Strategic Alignment of Enterprise Systems and Business Strategies under Systems and Bivariate Approaches

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Abstract

Across holistic and bivariate approaches, we examine complex relationships amongst strategic alignment, strategic enterprise systems flexibility, and business performance. Our evidence is based on data collected from top management in North America. We observe a positive correlation between alignment and business performance. In addition, the relationship between enterprise systems strategic flexibility and performance have shown more significant results with a robust correlation when alignment act as a mediator. Our results indicate that while systems approach provides more significant results, bivariate approach allows deeper examination of constructs.

1. Introduction

Alignment has been one of the key issues and concerns of Enterprise Systems (ES) in academia and among practitioners [1]. Alignment has been cited as one of the most critical concept for business executives for more than 20 years [2, 3] and the benefits of aligning business and ES strategies have been recognized by academics as well [4, 5]. Literature shows that alignment improves the performance by allowing organizations to use ES more strategically [6, 7]. In addition, Papp [8] states alignment is a key area that managers focus on in order to improve financial performance [9].

In spite of the fact that the benefits of aligning generic ICT and business strategies have been studied deeply, a more granular work i.e., in terms of technology on alignment [7] and a clear definition of alignment is still lacking. The main reason for this absence is the complexity and multi facet nature of the concept [7]. In addition, the perspectives to examine alignment play a critical role for alignment studies. These perspectives include whether alignment is an output or end state, or a dynamic process or a hybrid, the type of approach (holistic therefore system, or dimension-specific therefore bivariate, or selection) [10], and level (whether process, business unit, or firm). The objective of this study is twofold: first, to measure alignment via moderation approach [11], and second, examine the alignment of a specific ICT, Enterprise Systems (ES) and business strategies as well as the relationship between alignment and strategic flexibility of ES. Choosing the right method for alignment studies is critical for robustness of the study [7, 12-14]. Because of the design of this study and the fact that synergistic approaches such as moderation are superior methods than simplistic methods such as matching, we adapted the alignment as moderation approach, which is different from the moderation in SEM studies. The study addresses the gap on alignment studies with a specific technology (Enterprise Systems) focus rather than a generic approach and the conflicting findings in the literature regarding flexibility of alignment. With the aforementioned objective in mind, we perceive alignment as a hybrid (between continuous and end state) process and examine it at firm level from a holistic perspective. We define alignment as a continuous and dynamic process that requires appropriate and supportive use of ES with business strategies and objectives in order to contribute or enhance the business performance over time.

Alignment studies are complex in nature [7, 15] and require explanation and justification on several issues such as approach to study alignment (i.e., bivariate or systems approaches), components to be examined (i.e., flexibility, performance, measuring alignment, specific aspect of alignment) for alignment. Based on this, the rest of the document has been structured as follows: The next section, literature review will examine the alignment concept from different approaches, i.e., bivariate or systems approach, and measurement types, enterprise systems, flexibility, and performance. Methodology and results sections will clarify the methods and outputs of this research. Finally, conclusion will be the final section of the study.

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2. Literature Review

2.1. Bivariate and systems approaches

The most common approaches to alignment are interaction (bivariate), and systems [10]. Drazin and Van de Ven [10] define interaction and systems approaches of fit as: "the interaction of parts of organizational context-structure factors; it affects performance" and "the internal consistency of multiple contingencies and multiple structural characteristics; it affects performance characteristics" (p. 515). Interaction approach focuses on the effects of the interaction between structure and context on performance in terms of the variations. It is capable of detecting fit among certain and limited pairs of context-structure relationship [10, 16]. Models are analyzed through disaggregation of the elements of theory and their interaction with performance. While the advantages of integration include more detailed and accurate analysis, disadvantages include the reductionism and lack of capturing the whole aspect of the theory as well as being unstable because of their non-independent structure with other constructs or elements of constructs. On the other hand, systems approach allows more comprehensive multivariate analysis and holistic approach for observing the patterns in dimensions. In the systems approach, "relationships between complex constructs are meaningful" while in bivariate approach "the components or dimensions, of these complex constructs can be disaggregated and relationships between these can be meaningfully tested" [17], (p.135).

2.2. Measuring alignment

Measuring the alignment is one of the highly debated issues in alignment studies [18]. The most well-known, empirically tested, and conceptually robust method for the measurement of alignment put forth by Venkatraman [11]'s study. Venkatraman [11] identifies six perspectives to measure fit/alignment: (a) fit as moderation; (b) fit as mediation; (c) fit as matching; (d) fit as gestalts; (e) fit as profile deviation; and (f) fit as covariation. The main criteria for selecting the appropriate measurement type are the mathematical argument and the concept. The mathematical formulation must be adequate with the concept in order to get consistent results and the researchers should question the validity of their choices [10, 11, 19]. Because of these reasons and the type of data collected via survey questionnaire, fit as moderation has been selected as the measurement type for alignment.

Fit as Moderation (Interaction): Refers to the case where the impact of one variable to another one, a predictor variable and a criterion variable, is dependent on a third variable; moderator. In this case, both predictor and moderator and their fit have an effect on the criterion variable [20]. Fit as moderation has been suggested as an appropriate method for examining the link between typologies such as Miles and Snow typology and performance [21]. It is a synergistic approach and more suitable method than simplistic methods such as matching [7, 12].

2.3. Enterprise Systems

Enterprise systems are different from legacy systems because of their complex structures and intertwined nature with people and organizational processes. Choosing and installing software is relatively easy, but this is not the case for ES systems, which includes Enterprise Resource Planning, Supply Chain Management Systems, and Customer Relationship Systems for this study, because of the nature of the system.

Studies reveal ES has many benefits to organizations including integrating data, supporting business functions, customer satisfaction, and better business performance. However, it is difficult to reap the benefits from ES immediately. They require a detailed and careful plan before acquiring the system, during implementation, and after implementation. Considering they are expensive systems, failure of an ES could cause both tangible and intangible cost to an organization. Meanwhile, research shows adopting an ES system alone does not guarantee a competitive advantage or business performance benefits [22] by themselves alone.

ES may require significant changes in business practices or even in the strategies of an organization. ES projects are more successful when management understands their strategic importance and gives high priority to alignment [23]. In fact, most ES projects either fail during implementation or conflict with the business strategy after adoption because of a mismatch in objectives [24]. One way to avoid this mismatch is to align ES and business strategies.

2.4. Flexibility and strategic flexibility

Flexibility has been studied under several disciplines [25] thus had several definitions. In several studies, flexibility has been examined with or as related to agility [1, 26]. We perceive flexibility as a combination of Langdon [27] and Evans [25] approaches on flexibility. Evans [25] defines strategic

flexibility as "the contemporary term for a classical principle of strategy" (p. 69). On the other hand, Langdon [27] defines ES flexibility as "the ready capability of an information system [enterprise systems] to be adapted to new, different, or changing business requirements" (p. 6). Strategic flexibility allows an organization to modify the course of action based on the encountered situations, whether they are expected or unexpected. Considering the importance of high technology in today's business world, strategic flexibility would be more critical because of the speed of the change in business processes, production, manufacturing, and logistics [25]. By combining these two researches, we can understand the current ES flexibility concept more in depth.

Based on the aforementioned literature, we define ES flexibility as "the capability of an organization to adapt or react to the expected or unexpected conditions of business requirements through effective and supportive use of enterprise systems" and because of the strategic perspective on flexibility, we call it strategic ES flexibility. Strategic ES flexibility allows organizations to speed up operation [28], generate innovative solutions, introduce new products or services when realizing a chance [29], closely observing competitors, identify and evaluate new business opportunities, accommodate efficient changes based on the business requirements, give learning opportunity [28, 30], etc. A flexible Enterprise Wide Information Systems can allow organizations to give better and quicker response [28] to customers and suppliers changing demands and needs. Since the structure of ES plays a key role in performance [31-33], flexible ES can enhance the competitive performance of firms [9].

2.5. Business Performance

In the alignment research, business performance is the most widely used dependent variable [34-38]. Business performance can be examined based on perceptions [12, 39]. In ES literature, perception based measurement of performance is more common [13, 14, 40, 41]. One benefit of examining business performance through perception is to be able to capture realized performance rather than intended performance. An organization may have planned on their performance; however, these goals are not always achieved. Therefore, examining realized performance provides more reliable results while measuring performance of organizations.

In addition, a recent and well respected method for measuring performance is examining performance over different components such as profitability, productivity, and growth [4, 39, 42], asset turnover, profit margin, return on equity and sales markup [43]. This method is also a complementary approach while examining flexibility [44, 45]. Several researchers, Chan [4, 12, 39], Cragg et al. [46], Raymond and Croteau [42], and Croteau and Raymond [47] have adapted this approach for their studies. Therefore, as an extension of this approach we have adopted relative financial performance and absolute financial performance. Both these approaches use the elements suggested by researchers such as revenue growth, financial liquidity, market and share gains, net profits, return on investment, and overall performance relative to their competitors. There is also their actual cash flow, net profits, return on sales and return on investment. Another extension of performance measurement is the addition of product and service innovation which is also suggested by Chan.

In this study, we examine firm level strategic alignment from holistic and bivariate perspectives where alignment is a hybrid state and developed the instrument based on these perspectives. Therefore, the appropriate alignment measurement will be fit as moderation, which measures the synergy as the impact of individual elements and the collaborative impact or interaction of these two elements [11] for our study. In addition among various types of performance definitions and performance measurement, we follow the approach of Chan [17, 39] and focus on the perception of respondents regarding performance. Therefore, this study measures realized business performance based on perceived business performance supported with financial facts. See Figure 1a and 1b for the conceptual model of the study.

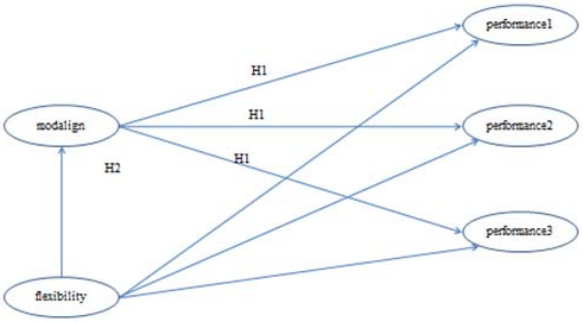

Figure 1a Conceptual model with bivariate approach

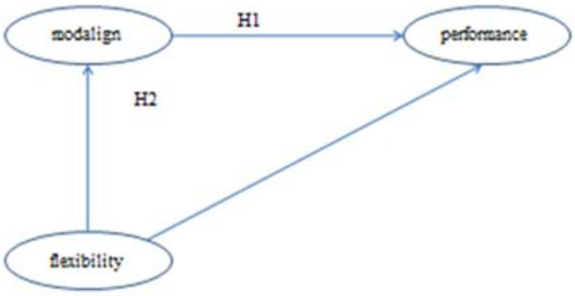

Figure 1b Conceptual model with systems (holistic) approach

The hypotheses of the study are as follows:
Hypothesis 1: There is a positive relationship between alignment and business performance.
Hypothesis 2: There is a positive relationship between flexibility and business performance through alignment.
Hypothesis 3: The level of ES flexibility is positively associated with alignment.
Hypothesis 4: Alignment mediates the relationship between flexibility and performance.

3. Methodology

Survey research is the appropriate method for collecting primary data pertaining to "describe, compare, or explain individual and societal knowledge, feelings, values, preferences, and behavior" [48, 49], (p.1). The survey instrument for this study has been developed using Venkatraman [11], Chan [39], and Sabherwal and Chan [4] studies. The survey instrument adopted in this study has been used and validated by other researchers [15, 46, 50, 51] as well. In addition, small pre-test including analyses for internal consistency, reliability, unidimensionality and convergent validity, and discriminant validity [52] have been conducted.

The respondents of the questionnaire were from North America and include several industries such as manufacturing and service. The survey questions are closed-ended questions with a five-point Likert scale. The survey questionnaires were sent to approximately 1000 companies; however, several of them were returned due to change of address, not accepting mail without specific names, not participating in surveys because of company policy. 114 surveys were returned. However, we had to eliminate 22 of the questionnaires due to incomplete data. Although the instrument had been tested by other researchers and it showed high validity, after minor modifications, a small pre-test has been conducted before finalizing the survey instrument.

In this study SPSS version 17, AMOS 6, SAS 9.0, and WarpPLS, a Structured Equation Modeling (SEM) based statistical tool have been utilized to conduct the analysis. Partial Least Squared (PLS) that is an SEM based tool has been used in order to analyze collected data. PLS is variance based and a second-generation multivariate method capable of identifying both linear and nonlinear relationships among the variables/constructs [53] (p. 314) and does not require normality. In addition, PLS and WarpPLS provide the estimated coefficients of the paths as well as the regression between latent variables.

4. Results

Among the participants, 12 of them were CIOs, 37 of them were IT managers, six reported themselves as users, and 37 of the respondents were "Other" including CEO, CFO, and Managers. Most of the companies, of which the data have been collected, can be considered as large corporations since their annual sales are more than (US) $10 million.

Exploratory Factor Analysis (EFA) has been conducted to explain the observed correlation and/or covariance structure among the items by grouping them into a number of factors. Another benefit of using EFA was to identify and eliminate the poorly loading items. Following the EFA, Confirmatory Factor Analysis has helped us to confirm our structure of factors. In a factor analysis, as a rule of thumb, 0.5 or higher loadings are required [54]. Our results indicate the Kaiser-Meyer-Olkin value as 0.797 and Bartlett's test of sphericity as 630.418 and significant (at 0.01 level) stating that factor analysis can be conducted. In addition, the Total Variance Explained is 63.323% for our analysis. Factor analyses reveal that the discriminant validity of the instrument holds. Table 1 also reveals information regarding the reliability of measurement. Cronbach's alpha and composite reliability are two measurements to assess the reliability [55, 56]. Our results show both Cronbach's alpha and composite reliability measurements are above the required levels. The minimum reliability measurement of Cronbach's alpha is 0.697 and the largest value is 0.887; while the minimum composite reliability measurement is 0.832 and maximum value is 0.912. Since these measures are above the threshold, our results indicate an acceptable reliability for the measurement model (see Table 1). Table 2 shows the correlations among the performance measures.

Performance	Variables	Factor1	Factor2	Factor3	Cronbach's Alpha	CR
Absolute Financial Performance	AFP1	***0.792***	-0.028	0.034	***0.887***	***0.912***
	AFP2	***0.660***	0.170	-0.078		
	AFP3	***0.669***	0.151	0.182		
	AFP4	***0.658***	0.172	-0.172		
	AFP5	***0.608***	0.262	-0.090		
	AFP6	***0.873***	0.219	0.187		
Relative Financial Performance	RFP1	-0.072	***0.797***	0.126	***0.862***	***0.907***
	RFP2	0.107	***0.833***	0.066		
	RFP3	0.232	***0.766***	0.104		
	RFP4	0.219	***0.822***	-0.029		
Product-Service Innovation	PSI1	-0.159	0.150	***0.714***	***0.697***	***0.832***
	PSI2	0.241	0.037	***0.649***		
	PSI3	0.118	0.041	***0.849***		

Table 1. Exploratory factor analysis and reliability values for performance measurement

Notes:

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
AFP: Absolute Financial Performance
RFP: Relative Financial Performance
PSI: Product-Service Innovation

Constructs	Perf1	Perf2	Perf4
Perf1	(0.775)		
Perf2	0.391**	(0.842)	
Perf3	0.209*	0.215*	(0.790)

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 2. Bivariate correlations and square roots of average variance extracted values for performance measurements

4.1. Alignment as moderation under bivariate approach

We have conducted further PLS analysis with a bivariate approach in order to get more detailed results related to our model. As researchers [10] stated bivariate approach provides rich information about each elements of the model. Although detailed results can provide valuable information, researcher should keep in mind the limitations about bivariate approach (i.e., unstable and un-independent [12]. Our results for the model of alignment as moderation with bivariate approach are shown in Figure 2. Alignment has positive and significant relationship with relative financial performance (β=0.22 and significant at 0.05 level) and product-service innovation (β=0.32 and significant at 0.01 level) while it does not have any significant relationship with absolute financial performance. Although the average path coefficient (APC) value is 0.235 and significant ($p<0.01$) the average R^2 (ARS) value was not significant. This may indicate problem in the fit of the model. Considering the concerns in literature, these results were not surprising because of the nature of the bivariate analysis.

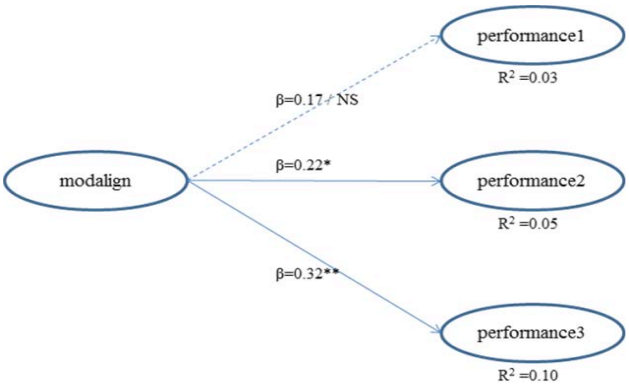

Figure 2. Path coefficients in SEM for alignment as moderation – bivariate approach

Notes:

*: Correlation is significant at the 0.05 level (2 tailed)
**: Correlation is significant at the 0.01 level (2 tailed)
NS: Not Significant
β: Path Coefficient
Modalign: Alignment as Moderation
Performance1: Absolute Financial Performance
Performance2: Relative Financial Performance
Performance3: Product-Service Innovation

Further bivariate analysis includes the model with strategic ES flexibility (see Figure 3). The surprising finding about the analysis was, although it was 0.1 level, there were significant results between flexibility and product-service innovation. The model fit is acceptable since APC is 0.230 ($p<0.01$) and ARS is 0.207 ($p<0.01$) and AVIF is 1.906, indicating no risk of multicollinearity.

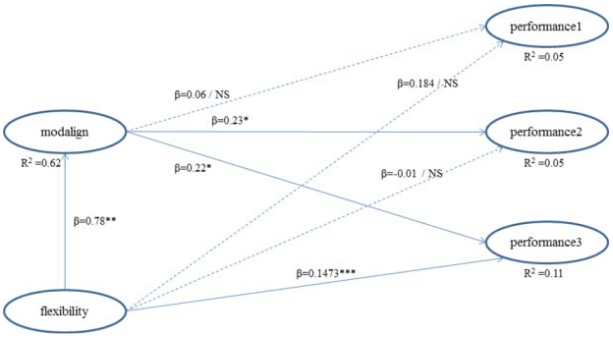

Figure 3. Path coefficients in SEM for alignment as moderation with flexibility – bivariate approach

Notes:

*: Correlation is significant at the 0.05 level (2 tailed)
**: Correlation is significant at the 0.01 level (2 tailed)
NS: Not Significant
β: Path Coefficient
Flexibility: Strategic ES Flexibility

4.2. Alignment as Moderation under Systems Approach

The results from WarpPLS analysis reveal the relationship between strategic alignment and performance is positive and significant (β=0.30 at 0.01 significance level). Total variance explained is found as 0.09. In addition to aforementioned analysis, we have calculated the fit for the theoretical model shown in Figure 4. Kock [57] suggests using a set of measures such as ARS, AVIF and APC values to examine the quality of the model. Our results show that ARS value is 0.089, APC value is 0.298 and both of these measurements are significant at the 0.01 level. In addition, AVIF value is 1.00, which is less than five; therefore indicating a good fit of the model. In other words, calculations of model fit reveal goodness-of-fit for the model is acceptable.

Figure 4. Path coefficients in structural equation model for alignment (moderation) and performance

Notes:
*: Correlation is significant at the 0.05 level (2 tailed)
**: Correlation is significant at the 0.01 level (2 tailed)
β: Path Coefficient
ModAlign: Alignment as Moderation

Furthermore, we have examined the relationship between alignment, performance, and flexibility. Therefore, we test the model with alignment as a mediator (different from the alignment measurement type) between flexibility and performance. As shown in Figure 5, the relationship between alignment and flexibility (β=0.78), and alignment and performance (β=0.26) are significant at 0.01 level and 0.05 level, respectively. However, the results reveal the relationship between flexibility and performance is not significant. For this model, the recorded APC value is 0.365; ARS is 0.353 and significant at 0.01 level while the AVIF value is 2.254 stating a good fit of the model without any risk of multicollinearity.

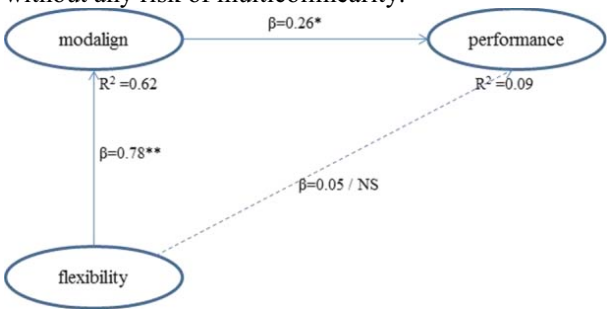

Figure 5. Path coefficients in structural equation model for alignment as mediator

After analyzing the relationship between alignment and performance, the ANOVA test was used to examine relationships between performance and flexibility. For this purpose, flexibility was converted into three levels: low, medium, and high for simplicity purposes. The ANOVA test has been used for testing the mean differences in performance for the three groups of flexibility (see Table 3).

Performance	Mean	Standard Deviation	Mean Squares	F Value	Sig.
Performance 1	3.384	0.745	0.554	1.151	0.321
Performance 2	3.342	0.863	0.737	1.507	0.227
Performance 3	3.301	0.733	0.509	3.575	0.032

Table 3. ANOVA results for performance based on level of flexibility

Further ANOVA results reveal three levels of flexibility, as low, medium, and high, are statistically significant for alignment as moderation. In addition, as the level of flexibility increases, the mean difference for alignment increases (see Table 5). Therefore, we can argue as the level of flexibility increases, the alignment increases as well.

Construct	Level of Flexibility	Mean	Standard Deviation	Mean Squares	F Value	Sig.
Alignment as Moderation	Low	11.343	2.614	8.237	49.949	0.000
	Medium	17.136	2.844			
	High	21.560	3.005			

Table 4. Results for alignment as moderation based on flexibility level

Construct	Levels of Flexibility		
Alignment as Moderation		Medium	High
	Low	-5.792**	-10.217**
	Medium	-	-4.424**

Table 5. Post hoc tests for alignment as moderation based on flexibility level

Based on the results, the statuses of some of our hypotheses are presented in Table 6.

Hypotheses	Status
Hypothesis 1: There is a positive relationship between alignment and business performance.	Supported
Hypothesis 2: There is a positive relationship between flexibility and business performance through alignment.	Supported
Hypothesis 3: The level of ES flexibility is positively associated with alignment.	Supported
Hypothesis4: Alignment mediates the relationship between flexibility and performance.	Supported

Table 6. Summary of hypotheses and their status

5. Discussion and Conclusion

Business performance interacts with other functions of business and Enterprise Systems (ES), either

directly or indirectly. Alignment of ES with business strategies and its flexibility are among the most important factors for the last several years [1, 58, 59]. In this study, we have examined the relationship between business performance and fit between a technology component and strategy. In addition, theorizing the role of strategic ES flexibility provided a better understanding of alignment and its antecedents. In summary, our research examines the nature of relationship between these three constructs within enterprise systems context.

After conducting the appropriate analysis with the data, our results indicate alignment is positively and significantly correlate with performance. Moreover, individual examinations of flexibility and performance, and alignment and performance reveal these constructs are related to each other. Further examination of the constructs enhances our understanding about the relationships among them when they are interacting. In addition, strategic ES flexibility has indirect impact on business performance through alignment. As hypothesized, our results showed flexibility had an impact on performance through alignment in addition to its individual impact. In other words, alignment in this study mediates the relationship between flexibility and performance.

Based on our results, we argue that alignment is a critical factor with an impact on performance. ES alignment is not just a simple function of ES and business strategies; it is part of a complex mechanism that incorporates the flexibility of an enterprise system. A flexible ES contributes to improvement of the performance; this impact is more likely to be greater through alignment.

In addition, a comparison of results reveals that analysis based on the systems approach provides more significant results than the bivariate approach, which may be chosen when detailed analysis on specific constructs are needed [10].

The nature of this study required data collection from the top management. Therefore, response rate and longtime availability of subjects were its major limitations.

This study contributes to the strategic alignment theory by expanding it with the use of a specific technology and inclusion of ES flexibility. In addition, practitioners can benefit from this research as a guide to assess their alignment between their ES strategy and their business strategy.

This stream of research can be extended with different perspectives. These perspectives include using a longitudinal study to have a deeper understanding on alignment concept; examining flexibility from agility (sense and respond as Overby et al. [60] identify it) perspective; and last but not the least by using different and appropriate methods for measuring alignment.

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