

How Strategy and Governance Choices Influence Innovation Success in Software Products and Services

Completed Research Paper

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Abstract

This research studies the effect of key strategy and governance choices on chances of success of innovation in software products, and we test our hypotheses based on data from more than 150 professionals in the United States who are responsible for new software product development. We find the right balance of onshore and offshore team members to be more salient in influencing innovation success than decisions related to insourced versus outsourced development. Our findings suggest a greater likelihood of innovation when business executives make technical decisions, particularly if firms compete by selling high price margin software products or services.

Keywords: Software Product Innovation, Outsourcing, Offshoring, Governance, Decision Rights

Introduction

Information technology (IT) and software innovations are not only key for survival and success of high-technology firms in IT-producing sectors of the economy, they are becoming a key consideration in other sectors as well, as demonstrated by success of firms such as Uber and Airbnb in challenging incumbents. Arguably, to the extent all businesses are becoming information businesses, there is a general awareness about the importance of innovating with new software products and services. Many firms are trying new software development approaches to become more responsive to their customers, develop software functionalities more quickly and generate new revenue streams from software based products and services (Kude et al. 2015; Loftus 2015; Maruping et al. 2009; Rubinstein 2015). However, despite significant interest in understanding the factors influencing innovation success (Kwon and Zmud 1987; Robey and Boudreau 1999), and interest in exploring situational determinants of innovative environments (Nambisan et al. 1999), we know little about how strategic and governance choices of firms influence success in innovating with new software products and services.

We view innovation success broadly here to include time to roll out, new revenue streams created by new software products, and competitiveness of software in the market. This view of innovation is consistent with similar broad definitions of innovation in prior literature. Nonaka et al. (2003) define innovation as

a “result of combining different knowledge sets”, and such knowledge usually resides outside organizations (Chesbrough 2003; De Wit et al. 2007). Besides creation of knowledge, Afuah (1998) emphasize its implementation and use in the marketplace. Maranville (1992) argues that “every product that is new to the organization is not necessarily an innovation. A product is innovative when it satisfies new market needs or existing market needs in a new way” (p. 30). Baregheh et al. (2009) conducted a meta-analysis of innovation and defined innovation as “the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace” (p. 1334). Leiponen and Helfat (2010) operationalize innovation by considering whether a firm introduced any technological innovations and percent of sales revenues from the sale of new technological products regardless of whether they were new to the market.

This study focuses on the effect of a firm's strategic and governance choices on success of new product development. Our key assertion is that creating successful innovations requires transfer of individual and collective knowledge between internal and external resources across geographies, making it necessary to pay careful attention to how a firm disaggregates itself in its value chain or across geography (Apte and Mason 1995; Mithas and Whitaker 2007). In turn, these choices reflect in terms of a firm's strategic posture with respect to outsourcing (value chain disaggregation) and offshoring (geographic disaggregation), and it is not uncommon for firms to swing back and forth in the extent to which they use outsourcing and offshoring with mixed results (Aron and Singh 2005; Carmel and Agarwal 2002; Mithas et al. 2013; Overby 2006). For example, according to media reports, GM was reportedly trying to reverse its use of outsourcing from 90% in 2012 to only about 10% by 2015 (Murphy 2012), partly to become more innovative. Likewise, the extent to which business leaders should get involved in technical decisions has been a fundamental question in the IT governance literature (Weill 2004) with little empirical guidance on the implications of those choices for innovation success.

Against this backdrop, the goal of this study is to examine the effect of dispersion across geographic boundaries and dispersion across firm boundaries on firms' success to create innovative products and services. In addition, we focus on where to locate decision rights for technical decisions. One of the objectives of many innovation programs is to create a diverse environment because studies show that there is a positive relationship between diversity of the knowledge base and a firm's innovation success (Breschi et al. 2003; Garcia-Vega 2006; Leiponen and Helfat 2010; Leiponen and Helfat 2011). Prior work argues that software development projects may benefit from the diversity of the knowledge and experience of involved individuals (Quintana-García and Benavides-Velasco 2008). We focus on three types of diversity: cultural diversity (Stahl et al. 2010), institutional diversity (Malmberg and Maskell 2006), and experience diversity (Lant et al. 1992). We argue that an appropriate mix of onshore and offshore staffs may provide cultural diversity, an appropriate mix of insourced and outsourced resources might provide institutional diversity, and governance of top managers' decision rights might generate knowledge and experience diversity. These diversities then help firms to achieve innovation success.

Based on existing literature, we develop a theoretical model that links key governance decisions to innovation success in new software development projects. We test our model with data from more than 150 professionals. Our findings indicate that dispersion across geographic boundaries plays a more important role than dispersion across firms in enabling successful innovation; and that there is a greater likelihood of innovation success when business executives make technical decisions, particularly if firms compete by selling high price margin software products or services.

Background and Theoretical Framework

Background

Although IS researchers are increasingly studying product and service innovations (Barrett et al. 2015; Fichman et al. 2014; Lusch and Nambisan 2015; Nambisan 2013), few empirical studies have assessed the role of strategy and governance choices in influencing innovation outcomes. Among prior studies, Pavlou and El Sawy (2006) show that the effective use of IT by business units helps to create firms' competitive advantage. Kleis et al. (2012) use annual panel data from U.S. manufacturing firms between 1987 and 1997 and find that IT is positively associated with increases in innovation output. Song and Song (2010) show that IT could help reduce the integration barrier between R&D and marketing, and in turn contribute to the development of successful new products.

Innovation is especially important for organizations in knowledge-intensive industries (Black and Lynch 2004). Ramasubbu et al. (2008) show that offshore software development could benefit from process maturity models, such as the capability maturity model (CMM), to increase team effectiveness by utilizing CMM as a platform for learning routines.

Increasingly, firms are relying on external resources or engaging with partners to develop new products or services (Chesbrough 2003; Majchrzak and Malhotra 2013; Nambisan and Sawhney 2011). Global firms often face challenges to appropriately allocate human capital resources between their onshore and offshore resources, or insourced or outsourced capabilities for innovation success (Lewin et al. 2009; Linder et al. 2003; Rottman and Lacity 2004; Slaughter and Ang 1996; Weeks and Feeny 2008). Yet, not much attention has been paid to the link between an appropriate mix of internal versus external resources, their geographic distribution and innovation success. Recent examples of firms such as GM (Bennett 2015; Murphy 2012; Rosenbush 2013; Weier 2009) and Target (King 2013) back-sourcing and bringing in-house what they were doing earlier through outsourcing, at the same time FedEx's inclination toward greater outsourcing (Murphy 2013), point to the importance of getting the mix of outsourcing vs. insourcing right. In addition, top managers' decision rights and behavior can influence employees' motivation and satisfaction, create a climate for creativity, and reward innovation (Damanpour and Schneider 2006; Elenkov et al. 2005). Therefore, their involvement in decisions and governance structures can influence innovation success (Bantel and Jackson 1989; Howell and Higgins 1990).

Hypotheses

Onshore or Offshore Choice and Innovation Success

We expect that a balanced mix of onshore and offshore resources will increase innovation success for three key reasons. First, creating a balanced mix allows firms to benefit from cultural dispersion even though offshore collaboration creates the risk of geographical or temporal distance (Holmstrom et al. 2006). Ang and Inkpen (2008) argue that cultural intelligence, which is likely to be higher in teams that have a balanced mix of onshore and offshore resources, can improve firm performance by enabling individuals to function and manage effectively in culturally diverse settings (Earley and Ang 2003). Cultural diversity in ethnicity broadens the perspectives and viewpoints in a firm (Dahlin et al. 2005; Richard 2000), which may influence team performance. Stahl et al.'s (2010) meta-analysis of culture creativity shows that cultural diversity, on the one hand, would increase divergent processes, and, on the other hand, might reduce convergent processes. Since both divergent and convergent processes are associated with performance gains and losses, increasing cultural diversity may not always result in favorable outcomes. The meta-analysis of 108 empirical studies in 10,632 teams shows that cultural diversity leads to process losses through task conflict and social integration, but gains through creativity and satisfaction. Therefore, in order to reap maximum benefit of cultural diversity, managers have to manage processes carefully in an effective manner to avoid conflicts and enhance social integration.

Second, a balanced mix of onshore and offshore resources can help firms to fulfill local markets' needs in their offshore markets by bridging the knowledge gap between customers and developers across geographic locations (Boh et al. 2007; Espinosa et al. 2007; Ramasubbu et al. 2008). Firms setting up R&D facilities in foreign market to adapt firms' existing knowledge to the markets was termed by Kuemmerle (1999) as "home-base-exploiting" R&D, and firms seeking to acquire location-based knowledge from foreign market was termed as "home-base-augmenting" R&D. Von Hippel (1998) mentioned that firms could gain valuable ideas for "user-based" innovation" from their customers. Having geographically dispersed staffs supports new product development as long as firms overcome subgroup dynamics and ensure connectedness and involvement (O'Leary and Cummings 2007).

Third, a balanced mix of onshore and offshore resources can help firms to acquire capabilities unavailable onshore. Lewin et al. (2009) show that the shortage of highly skilled science and engineering professionals in the United States drives firms to seek talent around the world. While there are reported shortages of scientists and engineers in the United States, Asian countries such as China and India have significantly expanded their talent pool (Ernst 2006). Yet, completely relying on global talent might incur risks such as loss of managerial control, wage inflation, and offshore employee turnover (Lewin et al. 2007). Some early pioneers of service offshoring are considering taking those services home because the cost difference between Indian software developers and local software developers is likely to decrease over

time¹. Therefore, maintaining a balanced mix of onshore and offshore resources will increase firms' flexibility and performance. Hence, we hypothesize:

Hypothesis 1: Having a balanced mix of onshore and offshore staffs will increase innovation success.

Make or Buy Choice and Innovation Success

We expect that a balanced mix of insourced and outsourced resources will increase innovation success for the following three reasons. First, innovation is the process of combining different types of knowledge (Nonaka et al. 2003; Tidd et al. 1998), and not all knowledge resides within a firm (Chesbrough 2003). Interaction with external firms may generate important ideas for innovation because the process facilitates the acquisition of outside knowledge (Malmberg and Maskell 2006; Maskell 2001). Therefore, having a balanced mix of in-house versus outsourced resources is likely to contribute to innovation success.

Second, a balanced mix of insourced and outsourced resources helps to align interests of team members. Han and Mithas (2013) show that firms benefit more from IT outsourcing when they also have a certain degree of internal IT resources. The reason to maintain internal IT employees is that they could help convey the functional domain knowledge of their internal business clients to the outsourced technical IT staff in an understandable way, and vice versa. Hirschheim (2009) also highlights the importance of keeping in-house IT staff to manage IT outsourcing and notes that companies that outsourced their entire IT function to outsourcing vendors typically failed. Chang and Gurbaxani (2012) find that IT outsourcing leads to productivity gains because of IT-related knowledge held by outsourcing vendors particularly if a certain extent of IT capacity is kept within firms.

Third, creating a balanced mix also avoids becoming overly dependent on vendors, which can limit a firms' choice in various situations, and the vendors' motivation to improve (Currie and Willcocks 1998). Tan and Sia (2006) suggest that firms should retain the flexibility to exit an outsourcing relationship because that enables "transfer of services to other vendors, or to have them brought in-house" (p. 185). The benefit of having some in-house IT resources is to handle situation such as premature termination, vendor instability, pricing disagreements, or disputes. Therefore, keeping a balanced mix of insourced and outsourced resources would provide firms more flexibility by maintaining internal capabilities while absorbing complementary external resources (Lee et al. 2001; Zhang and Li 2008) for innovation. Therefore, we hypothesize:

Hypothesis 2: Having a balanced mix of insourced and outsourced resources will increase innovation success.

Decision Rights for Technical Decisions and Innovation Success

Finding the optimal allocation for the responsibility for decision-making between IT and client department is one of the central challenges of IT governance (Weill & Ross, 2004). According to Tiwana (2009), technical knowledge is defined as "knowledge about design, programming, and software development processes", and business knowledge is defined as "knowledge about the business processes, business rules, policies and procedures, and the business objectives associated with the project's problem domain" (p. 184). Technical decisions are often made by IT executives and professionals who have specialized technical expertise but may lack customer and market knowledge (Tiwana 2009). In contrast, business executives often have customer and market knowledge, but lack technical expertise. In order to facilitate effective decision-making, it is important to understand who should have decision rights for new product development.

We argue that granting decision rights for technical decisions to business leaders will increase innovation success when developing high price margin software products for three major reasons. First, the role of business leaders to shape IT decisions is generally acknowledged in prior research because senior business leaders help to set IT principles for organizations. Weill (2004) defines IT governance as "the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT" (p. 3) and one of the successful configurations for IT governance involves letting business monarchies make

¹ Offshoring: Welcome home <http://www.economist.com/news/leaders/21569739-outsourcing-jobs-faraway-places-wane-will-not-solve-wests>

most IT-related decisions. Weill (2004) suggested a more centralized approach to be appropriate when profitability or cost control is a predominant objective for firms.

Second, letting business executives make technical decision can help technical teams to understand business goals and customers' needs directly. Luftman and Brier (1999) defined business-IT alignment as "applying IT in an appropriate and timely way and in harmony with business strategies, goals and needs" (p. 109). The stream of business-IT alignment literature focuses on how IT is aligned with the business, and how to use IT effectively to achieve business objectives. Luftman and Brier (1999) discuss the enablers and inhibitors of business-IT alignment, and underscore that it is important that IT understands the business. To the extent firms enjoy higher price margins for differentiated products because customers are willing to pay more than the marginal cost of the unique features, knowledge of customers brought in by business executives to technical teams can help develop differentiated products.

Third, even though IT professionals may have better knowledge of how to design and code, they may fall into the traps of daily routine that impede innovation. Hence, diversity and conflict during new product development that may be fostered when business leaders make technical decisions may create a potential for more thoughtful decision-making and lead to superior innovation outcomes. Prior research on top management teams emphasizes that differences in knowledge and perspectives due to heterogeneous composition of team members provides more diverse thinking opportunities compared to homogeneous team (Lant et al. 1992). For example, instead of adding all kinds of features that maximize products' functionality and may result in feature fatigue (Thompson et al. 2005), business executives might adopt strategies that quickly bring the products into market. Dahlin et al. (2005) suggest that educational diversity, e.g., team members with a business and technical background, positively affects information use within work team, and other studies also suggest that cognitive heterogeneity helps to generate more ideas in decision-making (Bantel and Jackson 1989; Pelled et al. 1999), which in turn can help to generate more creative solutions (Cox 1994). Leiponen and Helfat (2010) conducted an empirical research showing that greater breadth of knowledge is associated with greater innovation success in terms of sales revenues, especially for newly commercialized innovation. Because realizing high price margins may require creative and disruptive ideas, cognitive diversity may be particularly conducive to innovation success in such a context. Thus, we hypothesize:

Hypothesis 3: Firms are more likely to achieve innovation success in high price margin product development when business leaders make technical decisions.

Method

Data

We test our hypotheses based on data from 164 professionals who are responsible for new software product development. We obtained the data from a leading market research firm which collected this data by surveying software product development professionals in mid-sized and large corporations. The respondents belong to a wide range of industries including business services, education, financial services, information services, media/entertainment, technology, and telecommunications. Ninety percent of the sample participants come from companies with annual revenues over \$50 million, and all participants have some decision-making authority on new software development or provide input to the process.

Tables 1 and 2 describe the roles and responsibilities of all the respondents in the survey. The top three job titles of the respondents are directors (29%), senior managers (20%), and vice presidents (17%). The respondents have either shared decision (47%) or sole decision rights (23%) on new software product development, indicating that a high percentage of respondents can influence new software product development.

Appendix A provides a list of the key variables used in this research explaining how they were constructed. Our main dependent variable is software innovation. *SWInnovation* is composed of several indicators, including time to roll out, new revenue streams created by new software products, and competitiveness of software in the market. The construction echoed the definition of innovation from Baregheh et al. (2009), which emphasized the importance of how the new/improved products compete and differentiate themselves in the marketplace.

Table 1. Respondents' Job title description

Which of the following best represents your job title?		
	Freq.	Percent
Chief Executive Officer (CEO)	10	6.10%
Chief Information Officer (CIO)	9	5.49%
Chief Marketing Officer (CMO)	2	1.22%
Chief Operating Officer (COO)	3	1.83%
Chief Technical Officer (CTO)	4	2.44%
President	5	3.05%
Executive Vice President	11	6.71%
Vice President	28	17.07%
Director	48	29.27%
Senior Manager	32	19.51%
Product Manager	6	3.66%
Manager	2	1.22%
Senior Developer	2	1.22%
Other	2	1.22%
Total	164	100%

Table 2. Respondents' Role in decision-making

Which of the following best describes your role in decision making with regards to new software product development at your organization?		
	Freq.	Percent
I have input into the decision making process but do not make decisions	50	30.49%
I have shared decision making responsibility	77	46.95%
I have sole decision making responsibility	37	22.56%
Total	164	100%

For the independent variables, we investigate whether firms have a balanced mix of onshore and offshore staffs (*MixOnOffShore*), and a balanced mix of in-house and outsourcing resources (*MixInOutSource*). Our approach is consistent with prior literature. For example, DiRomauldo et al. (1998) and Aris et al. (2008) emphasize that firms should find service providers with the right mix of know-how, operating style, reputation, and experience that suitable for firms' need. Economies of scale and technical expertise are different from firm to firm. It is therefore difficult to find a universal ratio that fits all firms' needs. Besides that, the term "right mix" has also been used in other researches. Cornforth (2001) investigate whether boards have "the right mix of skills and experience" to become effective. The software industry in its nature is a labor-intensive industry (Arora and Athreye 2002), and human assets were thought to be the most relevant resources for software outsourcing (Wang 2002). Therefore, the mix of insourced and outsourced "resources" here mainly refers to human resources.

We investigate whether firms sell innovative products at a high price margin to construct *HighPriceMargin* variable. Finally, we measure the extent to which business leaders make technical decisions for new software development (*BLMakeTechDecision*). Providing a route to the top of the career

ladder is vital for employees to devote their energy to the firms. As we mentioned above, firms with resources across geographical and institutional boundaries help generate diversity, but studies show that inequity of career growth would reduce diversity of firms (Cox Jr and Smolinski 1994). Therefore, we control for the degree to which firms provide room for career growth and personal development (*CareerGrowth*). In addition, we control for *AnnualRevenue*, which indicates firms' annual revenue in the most recent fiscal year, as well as *IndustryCompetitiveness*, which represents the competitiveness of the industry in which the firm operates.

We assessed validity of our key measures and computed Cronbach's alpha for *SWInnovation* as a variable with multiple items. Cronbach's alpha for *SWInnovation* was 0.823, suggesting a reliable measurement instrument (MacKenzie, Podsakoff, & Podsakoff, 2011).

Table 3 provides descriptive statistics for the sample. The mean value of successful software innovation rating in the sample is 4.74. On average, firms report a better balance in their insourced and outsourced resources than in their onshore and offshore resources. Only 11% of companies in our sample let business leaders make technical decisions for new software product development.

Table 4 shows correlations among variables. As expected, career growth shows a positive and strong correlation with software innovation. One should interpret these descriptive statistics and correlations with caution because they do not control for any covariates.

Empirical Models and Econometric Considerations

We begin with ordinary least square (OLS) regression to assess the impact of onshore and offshore staffs, in-house and outsourced resources, career growth, and differentiation strategy on software innovation. We control for firm's size by the annual revenues of the firm. Besides that, to control for industry heterogeneity, we account for industry competitiveness.

Our empirical models to test Hypothesis 1 and Hypothesis 2 are specified as:

$$SWInnovation_i = \beta_0 + \beta_1 * MixOnOffShore_i + \beta_2 * MixInOutSource_i + \beta_3 * CareerGrowth_i + \beta_4 * HighPriceMargin_i + \beta_5 * AnnualRevenue_i + \beta_6 * IndustryCompetitiveness_i + \varepsilon_i \quad (1)$$

where i refers to a specific firm.

To test Hypothesis 3, we include one interaction term using the following empirical model:

$$SWInnovation_i = \beta_0 + \beta_1 * MixOnOffShore_i + \beta_2 * MixInOutSource_i + \beta_3 * CareerGrowth_i + \beta_4 * HighPriceMargin_i + \beta_5 * BLMakeTechDecision_i + \beta_6 * HighPriceMargin_i * BLMakeTechDecision_i + \beta_7 * AnnualRevenue_i + \beta_8 * IndustryCompetitiveness_i + \varepsilon_i \quad (2)$$

Because participants' answers can be considered ordinal, we also conducted ordered Probit regressions to estimate coefficients and standard errors.

We tested for multicollinearity by computing variance inflation factors and found the maximum variance inflation factor value to be less than 10. In order to test for common method bias, we conducted Harman's single factor test. This test is one of the most widely used techniques to diagnose common method variation (CMV), which assumes that if a substantial amount of CMV is present, then either (a) a single factor will emerge from the factor analysis or (b) one general factor will account for the majority of the covariance among the variables (Podsakoff et al. 2003). We entered all the variables into exploratory factor analysis, using unrotated principal component factor analysis and principal component analysis with varimax rotation to determine the number of factors. Our unrotated component matrix yielded 8 factors and the largest factor only explained 35% of the total variance indicating a low likelihood of common methods variance. A further robustness check was conducted by using different facets of software innovation as dependent variables.

Table 3. Descriptive Statistics

	Obs.	Mean	Median	Std. Dev.	Min	Max
SWInnovation	164	4.74	5.00	1.36	1	7
MixOnOffshore	164	4.57	5.00	1.89	1	7
MixInOutSource	164	4.88	5.00	1.56	1	7
CareerGrowth	164	5.07	5.00	1.47	2	7
HighPriceMargin	164	4.38	4.50	1.70	1	7
BLMakeTechDecision	164	0.11	0.00	0.31	0	1
AnnualRevenue	164	6.38	6.62	1.36	3.22	7.60
IndustryCompetitiveness	164	3.57	4.00	0.59	2	4

Table 4. Correlations

	1	2	3	4	5	6	7	8
1. SWInnovation	1							
2. MixOnOffshore	0.550**	1						
3. MixInOutSource	0.362**	0.599**	1					
4. CareerGrowth	0.443**	0.465**	0.406**	1				
5. HighPriceMargin	0.578**	0.374**	0.259**	0.351**	1			
6. BLMakeTechDecision	0.107	0.101	0.101	0.104	0.163*	1		
7. AnnualRevenue	-0.0373	0.0112	-0.0558	0.0169	0.0418	-0.0000347	1	
8. IndustryCompetitiveness	-0.00125	-0.134	-0.121	-0.0520	-0.0341	0.0561	0.0883	1

* $p < 0.05$ ** $p < 0.01$

Results

We find support for Hypothesis 1, which predicted that having a balanced mix between onshore and offshore staffs will have a positive association with software innovation success (refer to column 1 of Table 5; $\beta_1 = 0.246$, $p < 0.01$).

Surprisingly, we do not find support for Hypothesis 2, which predicted that having a balanced mix between in-house and outsourced resources will have a positive association with software innovation (refer to column 1 of Table 5; $\beta_2 = -0.002$, $p > 0.1$).

We find support for Hypothesis 3, which predicted that technical decisions made by business executives would increase software innovation in firms that follow a high price margin software strategy (refer to column 2 of Table 5; $\beta_6 = 0.324$, $p < 0.05$).

Figure 1 shows the interaction effect of business executives making technical decisions and the degree to which firms follow a high price margin strategy on innovation success.

Among other results, we find that *CareerGrowth* and *HighPriceMargin* have a significant impact on software innovation success (refer to column 1 of Table 5; $\beta_3 = 0.136$, $p < 0.05$ $\beta_4 = 0.322$, $p < 0.01$).

We performed a number of robustness checks. First, we re-estimated the models using ordered Probit models and obtained similar results. We find support for Hypothesis 1 (refer to column 3 of Table 5;

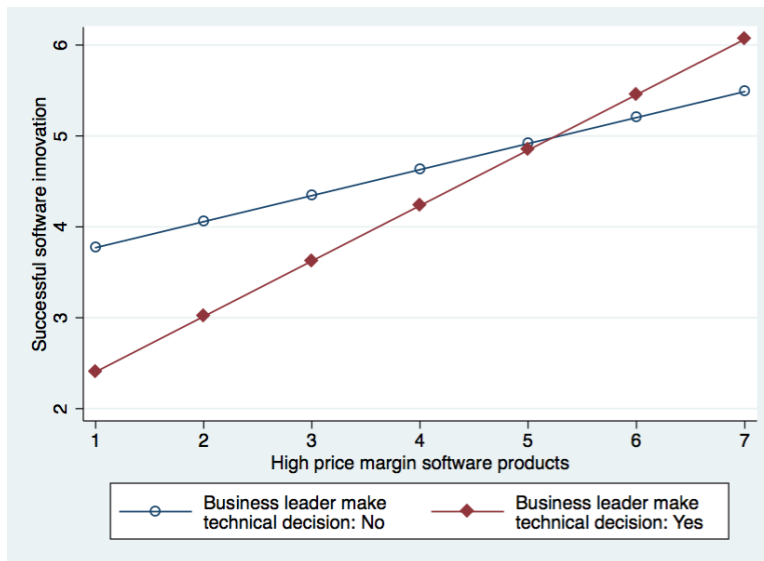
$\beta_1=0.250$, $p<0.01$), and do not find support for Hypothesis 2 (refer to column 3 of Table 5; $\beta_2=-0.016$, $p>0.1$). We also find support for Hypothesis 3 (refer to column 4 of Table 5; $\beta_6=0.397$, $p<0.01$).

Table 5: Parameter Estimates

	OLS	OLS	Ordered Probit	Ordered Probit
	(1)	(2)	(3)	(4)
	SWInnovation	SWInnovation	SWInnovation	SWInnovation
MixOnOffshore	0.246**	0.252**	0.250**	0.263**
MixInOutSource	-0.002	-0.015	-0.016	-0.035
CareerGrowth	0.136*	0.136*	0.169**	0.172**
HighPriceMargin	0.322**	0.323**	0.339**	0.345**
BLMakeTechDecision		-0.257		-0.160
High_BLMakeTechDecision		0.324*		0.397**
AnnualRevenue	-0.067	-0.080	-0.077	-0.095
IndustryCompetitiveness	0.166	0.147	0.216	0.196
_cons	1.355*	1.540*		
adj. (pseudo) R-sq	0.469	0.479	0.126	0.134
N	164	164	164	164

* $p<0.05$ ** $p<0.01$

Figure 1. How Strategy and Choice of Decision Rights for Technical Decisions Influences Innovation Success



Second, because SWInnovation is an indicator that combines several factors, we validated whether the hypotheses still hold for some salient facets of innovation. Table 6 presents the results. All facets of innovation show support for Hypothesis 1 (*QuicklyRollOut*, *SWAsNewRevenue*, *SWCompetitive*), indicating a strong relationship between innovation and a better mix of onshore and offshore staffs. As before, Hypothesis 2 was not supported.

Hypothesis 3 was supported for *QuicklyRollOut*, and *SWCompetitive*, but not for *SWAsNewRevenue*. This indicates that while developing high price margin software products, business leaders contribute most on rolling out products quickly, and making competitive software, but may not necessarily help to create new revenue streams by developing new software products. It is likely that developing new software products that create new revenue streams is a more complex process that involves having brilliant technical people who come up with new algorithms or products but these have to be successfully marketed and sold to realize new revenues; we call for further studies to examine the factors that help to convert software innovations in new revenue streams successfully.

Table 6: Different Facets of Innovation (Ordered Probit)

	(1)	(2)	(3)
	QuicklyRollOut	SWAsNewRevenue	SWCompetitive
MixOnOffshore	0.166**	0.290**	0.207**
MixInOutSource	-0.011	-0.062	-0.028
CareerGrowth	0.206**	0.084	0.110
HighPriceMargin	0.351**	0.289**	0.229**
BLMakeTechDecision	0.155	-0.139	-0.490
High_BLMakeTechDecision	0.380*	0.185	0.423**
AnnualRevenue	-0.191**	-0.023	-0.021
IndustryCompetitiveness	0.189	0.050	0.208
Pseudo R-sq	0.178	0.154	0.117
N	164	164	164

* p<0.05 ** p<0.01

Figure 2, 3, and 4 plot results in Table 6, showing that business executives making technical decisions has a positive effect on innovation while adopting high price margin strategy. The difference of slopes between the two lines in Figure 3 is relatively small, consistent with a non-significant yet positive effect of business executive on *SWAsNewRevenue*.

Figure 2. How Strategy and Choice of Decision Rights for Technical Decisions Influences Quickly Roll Out

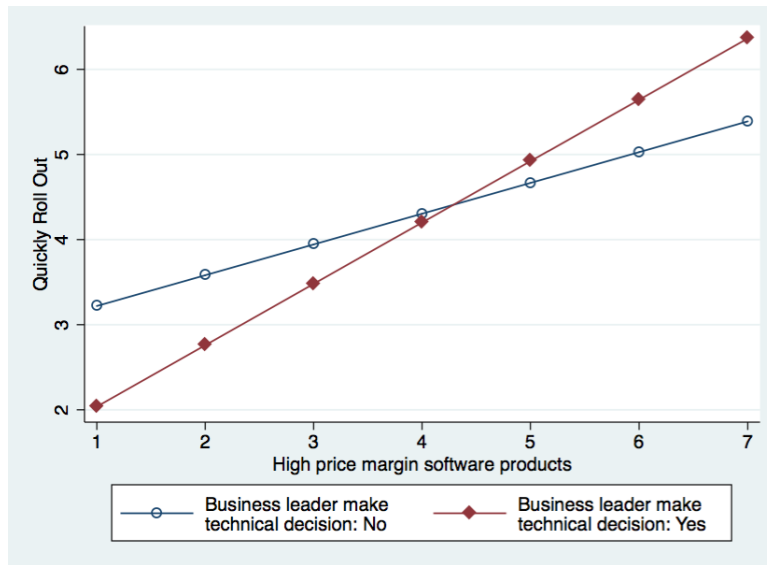


Figure 3. How Strategy and Choice of Decision Rights for Technical Decisions Influences Software as New Revenue

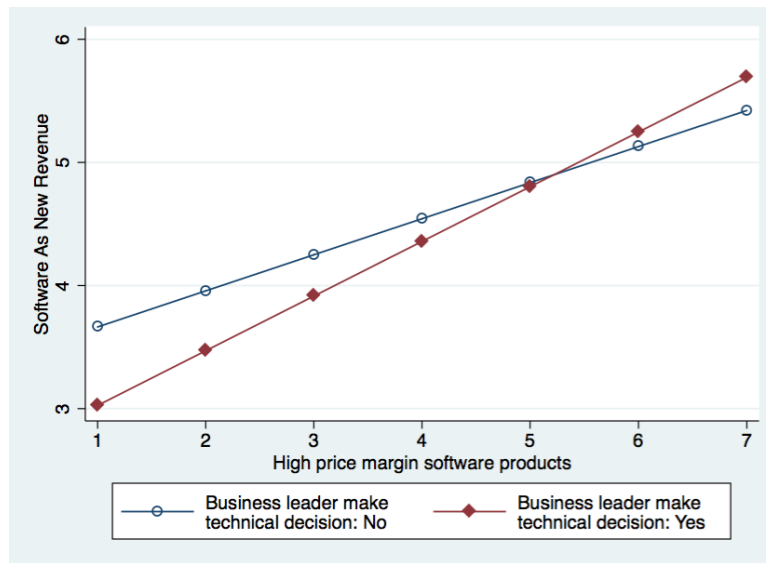
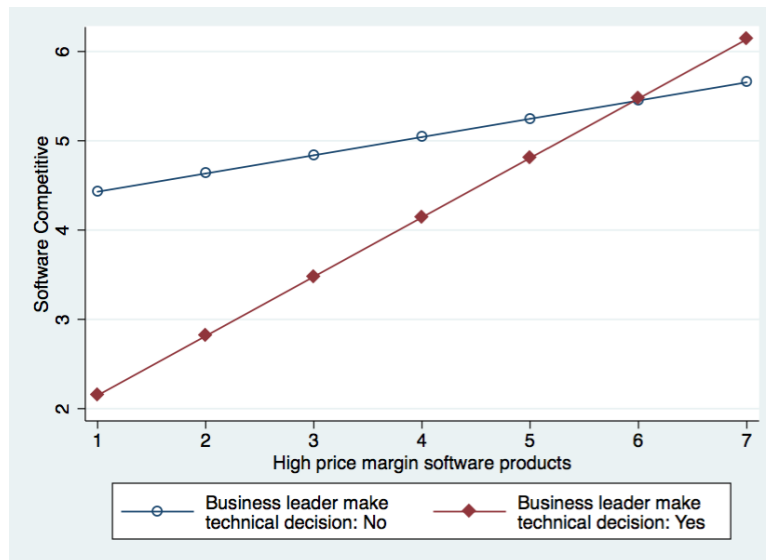


Figure 4. How Strategy and Choice of Decision Rights for Technical Decisions Influences Software Competitiveness



Discussion

Our goal in this study was to assess the influence of various strategic and governance choices on software product innovation. We drew on prior conceptual evidence to develop and test hypotheses relating to the importance of a balanced mix of onshore versus offshore, in-house versus outsourced resources, and decision rights for technical decisions. We found that having the right mix of onshore and offshoring is an important determinant of innovation success. Despite the challenge to conquer geographic, temporal, cultural, and linguistic distance in creating the right mix of onshore/offshore configuration, firms appear to benefit from the cultural dispersion that cultivates individuals' capability to function and manage effectively in culturally diverse settings.

In addition, contrary to our conjecture that firms should benefit from the right mix of insourced and outsourced resources, we did not find support for this argument. One possibility is that firms might face the risk of losing on the learning-by-doing knowledge, a phenomenon known as deskilling. Cha et al.

(2008) term this phenomenon as a disruption in the firm's knowledge supply chain. Since knowledge supply chain is important for successful innovation products and services, outsourcing per se may not enhance a firm's capability for successful software innovation. Our finding is consistent with the notion that many times outsourcing is done for other reasons such as improving cost competitiveness or to get access to skilled professionals which may be important in their own right (Dyer 2000; Ethiraj et al. 2005; Whitaker et al. 2011).

Finally, we find that technical decisions made by business leaders might generate better innovation outcomes than those made by non-business executives. This may be because business executives could help members of technical teams understand customers' need and business goals, and the heterogeneous background of business executives and members of technical teams may provide diverse ideas to the teams. Both are vital resources for innovation success because they not only create more options but also enhance team members' participation. Our results imply that firms with higher diversity in their working environment will have a higher likelihood of innovation.

Not unlike other empirical research efforts, this study also has limitations that can be addressed in future studies. First, in this study we focused on some dimensions of strategy and governance choices that influence innovation success in software development. Future research should focus on other strategy and governance factors such as the extent to which a firm emphasizes revenue growth versus cost reduction in its strategy (Mithas and Rust 2015; Rust et al. 2002), how centralized or decentralized its IT governance processes are (Xue et al. 2014), the extent to which firm uses regulation- versus consensus-based governance approaches (Lazic et al. 2014), the extent to which a firm involves users or customers in software development (Saldanha et al. 2015; Subramanyam et al. 2010), how a firm positions itself in a network with IT-users or IT-producers (Tafti et al. 2015), and the amount a firm invests in its IT and digital resources (Ravichandran et al. 2015). There may also be some trade-offs among different dimensions of innovation outcomes and understanding which managerial interventions are most effective in achieving specific outcomes can help managers to prioritize their initiatives according to their desired goals. There is also a need to link innovation success measures with other important measures such as customer satisfaction, profits and market value to generate implications for resource allocations toward IT and new software development projects in the overall decision-making of firms.

Second, this study dealt with software innovation, and result may not be generalizable to innovations in other contexts such as manufacturing innovation or innovations in other service contexts (Ostrom et al. 2015). There is also a need to replicate this research in other countries and national settings to assess generalizability of findings (e.g., Dibbern et al. 2012; Krishnan and Subramanyam 2004).

The finding of this study provides a number of implications for managers. First, managers should be aware that having a right mix of in-house and outsourced resources is not a guarantee for software innovation, instead creating a culturally diversified environment perhaps through a right mix of onshore and offshore staff may help more. Although offshoring entails risks due to geographic, temporal, and linguistic distance, managers could build a better environment to reduce such barriers by relying on IT systems and communication software to reduce geographic distance and better resources arrangement to relieve temporal burden (Gordon and Tarafdar 2010).

Second, managers should be aware of the trade-off between the production cost advantage due to outsourcing but any potential disadvantages in terms of a lower likelihood, speed or inimitability of software innovation success. One reason for lack of support for the right mix of insourced and outsourced resources may be the disruption of the knowledge supply chain. Finally, our results suggest that participation of business executives in technical decisions improves innovation outcomes. However, such participation requires that business executives invest in their IT competence and digital intelligence to effectively participate in technical decisions for new software products (Mithas 2012). Firms should facilitate learning about information technology through on-the-job experiences, appropriate job rotation and education and training opportunities.

In conclusion, this research investigates the effect of key strategy and governance choices on innovation success for software products by using data from more than 150 professionals in the United States who are responsible for new software product development. We find that governance choices such as getting the right mix of onshore and offshore team members is more important than the decisions relating to insourced versus outsourced development, implying that geographic dispersion may be more important

determinant of innovation than the dispersion across firm boundaries. The effect of firm strategy is moderated by the governance choice of who makes technical decisions for new software development: the chances of innovation success are higher when technical decisions are made by business executives (and not IT executives). Together, these findings provide new insights on strategy and governance choices and suggest that business executives should invest in their digital skills to guide decisions for software product development that are critical for survival and success in today's information economy.

Acknowledgements

We thank Charles Colby (Rockbridge Associates) and Tony Orlando (3Pillar) for facilitating this research by providing us necessary data.

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Appendix A: Variables

Variable	Items	Scale
SWInnovation	<ol style="list-style-type: none"> 1. Quickly rolling out new products/services 2. Developing new software products that create new revenue streams 3. Developing software products that are competitive in the market 	1 = Low Success 7 = High Success
BLMakeTech Decision	Who makes the technical decisions for new software product development in your organization? Mostly business executives	0 = No 1 = Yes
AnnualRevenue	Which of the following categories best represents your organization's annual revenue in the most recent fiscal year? (log)	1 = Less than \$1Million 2 = \$1 Million to less than \$50 Million 3 = \$50 Million to less than \$100 Million 4 = \$100 Million to less than \$500 Million 5 = \$500 Million to less than \$1 Billion 6 = \$1 Billion to less than \$2 Billion 7 = \$2 Billion or more
Industry Competitiveness	How competitive is your industry?	1 = Not at all competitive 4 = Very competitive
The following is a list of statements that may describe an organization's culture, processes and resources. For each one, please indicate how well the statement describes your organization. [7 Likert Scale; Does not Describe At All: 1; Somewhat Describes: 4; Completely Describes My Organization: 7]		
MixOnOffshore	My company has the right mix of onshore and offshore staffing resources	1 = Does not describe at all; 4= Somewhat describes; 7 = Completely describes my organization
MixInOutSource	My organization has an appropriate mix of in-house and outsourced resources	1 = Does not describe at all 4= Somewhat describes; 7 = Completely describes my organization
CareerGrowth	At my organization, there is room for career growth and personal development at all levels.	1 = Does not describe at all 4= Somewhat describes; 7 = Completely describes my organization
HighPriceMargin	How well does the following statements describe your organization? We sell innovative products and services at very high price margins.	1 = Does not describe at all 4= Somewhat describes; 7 = Completely describes my organization