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ON THE CONCEPTUALIZATION OF IT ALIGNMENT: MEASURING ALIGNMENT OF IT PROJECT PORTFOLIO

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Abstract

While alignment has received extensive attention in IT research, up to now, we have predominately focused on the current business value of IT by studying the alignment of the existing IT applications (i.e., IT operation) with the current strategies. However, given the highly dynamic environmental context, we also need to think about the alignment of the developing IT applications (i.e., IT projects) that will lead to future business value of IT. The paper is about rethinking the notion of strategic alignment to include future oriented dimension by conceptualizing and operationalizing alignment of the developing IT applications. We develop a multilevel tool that emergently measures portfolio alignment based on its individual IT projects. In the empirical section we test the proposed tool in a large organization. Finally, the implications of including IT projects in the alignment have been discussed.

Keywords: IT alignment, Alignment, IT project portfolio alignment, developing IT applications

1 INTRODUCTION

The strategic alignment of information technology (IT) is an important concern for both academics and practitioners (Luftman & Ben-Zvi, 2010; Oh & Pinsonneault, 2007; Sabherwal & Chan, 2001; Tallon & Pinsonneault, 2011). Research has made significant strides toward understanding the relationship between strategic alignment and the business value of IT. The evidence shows that the alignment of IT applications in operation in firms increases the business value of IT (Bergeron, Raymond, & Rivard, 2004; Chan, Huff, Barclay, & Copeland, 1997a; Kearns & Lederer, 2003; Luftman, 2000a; Oh & Pinsonneault, 2007; Sabherwal & Chan, 2001c; Tallon, Kraemer, & Gurbaxani, 2000; Tallon & Pinsonneault, 2011; Tavakolian, 1989). While it is important to understand the state of alignment of current IT investments, it is equally important to assess the alignment of IT applications in development. IT projects are the means by which organizations execute their strategies (Jenkin & Chan, 2010). IT applications currently being developed will become the IT applications that are in operations in the near future and as such will influence the business value of IT. As a result, it is important to study the alignment of the portfolio of IT applications[1] being developed.

IT change through IS development and application adoption has always been a central issue in organization science. Whether in public or private sector, for local or global players, the exploitation of IT and its continuous upgrade and development has been recognized as a prerequisite for survival. However, IS development has received less attention from alignment perspective. While intense research has been done on the method, process, and implementation aspects of the portfolio of developing IT applications (Conboy, 2009; Sabherwal & Robey, 1995), the alignment of the portfolio of the developing applications has received scant attention. IT projects will soon be a part of IT operation and therefore, the alignment of developing applications is essential for organizations, for the same reasons that alignment is necessary and important in IT operation. In this study, we attempt looking at another important aspect of alignment in organizations, which is the alignment in developing IT applications.

In the first part of the paper, we conceptualize IT project portfolio alignment and develop a multilevel tool that emergently constructs portfolio alignment based on the measurement of various aspects of IT projects. After a brief review on the method, in the next section, we take a design perspective to validate the tool in a large organization and illustrate its usefulness by comparing the tool's calculated alignment of the portfolio with management perception of the construct. The implications and contributions of the paper to IT alignment literature is finally discussed.

2 THEORIZING IT PROJECT PORTFOLIO ALIGNMENT

2.1 Theoretical background

The notion of alignment has been defined in various ways in IT research that can be generally classified in three different groups. First, the majority of studies conceptualize the notion of "strategic alignment" by defining it as the degree to which business strategy and IT strategy are consistent (e.g., Chan, Huff, et al., 1997a; Oh & Pinsonneault, 2007). This body of research focuses on business strategy and IT strategy, which is often measured through proxy concepts such as how IT investments have been allocated or how IT applications that are in operations have been deployed (Oh and Pinsonneault, 2007). This approach relies on a unidimensional view of alignment, i.e, establishes alignment based on a single dimension. The second group is broader in scope of construct inclusion in its profile of strategic IS management by including structure in addition to the strategy dimension: IS and business strategies, and IS and business structures (Henderson & Venkatraman, 1993). In this view, three types of alignment between strategy and structure are analyzed: (a) business alignment (i.e., alignment between business strategy and structure), (b) IS alignment (i.e., alignment between IS strategy and structure), and (c) cross-dimension alignment (i.e., alignment between business structure

[1] "Developing IT applications" and "IT projects" are used interchangeably in this essay. The construct include the applications that are developed internally as well as the applications that are acquired such as ERP packages.

and IS strategy; or business strategy and IS structure) (for review see Sabherwal, Hirschheim, & Goles, 2001).

While rarely used in IT research, the third group adapts a configurational view of alignment (Drazin & Van de Ven, 1985) from organization theory literature (e.g., Chatfield & P. Yetton, 2000; Hsiao & Ormerod, 1998; Johnston & P. W. Yetton, 1996; Morton, 1991; Sharma, P. W. Yetton, & Zmud, 2008). This view incorporates different organizational dimensions: strategy, structure, process, IT and human resource. Configurational view defines alignment as "a feasible set of equally effective, internally consistent patterns of organizations context and structure" (Johnston & P. W. Yetton, 1996, p. 190 cite Van de Ven and Drazin, 1985). This approach argues that IT can bring about ample rewards as long as various IT-related organizational elements are kept aligned (Chan & Reich, 2007b; Morton, 1991). Accordingly, an ideal configuration is specified and the higher the degree of adherence to this ideal configuration among elements, the higher would be the alignment. Ideal types are "complex constructs that can be used to represent holistic configurations" of multiple organizational dimensions (Doty & Glick, 1994, p. 233).

Among the above three approaches, we conceptualized the alignment of IT project portfolio in a configurational way. According to our general conceptualization, an organization's portfolio of IT projects is defined to be high in alignment when different aspects of the portfolio of IT projects (i.e., strategic, structural, technological, social, and processual) are internally in a balanced state. By internally balanced, we mean that in order to be highly aligned, there should be a balanced state (the how will be specifically defined in next the section) among the five elements of the portfolio. In other words, these elements are not compared with an external factor. As Johnston & Yetton (1996) point out, theorists are different in their emphasis on internal or external (environmental) alignment. In this paper we focus on the internal alignment of the organizational configurations of IT project portfolio.

There are some reasons behind our selection. First, comparing to well-established operations, IT projects are new to organizations and are potential to bring ample changes to their social and technological context. As a result, for having a successful and well aligned project implementation it is necessary to take a thorough, comprehensive view of various aspects of the project that are in interaction with their implementation context. In other words, while conceptualizing alignment as fit between project goals and IS or business strategy (e.g., in Jenkin & Chan, 2010; Srivannaboon & Milosevic, 2006) is insightful, it provides us with a partial view of the big picture of the way that the portfolio of IT projects interact with organization. Particularly, the portfolio of IT projects and its fit with organizations needs to be scrutinized from variety of aspects including strategic, technological, structural, processual and social. Accordingly, the configurational view is a good option because it is found to be appropriate for more complex situations by broadening the scope of analysis to multiple dimensions (Johnston & P. W. Yetton, 1996; Van de Ven & Drazin, 1985). Second, configurational approach is more consistent with project management literature and practice that emphasizes the importance of alignment among various project elements toward success (Duncan, 2003; PMI, 2008). The following section expands on configurational alignment and its operationalization. Finally, while rarely use for the hardship in data gathering and impossibility in narrowing down in all the five factors, configurational definition of alignment is consistent with IS research. Morton's (1991) argues that IT "can bring substantial reward as long as the key elements of strategy, technology, structure, management processes and individuals and roles are kept in alignment" (Chan & Reich, 2007, p. 303). Chatfield & Yetton (2000), Hsiao & Ormerod (1998), Sharma, Yetton, & Zmud (2008), and Johnston & Yetton (1996) are some IT studies that employ a configurational view to alignment.

2.2 Configurational definition of alignment

As discussed above, according to configurational view, portfolio of IT project enjoys high degree of alignment when there is a state of balance among its five dimensions. In this section, we elaborate on various ways that can the state of balance be conceptualized based on the five portfolio dimensions.

In order to develop a configurational definition of alignment for IT project portfolio, we need to initially define the five dimensions of the IT project portfolio. Accordingly, we take a multilevel approach by employing a bottom-up process (Klein & Kozlowski, 2000) that assumes individual IT

projects are the building blocks of the portfolio of IT projects. In other words, we firstly conceptualize strategic, technological, structural, processual and social dimension for each IT project. Accordingly, "structural" aspect of an IT project is defined as the degree of organization in roles, responsibilities, and governance of the IT project. The "processual" element is conceptualized as the degree of project's maturity in initiation, implementation and integration processes. The "social" aspect refers to the degree of user's project buy-in and its uses. "Technological" dimension is defined as the degree of technology acceptance and internalization in organization. Finally, "strategic" element refers to the degree of perceived association between the IT project and perceived organizational business and IT strategies. Each IT project can be evaluated in each of the five project dimensions by developing multiple items in each of these dimension. More details about the measures in each dimension are provided in Appendix 1.

Second, we aggregate each of the project dimensions across all projects to emergently construct each dimension at the collective level. Figure 1 illustrates the relationship between IT project elements and the portfolio alignment. After calculating the state of each dimension in all projects, each of the portfolio's dimensions is emergently constructed. We simply defined each portfolio dimension as the average state of its IT project members in the corresponding dimension. For instance, by averaging the state of processual aspect across IT projects we evaluate the portfolio's average degree of maturity of the portfolio in initiation, implementation and integration of IT projects into business processes. Similar analogy is employed for other portfolio dimensions as well.

Third, after defining the five elements of the portfolio, the concept of alignment of the IT project portfolio have to be theorized. In other words, what do we mean when we argue that an IT project portfolio is highly or poorly aligned? While configurational approach generally argues that the portfolio of developing IT applications enjoys high degree of alignment when there is an *internal state of balance* among the five portfolio elements, the state of balance can be conceptualized differently based on the elements. According to strategy (e.g., Drazin & Van de Ven, 1985; Venkatraman, 1989) and IS literature (e.g., Bergeron, Raymond, & S. Rivard, 2001a) variety of linear (e.g., Chan, Huff, et al., 1997a) and nonlinear (e.g., Oh & Pinsonneault, 2007) conceptualizations can be employed. In other words, different linear and nonlinear combinations of the five dimensions can be leveraged for defining the ideal type[2] of high alignment. At this stage, while we have adopted a configurational view by including various dimension in the study, we decided to keep various conceptualizations in order to compare and contrast them toward finding the more effective ones. After calculating the score of the five elements at portfolio level, we explain three competing conceptualizations and their operationalizations in the following.

- First, in a *matching* formulation method, a portfolio with the lowest degree of deviation among the five elements is the most aligned one. This means that if the elements are all high, or all low or all medium the portfolio is defined as high in alignment since all the dimension are in harmony. Hence, the ideal type is theoretically defined as the situation that all the five elements are at the same score. In other words, there is no standard deviation among the five dimensions. For instance, by assuming the score of each element to be between 1 and 3, the matching method only cares about the variance among different aspects and ignores the level at which alignment occurs. In other words, [1,1,1,1,1], [2,2,2,2,2] , and [3,3,3,3,3] situations are three ideal types with maximum alignment).

2 "Ideal types are complex constructs that can be used to represent holistic configurations of multiple unidimensional constructs. They are intended to provide an abstract model, so that deviation from the extreme or ideal type can be noted and explained (Doty & Glick, 1994, p. 233)"

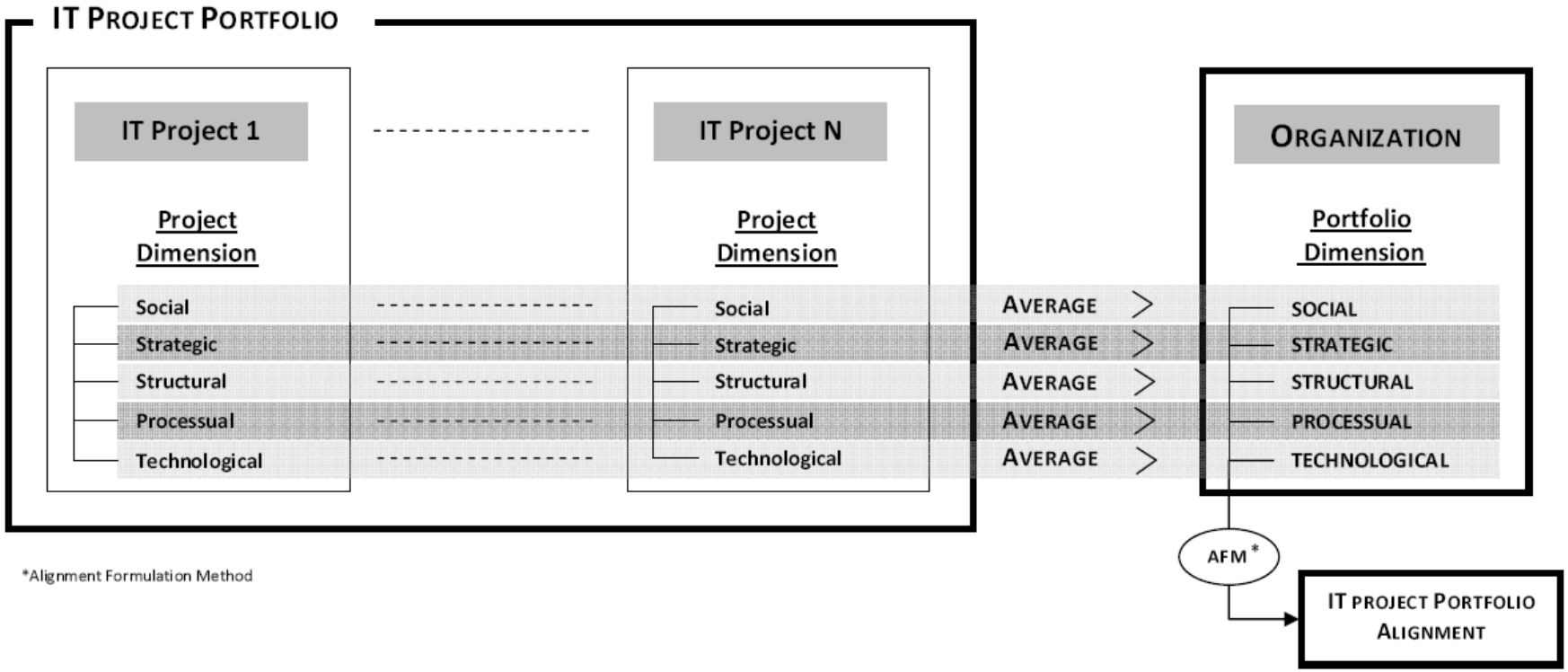

Figure 1. The procedure for calculating the alignment of IT project portfolio

- Second, in an *averaging* method, the portfolio that has the highest sum (or average) of the dimensions is the most aligned one (e.g., see Luftman, 2000a; Sledgianowski, Luftman, & Reilly, 2006). As a result, alignment is higher for the situation with which the average among the five dimensions is higher and the alignment is the same if the average of two different situations are similar (e.g., [2,2,2,2,2] and [1,3,2,1,3] are the same in alignment). In this conceptualization there is only one ideal type which is [3,3,3,3,3] with the maximum average possible, i.e, three. This method appreciates the level at which alignment among the five elements occurs and ignores the variance and mismatch among the scores (see Oh & Pinsonneault, 2007 for a more comprehensive review of these methods).
- Third, since each of the two factors (i.e., mean and standard deviation) partially contributes to the meaning of alignment, we introduce a novel formulation method which aims to integrate the matching and averaging. According to Oh & Pinsonneault's (2007) review, the advantages and disadvantages of the two approaches are complementary and we believe that there can be value in their integration. In our integrative formulation, the first and most important determinant is the level of dimensions (i.e., average). A portfolio with high average score shows that the portfolio's dimensions are in relatively high level, developed, and individually more matured. Second, having a match (i.e., ideally the same score for all elements) between the five elements is another, but minor, criterion for making a portfolio more aligned. In configurational view, the "balances state among the five elements" is also important. Appendix 3 elaborates on the details of formulation.

3 METHODOLOGY

For convenience reasons resulting from the interest of top management, the first two authors had a chance of testing the designed tool in the Department of Transportation (DOT) that is responsible for all modes of transportation in a developing country in Middle East. It is a relatively old organization which was founded 90 years ago as the single organization responsible for constructing and maintaining roads across the country. Other affiliated organizations, were added to DOT during the following decades. The business natures, culture, the context of these affiliated organizations are totally different (including IT use and maturity). Meteorological Organization is IT-based and its business relies on data gathering and analysis. In Civil Aviation Organization (CAO), business relies less on IT but IT plays a strategic role in it, especially for its relationship with international organizations. In contrast, the Railway and Roads Maintenance and Transportation and Railway organizations had barely used IT in their core business and had low degree of IT diffusion and use.

We have generally selected a qualitative approach for data gathering, since the interrelationships between the organization and IT projects specifically in more qualitative dimensions (e.g., social or strategic) requires a qualitative approach such as storytelling. Before data gathering, the instrument development, pretesting and modifications were carried out in three large IT projects outside of DOT and the modifications were made. The choice of projects was guided by first author's discussions with an upper-level manager in IT function (i.e., CIO) who is a knowledgeable person about the projects and their business values. (Markham, Green, & Basu, 1991). We chose to use the "key informant approach" in IT project data gathering. The data was gathered from semi-structured, in-depth interviews with IT project managers in 44 IT projects. This approach is consistent with Huber and Power's (1985) recommendation; in the case where one respondent per project is solicited, it should be the most informed respondent. It is presumed that the project manager would be the most informed respondent regarding the IT project within the IS function and throughout the host organization (Grover, Fiedler, & Teng, 1997). The interviews were conducted by at least two interviewers (including first author). All the notes were compared and aggregated in one manuscript. In the next stage, the summaries were provided to the second author who was isolated from the interview. Based on the interview transcripts, both the first and second author scored each of the projects with the developed tool (example of the template in Appendix 2) and results were compared to each other. On the few disagreement cases, the case was discussed and the two researchers made consensus on the stage of each item that was disputed. The entire process is summarized in Table 1:

Steps	Description	Outcome
1	Selecting IT projects in each organization	
2	Qualitative data gathering through interviews for each IT project	Transcripts
3	Using the capability maturity model developed and validated for quantifying the qualitative data in each IT project (Instrument sample in Appendix 2)	Score for all five aspects of each IT project
4	Calculating the score of each element at the portfolio level (By simple averaging of the corresponding element across all IT projects)	Scores of the portfolio elements in each organization
5	Using different alignment formulation methods (AFM) to calculate the overall alignment in each portfolio	Score of the overall alignment in each portfolio
6	Comparison and validation of the three formulation methods	

Table 1. Research process

4 RESULTS

The alignment of each project and then each organization's portfolio of developing IT applications are calculated. A summary of the descriptive statistics and the three alignment calculation methods are shown in Table 2. The result can be classified in two groups. In the first class, the averaging and integrative methods are similar in the ranking of the organizations. In both methods, the Meteorological, CAO, Roads Maintenance and Transportation, Railway and headquarter are discerningly ranked. The difference between the two method can be observed in the difference is the level of the total portfolio alignment. In particular, the portfolio alignment is significantly higher in linear averaging method compared with integrative method. In the second class, that is the nonlinear matching, the order of the organizational alignment ranking is completely different: Railway, Meteorological, Roads Maintenance and Transportation, headquarter, and CAO.

4.1 Validation of competing formulation methods

The proposed integrative formulation requires to be practically validated comparing to the common alignment formulation methods (AFM) in terms of its usefulness. Accordingly, using the senior management's *perceived degree of portfolio alignment* is a legitimate and common source for validation. The result of the three competing AFMs was shown (including our novel nonlinear method) to four senior IT/business managers who took the role of judges. In this "search process" (Hevner, March, Park, & Ram, 2004), the authors tried to see how AFMs distinctively make sense to judges. By making sense we mean the consistency between manager's perceived portfolio alignment in each organization with the result of each formulation method in alignment ranking and their absolute alignment scores. Particularly, we asked them to pay attention to the ranking of the organizations in portfolio alignment, and also the absolute score (i.e., level) of alignment (e.g., 2.61 out of 3 for Meteorological in averaging approach) in each organization comparing to the others. This enables us to compare various formulations of the emergent portfolio alignment with the high-level measure resulting from senior management's perception of the portfolio alignment. Table 3 illustrates the validation results.

Alignment Formulation Method	Ranking of Alignment	Level of Alignment
Non-linear Matching	×	×
Averaging	✓	×
Integrative Matching	✓	✓

Table 3. Comparing three competing AFMs based on senior management judgments on the ranking and the level of alignment

According to Table 3, the nonlinear matching method received no support from our respondents. All respondents argued that the ranking of the organizational alignment of headquarter and its affiliated

organizations did not make any sense to them in this type of calculation (e.g., first rank of Railway). The averaging method of alignment found partial support in terms of its ranking of the organizations. The respondents argued that the ranking of five organizations made sense to them. However, they emphasized that in this method the alignment scores are overestimated (all scores are above 1.9 out of three). Our new nonlinear calculation of alignment found the most support among the respondents. In addition to the consensus on its ranking, they argued that the level of alignment scores were more realistic. For instance, the IT consultant of the DOT's minister stated that

"Comparatively, this is the most realistic scenario among the three. While I do agree with the ranking of the organizations in terms of the alignment among IT and various organizational elements, the overall score of alignment of all are less than 2 [out of 3] which is consistent with my perception of the IT in DOT. Your previous ranking [averaging] was misleading in showing high degree of alignment for all organizations. Even for meteorological organization that I am closely familiar with, the score was overestimated and things are not that much promising!"

Portfolio Alignment Dimension	Dimension's items (measured at project level)	DOT headquarter and its affiliated organizations				
		Railway	Headquarter	CAO	Roads	Meteorological
Structural	Project structure	1	1.29	1.29	1.17	2
	Reporting relationship	2	2	2	1.92	2.5
	Project budgeting view	2	2	1.86	1.75	2.25
	Project steering committee	2.14	1.71	2.14	1.75	2.5
	Dimension AVERAGE over items	1.79	1.75	1.82	1.65	2.31
Processual	Initiation process	1.43	1	1.43	1.33	1.25
	Implementation process	1.57	1.71	2.43	2.42	2.75
	Project's process integration	2.14	1.86	2.43	1.92	2.5
	Dimension AVERAGE over items	1.71	1.52	2.09	1.89	2.17
Social	The degree of USE by users	2	1.57	2	2	2
	The impact of current culture on the project result exploitations	1.86	1.86	2.43	2.58	3
	Resistance	2.29	2.29	2.43	2.83	3
	Dimension AVERAGE over items	2.05	1.91	2.29	2.47	2.67
Technological	Technological integration and adaptability	2.29	2.14	2.86	2	3
	Supply method (insourcing vs. outsourcing)	2.71	3	3	3	3
	Dimension AVERAGE over items	2.5	2.57	2.93	2.5	3
Strategic	Perceived degree of association between the project goal and business strategies	1.57	1.29	1.86	1.58	2.5
	Perceived degree of association between the project goal and IT strategies	1.86	2.14	2	2	3
	Perceived middle management support	2	1.86	2.43	2.25	3
	Perceived top management support	2	2.14	2.57	2.67	3
	Dimension AVERAGE over items	1.86	1.86	2.21	2.13	2.88
Portfolio's Grand Average (Simple Average of the portfolio's dimensions)		1.98	1.92	2.27	2.13	2.61
Portfolio's Standard Deviation (Standard deviation of the portfolio's dimensions)		0.32	0.39	0.41	0.37	0.36
Alignment Calculation Methods	Linear moderating	**1.98**	**1.92**	**2.27**	**2.13**	**2.61**
	Non-Linear matching	**2.27**	**2.16**	**2.13**	**2.19**	**2.21**
	Integrative	**1.5**	**1.38**	**1.61**	**1.55**	**1.92**

Table 2. Analysis results

5 DISCUSSION: RECONCEPTUALIZING IT ALIGNMENT

5.1 Implications for research

Alignment between IT and business has shown to be an important and persistent source of value for organizations (Tallon & Pinsonneault, 2011). While important, IT research has predominantly focused on how alignment of IT operations with business strategy contributes to the organization's business values. In this paper, we showed that it is also necessary and important to examine alignment in the portfolio of developing IT applications. The portfolio of developing IT applications is argued as a part of the future IT operations and its alignment is contended to contribute to future business value of the organization. This brings another dimension to the notion of alignment in organizations and argues that "the strategic impact of IT not only depends on alignment of the existing IT operation, but also pertains to the alignment of the developing systems that will be a part of the operating applications in future". Accordingly, alignment can be conceptualized according to two dimensions: existing IT applications (i.e., IT processes) and developing IT applications (IT projects). Whatever the approach to alignment (e.g., configurational, strategic, or structural), an organization's alignment can be high or low in any of the IT processes versus projects. Hence, a typology of alignment can be proposed which is created based on different combinations of the two aspects of alignment in organizations. The typology identifies four different situations for the business value of IT where some organizations fit in the typology. This gives us four situations that an organization may be classified in.

First, *leading* organizations are the ones that are high in alignment in both project and operation aspects. For these organizations, especially companies competing in information-intensive industries, it is critically important to maintain the current high level of alignment for future by initiating and implementing IT projects that are highly aligned. In such organizations, while the IT operation is smoothly functioning with a high degree of coupling with other organizational elements (e.g., business strategy), the developing IT application portfolio is attentively tuned and watched for ensuring high degree of alignment. Considerable amount of planning and continuous scanning of the internal and external environment is necessary to ensure that the developing IT applications are progressing well in terms of their fit with desired strategy, structure, or processes. In addition, organizations leading in IT value have IS management in close collaboration with senior management. This ensures shared domain knowledge and shared language and understanding which are among important antecedents of IS strategic alignment (Preston & Karahanna, 2009).

Second, *recovering* organizations are the ones that have high degree of alignment project portfolio despite low alignment in existing applications. In recovering firms, alignment is low in the current IS operation since IT has previously received low attention owing to its low amount of impact and relative importance in the value chain of the business. On the other hand, the portfolio of the developing IT projects has a high degree of alignment with especially the changed aspects of the organization (e.g., new business strategies or a new organizational structure). That is because the organization has deliberately decided to pay more attention to IT in the business operations toward a better business performance. In other words, the organization is experiencing a transformation from a low level of alignment (i.e., low impact) of IT to a high level of alignment (i.e., high impact). The projects under development are mainly the vital applications that facilitate reaching the current and future organizational objectives. Growing manufacturing firms that aim for new products and new markets are good examples of organizations with recovering IT value. The relationship between IT and business folks are improving and IT may even provide the opportunity of vertical integration into the marketing and distribution operations in some businesses.

Third, *declining* organizations have low alignment in the developing portfolio while highly aligned in current IT operations. These organizations are successfully enjoying their current high degree of alignment and therefore, mindlessly extrapolating the same level of firm performance without vigilantly taking care of the developing IT application portfolio. This may also occur owing to IT fad and fashion that boosts when organizations backwardly looking at the success of the operating applications in other organizations (Swanson & Ramiller, 2004). However, Alignment has been found as an elusive challenge for organizations (Preston & Karahanna, 2009). Hence, they experience

decline in IT value and fail to maintain the alignment in developing IT application portfolio despite their high level of alignment in their current IT operations. Business turbulence intensifies the importance of revisiting the situation and making modifications in the developing IT applications portfolio. The illusion of the high degree of alignment in the existing systems may lead to less attention to the deviation of IT project alignment and its management during the IT project adoption to assimilation lifecycle. The partnership trend between IT and business is also declining for less attention to IT and its future contribution for business.

Finally, *lagging* organizations are the ones that are low in alignment both in developing and operational IT applications. Their existing IT applications are separated, non-integrated, and archipelago with low degree of alignment. In addition, their developing IT applications are also similar in that their unclear contribution to the whole organization and their blurred alignment with organizational aspects. For example, organizations that mindlessly adopt IT applications based on the IT fad and fashions are among the ones that are more likely to be classified as lagging since they pay less attention to the alignment (DiMaggio & Powell, 1983). In addition, organizations that are under survival concern and compete in an uncertain environment are also likely to pay less attention to the nuances of the IT application alignment in their IT project initiation to its assimilation (Martinez & Dacin, 1999). There is a minimum collaboration between IT and business people and IT people has no formal involvement in the business planning process (King, 2009).

As a result, this paper argues for a broader view of alignment by incorporating the notion of alignment in developing IT applications in addition to existing IT applications.

5.2 Future research

While the typology extends our understanding of the alignment in organizations and its expected effect on business, it raises some questions that could be addressed in future research. In particular, a lot of questions can be raised about the organizations in each situation. First, exploratory studies are needed to test whether there are common characteristics among organizations of a one type. For instance, firms competing in information-intensive industries are more likely to be found in leading category because of the long-term experience of the organization in exploiting IT in accordance with its business strategy. Integrated IT and business planning, organizational mindfulness, knowledge sharing, and good partnership between IT and business folks may also be some internal characteristics of leading organizations. Second, further research is needed to understand why an organization may experience change in alignment moving from operation to projects (in recovering and declining organizations)? In recovering firms, organizational learning and increasing concerns for survival may be some reasons that lead an organization to shift toward developing aligned IT applications. On the other hand, organizational mindlessness, fad and fashion, and preoccupation with success can lead an organization to initiate projects that are low in alignment in declining firms. Finally, an intriguing question for future research is to see the patterns of change for organizations from one type to another. Empirically exploring different patterns of change as well as the how and whys of such big changes for an organization require theory building through deep, qualitative studies in organizations. For instance, investigating the process of moving from a leading firm to declining organizations is an interesting question to answer.

5.3 Contributions

Several contributions are resulted from the current study. First, we opened a new discussion for including developing IT application in the alignment literature. We argued that ignoring the alignment in developing IT applications may harm future business values of IT in organizations. It is of crucial importance to simultaneously monitor, control and plan for alignment in existing as well as the developing IT applications and operations. Second, we have designed a multilevel tool which emergently constructs portfolio alignment based on IT projects. Current literature on alignment dominantly measures alignment construct at organizational level with employing proxy variables (e.g., CEO's perceived degree of alignment). While some studies have called for moving away from preoccupying with alignment at organizational level (e.g., see Tallon & Pinsonneault, 2011), to the

best of our knowledge, none has clearly conceptualized and operationalized alignment as an emergent construct based on the alignment at grass-roots levels of organization. We do agree that not reducing the portfolio alignment construct to lower level and taking a proxy approach to construct measurement is useful and necessary. However, grass-root measurement of alignment and emergently constructing the portfolio alignment can also be insightful by helping managers understand the roots and reasons behind their current misalignment at the lower levels. This enables managers to manage portfolio alignment (that will be a part of operation in near future). Third, the conceptualization and operationalization of IT project alignment is another contribution of this study. While the notion of IT project alignment has been introduced in IT research (see Chan & Reich, 2007b), the construct has been loosely defined. Our model theorized a configurational approach to alignment of IT project portfolio based on multiple organizational aspects. Fourth, we employed a novel alignment formulation method at portfolio level which illustrated to better explain variations in higher-order alignment in our limited number of cases. We empirically tested the artifact in a large organization and found general support for the usefulness of the designed tool. We believed that this integrative approach provides additional insights comparing to each of the previous approaches.

5.4 Limitations

There are also several limitations associated with our study. First, as mentioned earlier, the study has sacrificed IT project elements' "depth" in favour of the "comprehensiveness" of the study toward more usability. In essence, as the customer of such a design research are practitioners, they are more interested in having a tool that covers more organizational dimensions with accepted minimums comparing to a deep investigation of each element and its items. Second, this study only provides an illustration of our tool applicability and usefulness in our limited case and therefore, requires a broader testing of the proposed IT artifact. Third, interviews were dominantly based on project managers that can create bias in the result. Despite our attempts for triangulation, it was best to have the chance of interviewing more stakeholders of IT projects.

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6 APPENDIX 1

Finalized items for the five aspects of IT projects after validations.

Project Element	Description	Items		Reference
Structural	Degree of organization in project's roles, responsibilities, governance	Project governance structure		(Luftman, 2000a) (Sledgianowski et al., 2006)
		Roles, responsibility, and reporting relationship		
		Project budgeting		
		Project steering committee		
Processual	Degree of project's maturity in initiation, implementation and integration process	Project's process integration		(Earl, 1993; Segars & Grover, 1999) (Barki & Pinsonneault, 2005)
		Initiation process		
		Implementation process		
Social	Degree of user's project buy-in and its use	The degree of actual use by users		(Reich & Benbasat, 2000) (Chan & Reich, 2007b)
		The impact of current culture on the project result exploitations		
		Resistance		
Technological	Degree of technology acceptance and internalization	Technological integration and adaptability		(Barki & Pinsonneault, 2005) (Earl 1996), (Iacovou, Benbasat, & Dexter, 1995)
		Supply method (in-sourcing vs. outsourcing)		
Strategic	degree of perceived association between the IT project and perceived organizational business and IT strategies	Perceived degree of association between the project and	business strategies	(Lederer and Sethi 1988; Earl 1993) (Chan & Reich, 2007b)
			IT strategies	
		Perceived middle management support		
		Perceived top management support		

7 APPENDIX 2

Strategic Dimension			
	Level 1	**Level 2**	**Level 3**
Perceived degree of association between the project and business strategies	Business strategies are not specified and project manager does not have a clear understanding of the business strategies and its association with the project.	There is not a formal strategic planning practice, but the project manager perceives more than average degree of alignment between the project and the informal, perceived business strategies.	There is a formal strategic planning practice and the project manager perceives a high degree of alignment between the project and the business strategies.
Perceived degree of association between the project and IT strategies	IT strategies are not specified and project manager does not have a clear understanding of the IT strategies and its association with the project.	There is not a formal strategic planning practice for IT, but the project manager perceives more than average degree of alignment between the project and the informal, perceived IT strategies.	There is a formal IT strategic planning practice and the project manager perceives a high degree of alignment between the project and the IT strategies.
Perceived middle management support	Middle managers do not support the project both financially and non-financially (e.g., verbally)	Middle manages support the project non-financially (e.g., verbally) but not financially.	Middle manages support the project both non-financially (e.g., verbally) and financially.
Perceived top management support	Top managers do not support the project both financially and non-financially (e.g., verbally)	Top manages support the project non-financially (e.g., verbally) but not financially.	Top manages support the project both non-financially (e.g., verbally) and financially.

8 APPENDIX 3

The score of each portfolio element is calculated by averaging corresponding element across IT projects. After calculating the score of each element at portfolio level, we can calculate the alignment of developing IT application portfolio based on a nonlinear, integrative method that gives the most weigh to the average of the five elements and the second priority to the standard deviation at which matching occurs. The average (μ_o) is also a *simple mean* of the scores of the five portfolio dimensions. Sigma (σ_o) is the *standard deviation* of the scores of the five aspects of the portfolio that shows the degree of matching among the five elements. We have added 1 to the standard deviation in the denominator for two important reasons: First, without adding 1, μ_o/σ_o ratio (Sharpe ratio in risk management) would be a formulation which gives more power to standard deviation (i.e., matching), rather than the averaging. As such, the standard deviation in the denominator would strongly influence the overall ratio, unless combined with 1. Second, adding 1 would normalize the alignment score in the case of zero standard deviation among the alignment elements.

$$\text{Portfolio level alignment} = \frac{\mu_o}{\sigma_o + 1}$$

$$\textit{Variance of the five aspects at portfolio level:} \quad \sigma_o = {}^1\!/_5 \sum_{k=1}^{5} (X_k^o - \mu_o)^2$$

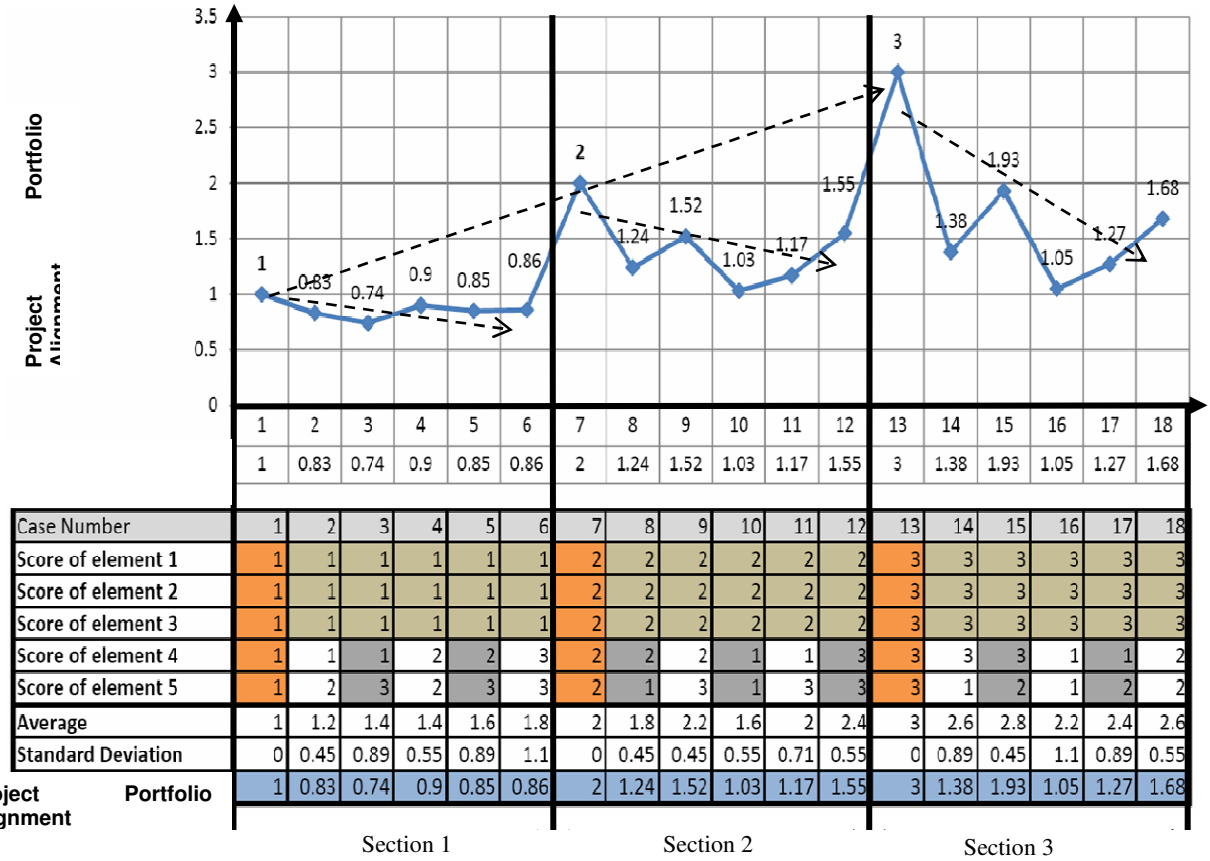
$$\textit{Mean of the five aspects at portfolio level:} \quad \mu_o = {}^1\!/_5 \sum_{k=1}^{5} X_k^o$$

Score of K^{th} element of the portfolio: $X_K^o = {}^1/_n \sum_{i=1}^{n} \text{Aspect } K' \text{s score in IT project } i$

Score of the K^{th} element of the project i: $X_K^{Pi} = {}^1/_m \sum_{m} \text{Item } m$

(o: Portfolio; i: project index; n: number of project; m: number of items in element K)

The following figure illustrates the trend of change in portfolio alignment with our integrative formulation method. On the one hand, *within sections*, the averages are close and therefore standard deviation plays a clear role in decreasing alignment when the variance increases. The decreasing trend of alignment in each section illustrates the second important role of standard deviation. On the other hand, *between sections,* the overall increase in alignment shows the importance of average as the main factor determining alignment. As a result, it can be observed that, overall, the alignment increase with escalation of dimension averages. However, it decreases when the standard deviation among dimensions rises.



Case Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Score of element 1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
Score of element 2	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
Score of element 3	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3
Score of element 4	1	1	1	2	2	3	2	2	2	1	1	3	3	3	3	1	1	2
Score of element 5	1	2	3	2	3	3	2	1	3	1	3	3	3	1	2	1	2	2
Average	1	1.2	1.4	1.4	1.6	1.8	2	1.8	2.2	1.6	2	2.4	3	2.6	2.8	2.2	2.4	2.6
Standard Deviation	0	0.45	0.89	0.55	0.89	1.1	0	0.45	0.45	0.55	0.71	0.55	0	0.89	0.45	1.1	0.89	0.55
Project Alignment / Portfolio	1	0.83	0.74	0.9	0.85	0.86	2	1.24	1.52	1.03	1.17	1.55	3	1.38	1.93	1.05	1.27	1.68

Section 1 Section 2 Section 3

Simulated trend of IT portfolio alignment – integrated method