the annual report. There was no meaning assignment. The meaning of organizational operation dimension covered operational strategy, operational management, operational policies, operational improvements, and operational partners and partnerships. The meaning of competition dimension included industry competition, peer competition, competitive advantages, and competition opportunities. The meaning of products and services dimension encompassed various topics about innovation, categories, research and development, challenges, and production of the products and services. The last dimension, risk, addressed the topics about risk analysis, risk mitigation, risk management, organization constraints, and perceived threads.

The second step annotated the categorized content with the XML. An XML file with report attributes (i.e., stock exchange TICKER and year of the report) and the five dimensions was prepared for each annual report. The categorized content in the first step was copied from the source file to the XML file. This 2-steps procedure was manually carried out for each source file by the researcher and his assistance. The result was annotated contents in 256 XML files, matching the 66 MS-Word and the 190 PDF extracted UTF-8 source files. Fig 1 displays an example of the XML file.

| Before | After |
|---|---|
| <report format=56_1 ticker=HANA year=2563> | <report format=56_1 ticker=HANA year=2563> |
| <mission> | <mission> |
|  | เพื่อสร้างคุณค่า ... |
| </mission> | </mission> |
| <operation> | <operation> |
|  | ในเดือนมิถุนายน ... |
| </operation> | </operation> |
| <competition> | <competition> |
|  | ความได้เปรียบ ... |
| </competition> | </competition> |
| <product> | <product> |
|  | 1. ผลิตภัณฑ์ ... |
| </product> | </product> |
| <risk> | <risk> |
|  | ปัจจัยความเสี่ยง ... |
| </risk> | </risk> |
| </report> | </report> |

Fig 1. XML example of before and after classification and annotation of a report

**Similarity calculation**

The objective at this stage is to perform cross-dimensions similarity calculation in each XML file. Before proceeding with the calculation, a python program scanned annotated contents in the 256 XML files to assess completeness of the text data. The program discovered files with empty dimensions. Some reports did not have contents covering all the planned dimensions. This study dropped XML files with any empty dimension because the empty dimension did not aid the calculation. However, empty dimensions must not be regarded as missing data because this emptiness is valid, but missing data is invalid. The program listed that 215 XML files (i.e., annotated annual report) readied for similarity calculation.

This study implemented 3 steps to achieve similarity calculation. The first step created pairs of contents from each dimension. There were 5 dimensions with their contents in each XML file. Therefore, there were 10 possible dimension-pairs of contents. The pairs were mission-operation (MISN-OPER), mission-competition (MISN-COMP), mission-product (MISN-PROD), mission-risk (MISN-RISK), operation-competition (OPER-COMP), operation-product (OPER-PROD), operation-risk (OPER-RISK), competition-product (COMP-PROD), competition-risk (COMP-RISK), and product-risk (PROD-RISK).

The second step, contents of each pair were vectorized using TF-IDF (Robertson, 2004). This vectorizer helped elevate differences between contents of the dimension-pair. Sklearn package version 0.24.1 provided the TF-IDF vectorizer. Content of each dimension was separated into words by the heuristic-based and dictionary-based tokenizers used during the data preparation. Each word was kept in one instance to equalize representation in the content. The heuristic-based words presented no concern because their tokens were similar across dimensions in the XML file. Vectorizer paid no difference between heuristic-based and dictionary-based tokens. This second step resulted in 10 TF-IDF vector-pairs corresponding to the 10 dimension-pairs in each XML file.

Cosine similarity measure (Tata & Patel, 2007) was used to calculate contents' similarity in the third step. Function for the measure was provided by Sklearn package version 0.24.1. Each TF-IDF vector-pair was entered into the similarity function and output from the function was one value. When this value is closer to 0, the vector-pair is very different. On the other hand, the vector-pair is very similar when the measure is closer to 1. Each XML file contained 10 dimension-pairs. As result, there were 10 cosine measures for each file. Two-hundred fifteen XML files from 215 annual reports were sent to the measure

function. Hence, the output matrix was 215 rows and 10 columns. The 215 rows were for the 215 annual reports and 10 columns were for the 10 cosine similar measures across the 10 dimension-pair. This matrix contains data for the discovery of organizational congruence.

## RESULT

### Exploratory factor analysis (EFA)

This study utilized exploratory factor analysis to discover latent dimensions of organizational congruence. Before carried out the analysis, basic characteristics of the data matrix were examined. Table 1 displays these characteristics. There was nothing out of the ordinary.

Table 1: Correlations of similarity-pairs and descriptive statistics (N=215)

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| MISN-OPER | - |  |  |  |  |  |  |  |  |  |
| MISN-COMP | 0.718* | - |  |  |  |  |  |  |  |  |
| MISN-PROD | 0.732* | 0.892* | - |  |  |  |  |  |  |  |
| MISN-RISK | 0.710* | 0.873* | 0.881* | - |  |  |  |  |  |  |
| OPER-COMP | 0.042* | 0.009* | 0.038* | 0.038* | - |  |  |  |  |  |
| OPER-PROD | 0.034* | -0.045* | 0.090* | 0.040* | 0.852* | - |  |  |  |  |
| OPER-RISK | 0.136* | 0.085* | 0.139* | 0.199* | 0.792* | 0.761* | - |  |  |  |
| COMP-PROD | -0.221* | -0.032* | 0.041* | -0.060* | 0.616* | 0.606* | 0.418* | - |  |  |
| COMP-RISK | -0.167* | 0.030* | 0.059* | 0.051* | 0.456* | 0.351* | 0.510* | 0.732* | - |  |
| PROD-RISK | -0.127* | -0.017* | 0.128* | 0.080* | 0.466* | 0.568* | 0.634* | 0.704* | 0.801* | - |
| Mean | 0.252 | 0.256 | 0.235 | 0.234 | 0.514 | 0.523 | 0.486 | 0.570 | 0.545 | 0.529 |
| S.D. | 0.108 | 0.093 | 0.078 | 0.079 | 0.107 | 0.123 | 0.098 | 0.110 | 0.088 | 0.105 |
| Min | 0.055 | 0.051 | 0.039 | 0.032 | 0.216 | 0.228 | 0.201 | 0.320 | 0.318 | 0.258 |
| Max | 0.606 | 0.457 | 0.442 | 0.721 | 0.782 | 0.680 | 0.775 | 0.758 | 0.752 | 0.606 |

\* $P < 0.05$

The EFA calculation utilized routine FactorAnalyzer in python package factor_analyzer version 0.4.0. To ensure the data's suitability for factor analysis, Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) were carried out (Lewis et al. 2005). The Bartlett's chi-square is 2303.38 with p-value less than 0.01 and KMO value was 0.71. These results confirm suitability of the data.

The factor analysis was calculated in two phases. The first phase was to determine the appropriate number of factors. There was no rotation during this phase. The eigenvalues of the first 10 factors were the following: 4.132, 3.418, 1.090, 0.480, 0.303, 0.272, 0.107, 0.079, 0.062, and 0.055. Nunnally (1978) recommends component with eigenvalue more than 1.

The second phase modeled the top-three components with varimax rotation. The statistical results of the model are in table 2. This model accounts for 81% of overall variance. All components have Cronbach's alpha ranging from 0.89 to 0.93. These values are higher than the recommended cutoff criteria at 0.7 and indicate good reliability of the three components. The variable loadings of each component are high with low cross-loadings. These loadings indicate good convergent and divergent validity. Therefore, all the statistical information suggests satisfactory validity and reliability of the model.

Table 2: EFA results

|  | Construct-1 | Construct-2 | Construct-3 |
|---|---|---|---|
| MISN-OPER | 0.785 | 0.112 | -0.233 |
| MISN-COMP | 0.935 | -0.042 | 0.032 |
| MISN-PROD | 0.947 | 0.030 | 0.096 |
| MISN-RISK | 0.928 | 0.036 | 0.045 |
| OPER-COMP | 0.005 | 0.888 | 0.272 |
| OPER-PROD | 0.002 | 0.900 | 0.253 |
| OPER-RISK | 0.135 | 0.759 | 0.344 |
| COMP-PROD | -0.083 | 0.414 | 0.701 |
| COMP-RISK | -0.000 | 0.205 | 0.912 |
| PROD-RISK | 0.019 | 0.378 | 0.796 |
| Individual variance | 0.327 | 0.255 | 0.228 |
| Cumulative variance | 0.327 | 0.582 | 0.810 |
| Cronbach's alpha | 0.931 | 0.920 | 0.892 |

The construct-1 loadings are firmly supported by variables connected to organization's mission. Environmental scanning and anticipation of future establish mission statement (Morris, 1987). This statement gives organization's purposes and goals. It represents the organization's reason for existing. Congruence perspective scholar maintains that firm's functions and resources must be aligned with the mission to achieve superior performance (Sillince, 2005). The variables' loadings clearly demonstrate

the alignment. Furthermore, this alignment is closely parallel to the concept of strategic consensus. Porck et al. (2020) defines strategic consensus as shared strategic understanding and strategic priority across organization. It is a type of organization internal congruence. Humburg et al. (1999) proposed two dimensions of strategic consensus. First dimension is subject of consensus. This dimension is revealed by the variable-pairs. The subjects are operation, competition, product, and risk. These subjects are consensus on the mission. Second dimension is object of consensus. In the context of this study, the objects are unique words in narrative of each subject that brought the subject closer to the narrative of the organization's mission. Both dimensions of strategic consensus are satisfied. This satisfaction strongly suggests that the construct-1 is the strategic consensus.

The construct-2 is manifested by the close-associations of variables based on the organization's operation. The narrative of competition, product, and risk contained very similar unique words to that of operation. Literature recognizes this formation of close-associations as operational congruence (aka, operational consistency, and operational alignment). This congruence materializes because of the complementary gains of the co-alignment between operational routine and the three other areas. The first, a comprehensive and systematic reviewed by Sansone et al. (2017) informed that six competitive dimensions were enhanced: cost, quality, delivery, flexibility, service, innovation, and environment. The reasons for this enhancement were better operations capabilities and improved competitive prioritization. Second area, product's scale and scope expansions require organization's operational congruence (Brahm et al., 2021). Organizations commonly tradeoff between product's scale and scope expansions because of resources' constraint. Brahm et al. (2021) discovered that both expansions are not mutually exclusive when operational congruence is in effect. Third area concerns operational risk. Organization's risks can be classified to either external or internal. Operational risks are largely internal stemming from activities related to resources and humans (Wang et al. 2020). This type of risks is mostly in routine and preventable in advance by monitoring and risk mitigation (Kaplan & Mikes, 2012). When risky incident arrives, the organization must have capabilities to mitigate uncertainty. One such capability is the ability to adapt. Congruence is a fundamental driver for adaptation because it demands organization to minimize difference between uncertainty brought about by the incident and current operation (Sarta et al., 2021). Literatures across the three areas inform that the second construct is the operational congruence.

Three variables strongly loaded on the third construct. This is a manifestation of competitive congruence. The risk related variables are the opposite to that of the second construct. The variables focus on external risk. This type of risk is originated from competitive environment (Shepherd, 1999). In agreement with the variables, the environment posts organization with two sources of risks. First is from competition among competitors. This source concerns threats materialized from competitors' activities (Gómez et al., 2020). Second source is from competition among products. Competing products lead to substitution and switching. Both are threats to organization's competitive position. When risk from competitive environment presents itself, organization's investment becomes liability and return on investment is uncertain. The organization is mindful of the risk. Therefore, there is congruence among competition, product, and risk. Last variable (i.e., COMP-PROD) expresses close relationship between competition and product. This relationship is to be expected because it accelerates product innovation, particularly in the IT industry (Chen et al. 2021). Competition encourages research and development investment and knowledge collaboration within the competitive community. Thus, the third construct is conceptually equivalent to competitive congruence.

**Confirmatory factor analysis (CFA)**
The latent constructs were unveiled, and these constructs needed further refinement. Confirmatory factor analysis (CFA) was conducted using the maximum likelihood estimation to validate the constructs. AMOS 28 carried out the CFA estimations. Table 3 displays the results. Model 1 was the direct model from EFA. Its fit indices (i.e., CFI, GFI, NFI, TLI, RMSEA) suggested lower than satisfactory fit (Cheung & Rensvold, 2002). One notable coefficient was the correlation between operational congruence and competitive congruence at 0.640, P-value < 0.05. This statistical significance indicated potential second-order latent construct. Therefore, model 2 was specified by the guide of this significance. The second model did not show any improvement over the late model. There was no change in Chi-square and fit indices. However, it unveiled correlation structure among the error variances via the modification indicators. This structure gave rise to the model 3.

Table 3: CFA models

| | Model 1 Coefficient | Model 2 Coefficient | Model 3 Coefficient |
|---|---|---|---|
| Strategic consensus (1st order) | | | |
| MISN-OPER | 0.767 | 0.767 | 0.767 |
| MISN-COMP | 0.939 | 0.939 | 0.937 |
| MISN-PROD | 0.950 | 0.950 | 0.954 |
| MISN-RISK | 0.928 | 0.928 | 0.926 |
| AVE | 0.808 | 0.808 | 0.808 |
| CR | 0.944 | 0.944 | 0.944 |
| Operational congruence (1st order) | | | |
| OPER-COMP | 0.933 | 0.933 | 0.930 |
| OPER-PROD | 0.907 | 0.907 | 0.893 |
| OPER-RISK | 0.851 | 0.851 | 0.867 |

| | | | |
|---|---|---|---|
| AVE | 0.806 | 0.806 | 0.805 |
| CR | 0.926 | 0.926 | 0.925 |
| Competitive congruence (1st order) | | | |
| COMP-PROD | 0.823 | 0.823 | 0.844 |
| COMP-RISK | 0.881 | 0.881 | 0.907 |
| PROD-RISK | 0.892 | 0.892 | 0.858 |
| AVE | 0.750 | 0.750 | 0.757 |
| CR | 0.900 | 0.900 | 0.903 |
| Ambidexterity (2nd order) | | | |
| Operational congruence | | 1.082 | 0.932 |
| Competitive congruence | | 0.591 | 0.844 |
| AVE | | 0.760 | 0.790 |
| CR | | 0.854 | 0.883 |
| Correlations | | | |
| Strategic cons. ↔ Operational cong. | 0.062 | | |
| Strategic cons. ↔ Competitive cong. | 0.034 | | |
| Operational cong. ↔ Competitive cong. | 0.640 | | |
| Strategic cons. ↔ Ambidexterity | | 0.057 | 0.061 |
| $e$(OPER-RISK) ↔ $e$(COMP-PROD) | | | -0.679 |
| $e$(OPER-PROD) ↔ $e$(COMP-RISK) | | | -0.569 |
| $e$(OPER-COMP) ↔ $e$(PROD-RISK) | | | -0.792 |
| $e$(OPER CONG.) ↔ $e$(COMP-RISK) | | | -1.186 |
| $e$(COMP CONG.) ↔ $e$(MISN-OPER) | | | -0.697 |
| | | | |
| Fitness statistics | | | |
| CFI | 0.810 | 0.810 | 0.959 |
| GFI | 0.728 | 0.728 | 0.911 |
| NFI | 0.800 | 0.800 | 0.948 |
| TLI | 0.733 | 0.733 | 0.931 |
| RMSEA | 0.252 | 0.252 | 0.128 |
| $\Delta X^2$ | | | *df*=5, 345.321 |

The fit indices of model 3 indicated satisfactory fit (Cheung & Rensvold, 2002) and were markedly improved over model 1 and model 2 judging by the chi-square difference (p < 0.05). The model was checked for construct internal reliability, divergent validity, and discriminant validity. All average variance extracted (AVE) and composite reliability (CR) values were higher than the suggested cutoff 0.5 and 0.7 respectively (Hair et al., 2010). Internal reliabilities of all constructs are indicated. All variables statistical significantly (p < 0.05) loaded on their respective latent constructs with values ranged between 0.767 and 0.932, larger than recommended 0.6 cutoff values (Hair et al., 2010). Constructs' convergent validity is confirmed. Discriminant validity was checked by the reported correlation between construct and the square root of the AVE values of each construct. The correlation was not significant (p > 0.05) and the square root values were more than correlation between the constructs. This suggests discriminant validity. Lastly, the statistical evidence thus far satisfies the criteria for second-order model (Johnson et al., 2011)

The emergence of model 3 revealed insights into the second-order construct. The loading values of its first-order constructs suggest that this construct contains 2 sub-constructs, and these sub-constructs have positive relationships with the second-order construct. Literature suggests that these relationships are akin to the concept of ambidexterity. Tushman & O'Reilly (1996) observed that organization survival required coevolution with its environment through two mechanisms of changes. One is evolutionary and another is revolutionary. A primary task of management team is to balance these two mechanisms. The researchers called for ambidextrous organization. He & Wong (2004) illuminated the nature both mechanisms through the lens of exploitation (i.e., evolution) and exploration (i.e., revolution) within the context of technological innovation. They discovered that both exploitation and exploration were loosely coupling and had combined positive effects on organization performance. Both mechanisms enhance organization performance through different means. Exploration helped performance through adaptation and experimentation, while exploitation increased efficiency and effectiveness through internal alignment (Gibson & Birkinshaw, 2004).

Exploration primarily situates within competitive congruence. It has been mentioned in literature using the words like "flexibility, experimentation, variation, discovery, innovation, creation, pioneer, and research" (Moss et al., 2014, p. 60). The spirit of these words is forward looking and future oriented. This spirit is well aligned with activities that entrench competitive position (Chen et al., 2022). Exploitation largely centers on operational congruence. Moss et al. (2014) pointed out that exploitation is commonly implemented in the guise of automation, routinization, and refindment. These implementations are most effective with alignments of operational processes and resources because they help organization continuously gain on economic value. Therefore, the discussion justifies the emergence of ambidexterity as the second-order construct.

## DISCUSSION

**Conclusion and contribution**

This study collected 288 annual reports between 2013 and 2020 of IT-oriented organizations in stock exchange of Thailand. These reports were preprocessed with text extraction, quality assurance, and information annotation processes. This preprocessing resulted in the annotated content of two hundred fifteen reports readied for organizational congruence discovery. The discovery process proceeded with the cosine similarity calculation among the 10 dimension-pairs in each annotated content and produced the matrix of 215 by 10 dimensions. This matrix was entered into exploratory factor analysis. Latent-construct interpretations were attempted. Then, the statistical results of the late factor analysis were used to guide confirmatory factor analysis for final identification. The final CFA model revealed three first-level constructs and one second-level construct. Strategy consensus, operational congruence, and competitive congruence are the first-level constructs. The second-level construct is organizational ambidexterity.

This study makes two major contributions. First, it empirically identifies four organizational level congruences from close inter-relationships among the five dimensions. This identification is closely aligned with the heart of congruence perspective because the study did not resource to contingency theorization. Second, it combines CATA with traditional measurement development methodology. This combination enables large data volume processing, cost savings from traditional data collection, and maintain rigor of the results.

**Implications**

The implication of this study first involves congruence measure method improvements. This study joins a group of quantitative congruent measures (e.g., Lin, 2014; Chatterjee et al., 2021) and provides an alternative to survey-based instrument. The combination of CATA and traditional measure modeling process provides both convenience and fidelity. Previous congruence studies measured their congruence-related constructs using survey-based instrument. Implementation of this type of instrument is costly, time consuming, and prone to subjective errors. Furthermore, it involves other parties such as ethic-committee and distribution channels, which amplify data collection uncertainty. The key advantage of the proposed method is that large volume of data can be collected from reliable sources and shaped into high quality contents for the study. The volume and quality help heighten the study's fidelity.

The second implication involves the application of congruence-based constructs. Congruence perspective may prove to be more valuable than contingency in forthcoming environment. Khanagha et al. (2018) suggests that incongruence detection is becoming more important than achieving all-around congruence in technological disruptive environment. The quick detection enables organization to initiate adaptation, which ranges from strategy to resource adjustments. Traditional measure method may not be as effective as the proposed method.

The third implication involves general progress of congruence for organization perspective. The perspective has been the foundation for other perspectives such as contingency, organizational design, and innovation. However, the perspective itself has recently been a slow progress. On the contrary, this study argues that the discovered constructs reaffirm the relevant of the perspective in contemporary literature. For example, strategic consensus is explored within the context of internal congruence (Lewis & Clark, 2020). In addition, ambidexterity is very much involved in organizational innovation (Maclean et al., 2021).

**Limitation and future direction**

This study recognizes several limitations, but also many future opportunities. First, it did not pursue causal relationships between the organizational congruences and other constructs. Provided, the result satisfies the aim of this study. The tradition of measure development may suggest that this satisfactory is not fully compliance with the preferred procedure. Nomological validity or the effectiveness evaluation of the measured constructure should be carried out by examining causal relationships with other constructs under the theoretical scope (Salisbury et al., 2002). This study acknowledges the absence and takes this absence as the opportunity for future improvement. Second, CATA may pose threats to the result's reliability. The result of this study centers on the similarity score. Cosine similarity is not the only text similarity score. Jaccard similarity is another popular alternative. Nonetheless, both cosine similarity and Jaccard similarity have demonstrated convergence under CATA studies (Arts et al., 2018). Additionally, McKenny et al. (2018) pointed out that CATA is prone to specific factor error by the preselection of words. This study attempted to mitigate the error by incorporating hand-coded categorization. However, this mitigation may lead to transient error that similarly phased topics in different reports contained different semantic of contents. One topic contained a quite departed narrative from another similarly phased topic when both topics should tell quite similar narratives. This is an opportunity for improvement. Recent advances in word embedding analysis can help assess the semantic differences (Zhu et al. 2022). This study takes this as a future direction. Lastly, this study was conducted using data from one country. Its generalizability is quite limited. Cross country examination is another potential direction.

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