Exploring Business Model Changes in Software-as-a-Service Firms

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Abstract. This paper reports the findings from research on the changes in the business models of Software-as-a-Service (SaaS) firms. The extant literature defines these firms through the use of cloud computing technologies as part of their products and service. However, current literature is missing consideration of the effects of adopting these technologies on the elements of business model, including value proposition, activities, structure and revenue logic. This paper presents findings from 324 responses to a questionnaire survey on how these business model elements of software firms have changed as a result of adopting cloud computing technologies and competitive pressures, and identifies the differences in changes between the SaaS firms originating from software product and software services business. The findings suggest that the SaaS firms are generally unifying their core product offering and pricing across customers and increasing their sales efforts. Besides, the two types of SaaS firms are different in terms of their software-related activities. The present study therefore provides insights into development of the software market, where SaaS firms are claimed to challenge the proprietary software vendors. The findings also imply that the conceptualization of SaaS in IS adoption and IT outsourcing studies can be improved.

Keywords: Software-as-a-Service · SaaS · Cloud computing
Business models · Changes · Software firms

1 Introduction

This paper contributes to the growing body of literature on Software-as-a-Service (SaaS). SaaS is one of the layers of cloud computing services [3, 28] and the term is used to designate standard applications delivered over the Internet [20, 37]. Choudary [10] submits that the SaaS model is associated with subscription-based revenue logic and, on that account, SaaS would entail different means of software licensing and way of charging customers compared to the traditional software business models.

The Software-as-a-Service (SaaS) firms are claimed to radically change the software business setting, by breaking down the positions of big proprietary software vendors [2]. It is therefore surprising that the consideration of SaaS firms business model in the extant literature is mostly limited to their core product offering and their

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revenue logic. Beyond this point, the contemporary literature does not provide much more empirical evidence about how the software firms have organized their business model to develop and deliver the SaaS offerings. Specifically, the absence of empirical research on SaaS firms' business models suggests a gap in understanding the changes in software firms' business model to encompass the possibilities of cloud computing technologies and perils of the competitive environment.

In this research, the authors investigated the changes in software firms' business models and a set of possible explanations for the changes. A business model is understood as a coherent configuration of the four key elements [1, 16, 19, 31, 42]: value proposition, activities, structure and revenue logic. The authors considered (1) what are the changes in software firms' business model induced by cloud computing technologies, (2) have the changes occurred because of availability of new technology or because of competitive pressures and (3) whether there are differences in changes caused by adoption of cloud computing technologies between software product firms and software services firms. These research questions were addressed by analyzing responses to a survey questionnaire from 324 Finnish software firms.

2 Theoretical Background: Business Models

Basically, a business model is a description or an interpretation of how a company organizes itself, operates and makes money [5, 25, 31]. Being a description, the business model acts as a conceptual tool, which narrates either the state of current business or planned future business [1, 16]. Business model is also a concept used to describe the key elements of a focal firm's business [18] and implies that the elements are interrelated. Individual decisions of business model design affect several aspects of the firm [16, 40]. The discussion on the key elements of a business model seems to be converging and researchers are then able to elaborate the details of individual elements (called parameters). The common elements include value proposition incorporating both the customer segment and product/service portfolio, activities performed by the focal firm to create and appropriate value, internal structure and position in the value network, and revenue logic referring to the structure of income.

Studies of business models of software firms often classify firms into representative groups to allow for statistical inferences. For instance, Rajala et al. [33] identify different characteristics of software firms according to their product strategy, revenue logic, cost structure/pricing strategy and distribution model. The German software industry survey uses a highly detailed classification scheme with five first-order constructs and 25 second-order constructs as parameters [36]. Cusumano [12, 13] alternatively uses two broad categories based on firms' value proposition and source of revenue, namely software product firms and software services firms. He observes the lifecycle dynamics, i.e. a gradual shift in software firms' business models towards increasing service offering and revenues, which is attributable to competitive pressures, but also individual firm's age and lagging sales [12, 13].

Also Teece [40] argues that business models are provisional and likely to be changed. The changes may appear as companies create new business models (in case of start-ups), extend their business model by adding activities, value propositions or

partners, revise their business model by modifying or replacing these elements, or terminate an existing business model [21]. An observable sign of business model change is a substantial change in the structure of revenue sources [16], which reflects overall changes in both the value proposition and the revenue logic.

The extant literature suggests that business models may change in response to both external and internal influences. Considering the external factor first, authors widely demonstrate and agree on two external factors for business model changes: Advances in contemporary technology [8, 9, 35, 42] and competitive forces [8, 13, 16, 35]. These external forces have the power to change the value of the firm's product/service portfolio, structure of the value network, and the costs of performing activities and acquiring resources [16], as well as reshape customer demand. In relation to the outcomes, Chesbrough and Rosenbloom [9] contend that the financial performance of a given firm *is* associated with developments in firm's environment, but *only* through changes in the firm's business model. Similarly, adoption of cloud computing technology does not directly improve or worsen financial performance of a software firm, but the business model extensions and revisions are mechanism to achieve such gains. However, adoption of the new technology may be a prerequisite to overcome the limitations of existing business model and adoption of new technologies may results in business model changes of different magnitude [9].

The business model changes also originate from within the company. A business model design, the practical means to create and appropriate value, is a choice of the company's managers and employees, who interpret the changes in the environment and accordingly make decisions about and implement the changes in the business model [4, 9, 16]. As underscored above, elements of the business model are interrelated. Consequently, the extensions and revisions to one element is likely to cause successive determined and emergent changes [16].

3 Prior Research on SaaS

The importance of business aspects of cloud computing has already been recognized and considered in information technology research [26]. To understand the role of cloud computing technologies to software firms' business, we explored the prior research on business aspects of the Software-as-a-Service (SaaS) firms. Our search on the relevant literature revealed that recent empirical studies have examined both demand and supply sides of this SaaS phenomenon. Most common topics looking at the client side include consideration of the opportunities and risks of SaaS adoption [7, 20], studies on service quality and related expectations by SaaS customers [7, 10] and explaining the reasons to outsource in SaaS mode [6, 39]. Software vendors' side has been investigated in studies seeking to find archetypal SaaS business models [38] in comparing SaaS to other business models [14, 37] and in papers examining distinct aspects of SaaS business [23, 41].

Our search of the extant literature reveals that, overall, holistic business models of SaaS firms have received relatively modest attention from researchers, beyond investigating isolated elements of the business model. We find this somewhat surprising, since business models convey several important aspects affecting adoption of software

applications, information technology outsourcing and software business. We also found that, to date, empirical examinations of the *changes* in the SaaS firm's business model at large is missing altogether. An article by Stuckenberg et al. [38] addresses this gap through a small set of interviews, but the focus of their article is rather able to identify the current parameters of SaaS firms business model than examining the changes thereof. Moreover, lack of empirical studies of business model changes signifies that we are unsure which changes in business model parameters are attributable to cloud computing technologies and which are related to the present competitive pressures. In the current study we therefore focused on empirically examining how adoption of cloud computing technology affects the business models of software firms.

4 Hypothesis Development

Some researchers see the value proposition of Software-as-a-Service firms as very similar to the traditional model for selling software products, where only a single set of functionalities is provided to all customers with limited possibilities for customer-specific alterations [7]. However, the business model of Software-as-a-Service firms is here argued to be different from preceding software business models, since the delivery of software capabilities using cloud computing technologies changes the business model configuration. Observed differences to software product business model include more direct customer relationship, subscription based pricing logic, and combining both software development and hosting as key activities [24, 38]. SaaS vendors may often provide their prices on their websites [23], indicating more transparent and unified pricing across customers. Consider Dropbox as a contemporary example of a firm with such SaaS business model. SaaS has also been compared to business of supplying customer-specific applications. SaaS firms would target smaller firms with one-to-many model for non-critical applications, as opposed to targeting large firms with customer-specific offering for critical applications [34, 36]. Based on the claimed characteristics of SaaS firms, we hypothesize that the cloud computing technologies has an effect on the business models parameters of software firms:

H1. Adoption of cloud computing technologies by software firms is associated with change toward (a) targeting the segment of smaller customers, (b) offering more standardized product, (c) decreasing customer-specific software development and production activities, (d) increasing the sales activities, (e) decreasing the allocation of employees into customer-specific activities, (e) increasing the allocation of employees into sales activities, (f) committing to shorter subscription periods and (g) unifying the pricing across different customers.

Whereas most authors perceive and conceptualize SaaS offering as described above, few articles [11, 24] introduce possible variations of the assumed pure-play SaaS. An enterprise SaaS business model is suggested, which is a configuration with more complex or bundled application aimed at larger customer firms and requiring support services, a combination of subscription fee and time and materials fee, more high-touch customer relationships and varying marginal costs. The latter business model configuration seems to inherit characteristics of software services firms. It follows that cloud computing may be employed differently by software firms and, thus,

adoption of cloud computing technology by a software firm may have varying effect on business model. Some firms use cloud computing to change their value proposition, whereas some deploy cloud computing for internal efficiency [26]. We find it likely that a software product firm revises its business model into being a SaaS firm with highly standardized software and minimal adjacent services. By contrast, software services firms would rather adjust their business model to enjoy the benefit of improved efficiency. Accordingly, we hypothesize that:

H2. Software product firms adopting cloud computing technologies are more likely to change their business model toward (a) targeting the segment of smaller customers, (b) offering more standardized product, (c) decreasing customer-specific software development and production activities, (d) increasing the sales activities, (e) decreasing the allocation of employees into customer-specific activities, (e) increasing the allocation of employees into sales activities, (f) committing to shorter subscription periods and (g) unifying the pricing across different customers, than software service firms adopting cloud computing technologies.

5 Research Method

5.1 Data Collection

Our empirical study is aimed at capturing changes in software firms' business models related to cloud adoption. This study uses data collected as part of the annual Finnish software industry survey, which target most of the software companies in Finland. The survey focuses on firms whose main activities are providing software as either products or services to their customers and follows a modified version of the tailored survey design [18], using postal mail and web-based form with email invitations to collect the data. The survey was developed in Finnish and delivered to respondents either in Finnish, Swedish or English. The mailing list of the survey contained key informants of 4878 software companies. Software firms are identified using their NACE industry classification code (division 62 in rev.2.), and contact persons for each software firm are identified from the Orbis database. After contacting the firms in the sample five times the data collection resulted in 379 complete and 121 partial responses.

For this paper, a subset of the data was used. As our focus is on firms providing Software-as-a- Service, we excluded producers of embedded software and software resellers from the analysis. Further, since the objective of this study is to examine the factors causing changes in the firms' business models that we deem are unclear in case of a start-up software firm, also the software firms younger than two years were excluded from the analysis. In total, 324 software companies matched our inclusion criteria and their complete answers were used for the analysis.

5.2 Concepts and Their Operationalization

The multifaceted business model construct was conceptualized through its constituent elements: value proposition, activities, structure and revenue logic of the firm. Value proposition combined the firm's choices of a customer segment and of a

product/service offering as parameters [9]. Structure was conceptualized as allocation of firm's employees into customer-facing unit performing customer-specific work, or the back-end unit producing products and services [14]. Activities performed by the software firm are then divided into software-related activities, including development, deployment and maintenance, and those associated with creating and maintaining the customer relationship [34]. Revenue logic incorporated the temporal rights (e.g. perpetual license or subscription) and price discrimination [22, 23].

Ascribed to the nature of the survey, the authors were faced with the choice of examining specific changes in the business models with single-item measures or examining one of the business model elements in detail. While the configuration approach [29] would advocate measuring one aspect and inferring changes to the whole business model, the configurations of SaaS firms business model evidentially vary irrespective of the assumption of cloud technology adoption. The authors therefore preferred the research design to measure and interpret various business model changes with single-item measurements.

Accordingly, the dependent variables of this study measure the changes of software firm's business model – value proposition, activities, revenue logic and structure – during the last three years. They are based on the characteristics of assumed business model of a SaaS firm capturing directly the change of parameters toward targeting firms marketing efforts smaller customers than before (labelled ValuePropSeg), toward offering more standardized product or service than before (ValuePropProd), toward decreasing the amount of customer-specific software development or service production activities (ActivitiesSW), toward increasing in the amount of personal sales activities (ActivitiesSales), toward committing to shorter contracts than before (RevenueSubs), and the change toward more unified pricing across the customers (RevenuePric). With these six dependent variables, the informant was asked "How well these statements describe the change of your company's business model during the last three years?" and response options were anchored ranging from "1 = strongly disagree" to "5 = strongly agree".

Further, the dependent variables reflecting the change in the internal structure directly measure the increase in the number of employees in customer-specific work as compared to the total (StructureCust) and the increase in the number of employees in sales as compared to the total (StructureSales). With these variables, the informant was asked "How has the structure of your company changed during the past three years?" and an ordinal measure was used ranging from "1 = decreased significantly" to "5 = increased significantly".

Cloud platform adoption is the independent variable (labelled isCloudAdopter), which was measured by the question "Which third party software platforms has your firm to a significant degree developed software?", and had four options; "Public cloud, rented computing capacity, e.g. Amazon EC2, Rackspace, Azure", "Public cloud, application platform, e.g. Heroku, App Engine, Azure", "Open-source, e.g. Hadoop, Cloud Foundry" and "Private Cloud". The cloud adoption was reduced to a dummy (binary) variable that describes whether or not firms develop software for private or public cloud platform. For classifying the software firms, the authors use an independent variable obtained from the question where the respondent is asked to describe their business being either a product firm, service firm or not a software firm. For

clarity, the authors created a dummy variable that describes whether or not the firm is a software product firm (labelled isProductFirm).

The authors controlled for the competitive forces, company age and company size. The competitive forces factor was operationalized by applying a set of five questions describing the environmental dynamism by Miller and Friesen [30]. The questions capture the competitor, technological and customer components of external forces. Compared to Miller and Friesen's scale, the survey instrument in this study used reverse coded measures (i.e. higher values of EnvDyn indicate less dynamism, hence less pressure from external forces). Using company age as control variable is justified, since the more mature companies are likely to suffer from inertial forces within the organization that obstructs changes. By contrast, a larger company may have better resources to initiate and execute changes compared to smaller firms with limited resources. The following analysis uses a ln(Age) and ln(Size). For the company size variable, the revenue of the firm was used as a proxy.

5.3 Data Analysis

The hypotheses in this study were investigated through the Mann-Whitney U test and multivariate ordinal regression analyses. In particular, the former is used to compare the business model changes of software firms; between adopters of cloud platforms and non-adopters, and between software product firms and software services firms that have adopted cloud platforms. The ordinal regression analyses were employed to assess whether the business model changes are attributable to adoption of cloud platforms or competitive forces in the software firms' environment. Ordinal regressions treat each ordinal value as an independent variable. It is therefore possible to examine parameter estimates for a certain range of values within an independent variable [27].

The checks prior to the data analysis affected the informed choice among different possible statistics. Specifically, the authors noticed that the dependent variables were negatively skewed and applied the Shapiro-Wilk's test of normality. The test was significant meaning that the sample did not come from normally distributed population. This advised use of non-parametric statistics. The other concerns were related to the potential presence of outliers, common method variance as a typical problem with the survey research [32], multicollinearity of the independent variables and the proportional odds assumption of the ordinal regression To avoid these concerns the authors first explored the data and detected four influential responses visually using box plots and removed them from the analysis. Next, the authors applied Harman's single-factor test to assess common method variance. The unrotated factor solution did not reveal a single factor, which would account for the majority of the variance in the model, suggesting that the method variance would not be a problem in the data. From the correlation statistics presented in the Table 1, the authors did not detect high correlations between the two independent variables. This suggested that multicollinearity would not impede the results, permitting the use of regression analysis. Finally, to test the proportional odds assumption the authors ran tests of parallel lines in SPSS. Within all the models, the Chi-Square statistics were insignificant, indicating that the assumption was not violated.

Table 1. Non-parametric correlations between the variables

Spearman rtio		1	2	3	4	5	6	7	8	9	10	11	12	13
ValueProp Seg	Coefficient	1,000												
	Sig.	.												
ValueProp Prod	Coefficient	−,002	1,000											
	Sig.	,974	.											
Activities SW	Coefficient	−,112	−,269	1,000										
	Sig.	,084	,000	.										
Activities Sales	Coefficient	−,124	,143	,186	1,000									
	Sig.	,057	,028	,004	.									
Revenue Subs	Coefficient	,229	,276	,218	,088	1,000								
	Sig.	,000	,000	,001	,180	.								
Revenue Pric	Coefficient	,019	,261	−,132	,003	,185	1,000							
	Sig.	,771	,000	,044	,959	,005	.							
Structure Cust	Coefficient	−,208	−,029	,262	,221	−,111	−,031	1,000						
	Sig.	,001	,654	,000	,001	,092	,633	.						
Structure Sales	Coefficient	−,152	,083	,044	,332	,052	−,001	,268	1,000					
	Sig.	,020	,206	,508	,000	,426	,984	,000	.					
In(Age)	Coefficient	,089	,010	,032	−,078	,047	,025	−,039	−,051	1,000				
	Sig.	,168	,876	,622	,232	,475	,697	,547	,434	.				
In(Size)	Coefficient	−,109	,114	,130	,251	,005	,017	,218	,227	,159	1,000			
	Sig.	,099	,086	,050	,000	,941	,802	,001	,001	,009	.			
EnvDyn	Coefficient	−,066	,070	−,051	−,219	−,065	,122	−.027	−,144	,071	−,077	1,000		
	Sig.	,308	,279	,437	,001	,316		,674	,026	,263	,235	.		
isProductFirm	Coefficient	,072	,234	,446	−,136	,153	,150	−,139	,058	,011	,034	,091	1,000	
	Sig.	,264	,000	,000	,035	,018	,021	,031	,373	,839	,580	,151	.	
isCloudAdopter	Coefficient	,019	,231	−,052	,134	,283	,193	−,045	,092	−,137	,128	−,058	,135	1,000
	Sig.	,765	,000	,427	,038	,000	,003	,483	,156	,025	,044	,357	,027	.

6 Results

Table 1 shows the variables together with their non-parametric correlations. The results show that some variables capturing the changes in software firms' business models are positively (ValuePropProd, ActiviesSales, RevenuePric) correlated with the adoption of cloud platforms. Also, the results demonstrate positive correlations (ValuePropProd, RevenuePric) and negative correlations (ActivitiesSW, ActivitiesSales, StructureCust) between changes in business models and the type of software firm (isProductFirm). Further, the results show negative correlations between environmental dynamism and ActivitiesSales, RevenueSubs and StructureSales variables (note the reverse coded EnvDyn variable). Table 1 also shows correlations between dependent variables. The authors mark the association between unifying the offering and the pricing, and between sales efforts and unifying both offering and pricing.

Table 2 is used to compare the means of variables capturing the business model parameters' change between adopters of cloud platforms and non-adopters and between software product firms and software services firms who have adopted cloud platforms. As can be seen in Table 2, the Mann- Whitney U tests indicate significant ($p < 0.05$) differences between adopters and non-adopters in terms of changes toward offering more standardized product or service, toward increasing in the amount of personal sales activities and toward more unified pricing across the customers, but not in terms of other hypothesized changes in business model parameters. Table 2 also shows significant differences between software product firms and software services firm in changes regarding the product/service offering, the software-related activities and the length of contract with customers. However, the Mann- Whitney U tests show that in relation to the rest of the changes in business model parameters product and services firms are not significantly different.

Results from the ordinal regressions of the eight models are shown in Table 3, which reports the regression parameter estimates for the levels of dependent variables ("threshold"), for the independent variables and controls. The table also reports two pseudo r-squares of Nagelkerke – for the full model and for controls only – which assess the overall goodness of fit of the ordinal regression models. While the values give some indication of the strength of the associations between the dependent and the predictor variables, the authors note that these r-squares should not be interpreted similarly to the OLS regressions. However, comparing the r-squares between a model including only controls and the full model, the higher r-square on each full model indicates better prediction on the outcome. Lastly, the tables include model fitting information for the final models; −2 log-likelihood, Chi-square and significance. The values are statistically acceptable for all models, except for the "DV = ValuePropSeg" model. This means that the rest of the models yield predictions more fitting than the marginal probabilities for the dependent variable categories.

Table 2. Comparing changes in business model parameters between groups

	All firms							Cloud platform adopters						
	isCloudAdopter = Q			isCloudAdopter = 1			U test Sig.	isProductFirm = Q			isProductFirm = 1			U test Sig.
	N	Mean	SD	N	Mean	SD		N	Mean	SD	N	Mean	SD	
ValueProp Seg	117	2,69	,995	123	2,76	1,074	,765	60	2,63	1,057	63	2,87	1,085	,219
ValueProp Prod	119	3,17	,986	122	3,59	,907	,000	59	3,24	0,953	63	3,92	0,725	,000
Activities SW	118	2,74	1,025	121	2,84	,983	,426	58	2,36	0,718	63	3,29	0,991	,000
Activities Sales	118	3,25	,924	121	3,49	,932	,038	59	3,54	0,877	62	3,44	0,985	,457
Revenue Subs	118	3,19	,945	121	3,71	,873	,000	60	3,59	0,899	61	3,82	1,015	,039
Revenue Pric	117	3,23	,875	122	3,57	,792	,003	60	3,45	0,79	62	3,69	0,781	,069
Structure Cust	119	3,29	,865	122	3,20	,968	,482	59	3,32	0,797	63	3,08	1,097	,201
Structure Sales	120	3,18	,718	121	3,31	,857	,155	59	3,27	0,784	62	3,35	0,925	,712

Table 3. Ordinal regression models with parameter estimates

	DV = ValueProp Seg			DV = ValueProp Prod			DV = Activities SW			DV = Activities Sales		
	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.
DV ordinal level = 1	−2,804	,913	,002	−1,803	,978	,065	−3,212	,967	,001	−4,499	1,023	,000
DV ordinal level = 2	−,712	,892	,425	,548	,911	,547	−,823	,928	,375	−1,921	,932	,039
DV ordinal level = 3	,341	,891	,702	1,753	,917	,056	,368	,925	,691	−,576	,923	,533
DV ordinal level = 4	3,010	,966	,002	4,555	,965	,000	3,477	,969	,000	2,201	,942	,019
ln(Age)	,256	,173	,140	,026	,178	,883	−,074	,182	,685	−,206	,181	,253
ln(Size)	−,068	,047	,151	,067	,048	,164	−,088	,050	,077	,143	,049	,004
EnvDyn	−,193	,175	,270	,108	,181	,553	,062	,183	,734	−,630	,186	,001
isProductFirm = 1	,331	,246	,179	,731	,259	,005	1,793	,274	,000	−,580	,256	,023
IsCloudAdopter = 1	,086	,246	,728	,831	,259	,001	,108	,257	,674	,498	,256	,052
Pseudo R^2 (Nagelkerke)	,030			,109			,223			,143		
Pseudo R^2 (Controls only)	,020			,013			,022			,111		
Model fitting information	631,91	6,514	,259	573,28	24,35	,000	552,44	52,72	,000	563,48	32,26	,000
	DV = Revenue Subs			DV = Revenue Pric			DV = Structure Cust			DV = Structure Sales		
	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.	Estimate	StdErr	Sig.
DV ordinal level = 1	−3,091	,966	,001	−1,288	1,024	,209	−2,410	,973	,013	−3,928	1,070	,000
DV ordinal level = 2	−1,822	,930	,050	,837	,947	,377	−,789	,930	,396	−1,944	0,969	,045
DV ordinal level = 3	−,102	,919	,911	2,427	,957	,011	1,665	,935	,075	,844	0,960	,379
DV ordinal level = 4	2,599	,942	,006	5,720	1,032	,000	3,404	,957	,000	3,221	0,996	,001
ln(Age)	,224	,181	,216	,127	,183	,487	−,143	,179	,425	−,180	0,185	,330
ln(Size)	−,024	,049	,619	,049	,049	,317	,142	,049	,004	,127	0,050	,012
EnvDyn	−,285	,182	,117	,396	,186	,033	−,042	,181	,818	−,394	0,189	,037
isProductFirm = 1	,573	,258	,026	,473	,262	,071	−,539	,258	,037	,189	0,261	,468
isCloudAdopter = 1	,990	,263	,000	,670	,262	,011	−,208	,256	,416	,143	0,263	,585
Pseudo R^2 (Nagelkerke)	,110			,079			,066			,064		
Pseudo R^2 (Controls only)	,012			,025			,041			,059		
Model fitting information	562,28	24,37	,000	529,56	16,81	,005	574,05	14,48	,013	511,95	13,47	,019

Focusing on the ordinal regression parameter estimates for this study, the adoption of cloud platform is significant in predicting the change in towards more standardized product or service and more unified pricing (in model "DV = ValuePropProd", Est. = .831, Sig. = .001 and in model "DV = RevenueSubs", Est. = .670, Sig. = 0.11), and to some extent notable in predicting the change towards increasing sales activities ("DV = ActivitiesSales, Est. = .498, Sig. = .052). In other words, the cloud platform adopters are more likely to make such changes in their business model parameters. However, the change toward more standardized product or service is also predicted by the type of the software firm, that is, software product firms are more likely to standardize their products and services ("DV = ValuePropProd", Est. = .731, Sig. = .005). The type of the software firm is also significant predictor of changes towards decreasing the amount of customer-specific activities ("ActivitiesSW", Est. = 1.793, Sig. = .000), *decreasing* the sales activities ("ActivitiesSales", Est. = −.580, Sig. = .023), committing to *longer* contracts ("RevenueSubs", Est. = −.814, Sig. = .001) and *decreasing* the number of employees in customer-specific work as compared to the total ("StructureCust", Est. = −.539, Sig. = .037).

Interestingly, environmental dynamism is a significant predictor for several of the business model parameters changes. The greater the environmental dynamism, the more likely the software firm's change towards increasing its sales activities ("ActivitiesSales", Est. = −.630, Sig. = .001), towards committing to longer contracts ("RevenueSubs", Est. = −.544, Sig. = .002), towards price discrimination ("RevenuePric", Est. = .396, Sig. = .033) and towards increasing its allocation of employees to sales activities as compared to the total ("StructureSales", Est. = −.394, Sig. = .037). Finally, the company size as measured by its revenues is a significant predictor for change towards increasing the sales activities ("ActivitiesSales", Est. = −.143, Sig. = .004), and in allocation of more employees to both customer-specific and sales activities as compared to the total ("StructureCust", Est. = .142, Sig. = .004; "StructureSales", Est. = .127, Sig. = .012).

7 Discussion

The current study identifies several interesting results on the effects of adopting cloud platforms and of environmental dynamism to changes in software firms' business model parameters. First, as the prior literature suggests [7, 38], adoption of cloud computing technology by a software firm is seemingly associated with change towards unifying both the product/service offering and pricing across different customer. The cloud adopters also appear to increase the sales effort, which is associated with offering commodity software, hence with decreasing competitive advantage. These findings confirm the hypotheses H1b, H1d and H1g, and also implicate connectedness of business model elements. However, this study could not find support for the rest of the hypothesized connections between cloud technologies and business model parameters. We find that: *Adoption of cloud computing technologies by software firms is associated with change toward offering more standardized product, increasing the sales activities and unifying the pricing across different customers.*

Instead, the software firms' changes in reducing customer-specific software-related activities, in preferring longer contracts and in decreasing the employees in customer-specific activities seem to be attributed to the software firm type rather than to the adoption of new technology. This can be interpreted through the lifecycle dynamics [13]: all software product firms are striving for efficiency regardless whether they are adopting cloud technology. In addition, the changes in increasing sales efforts, adding more employees to the sales activities and increasing the length of contract period are also associated with increasing competitive pressures for all software companies. The software product firms' aim for longer contracts could be explained by use of perpetual licenses or the required high initial investment in developing the software product; with longer customer relationships the firms secure their return of investments under potentially heavy competition.

By comparing the software product firms and the software services firms adopting cloud computing technologies, this study finds that the two kinds of firms are significantly different in terms of changing their business models towards offering more standardized product or service, towards extending the duration of customer contracts and towards reducing the customer-specific activities. The results lead to confirming the hypotheses H2b and H2c, but to rejecting the rest. Specifically, we find that: *Software product firms adopting cloud computing technologies are more likely to change their business model toward offering more standardized product and decreasing customer-specific software development and production activities, when compared to software service firms adopting cloud computing technologies.*

The observation regarding customer-specific activities is in line of the features of the enterprise SaaS firms [11, 24] and of importance considering the conceptualization of SaaS and SaaS as a form of IT outsourcing. Based on the results, the authors suggest that software product firms are moving towards SaaS offering with commodity application without customer- specific work and the software services firms are moving towards SaaS offering with standardized but more complex applications with required adjacent services such as tailoring, training and integration; both categories of SaaS firms configure their business models accordingly.

The values indicating the strength of associations between variables reflect the complexity of choices related to adjusting a business model. Thus, it possible that the software firm's managers' cognitive processes play an important role in changing the business model, even greater than the technological opportunities or competitive pressures. The authors also consider a possibility that the software firm had already executed the changes before, thus, there have not been changes in the last 3-year period.

The common sources of potential fallacies in survey research are related to the errors in measurements, sampling, coverage, and non-response [18]. To reduce the risk for measurement error we attained guidance on the survey questions from both researchers and practitioners in the field. One of the concerns with the measurements is the use of single-item measures, which is argued to insufficiently capture the conceptual domain. However, this claim has been challenged by DeVellis [17] by arguing that each item of a scale is precisely as good measure as any other of the scale items and that the items' relationship and errors to the variable are presumed identical. Understanding of this perplexity guided the authors not to make claims about the changes in business model elements (e.g. value proposition), but rather about the parameters (e.g. product/service portfolio).

The software industry survey practically covers and contacts all the Finnish software companies. The authors therefore consider coverage and sampling errors irrelevant. The overall sampling rate for the software industry survey nonetheless is roughly 10%, which suggests a potential risk of non-response bias. However, the effective sample contained software firms of all types, ages and sizes, and the concern is principally if there are theoretically relevant differences respondents and non- respondents. The authors note that the effective sample contained almost equal rate between adopters and non-adopters of cloud platforms and sufficient variety in dependent variables to support the analysis of the hypothesis.

Using Finnish software firms in deriving the empirical results implies a geographical limitation of the empirical study. The Finnish software firms serve mainly the local markets, but due to the limited size of the domestic market many software firms also attempt international operations. Most of software firms serve other businesses and organizations in the public sector. Overall, the market conditions are deemed equal to most other European markets in terms of distribution of software firms into large, small and medium-sized and micro-sized firms, in terms of industry consolidation and the effects of globalization, IT outsourcing and offshoring.

8 Conclusions

As a result of the exploration of the extant literature, the authors found a lack of studies focusing on the business models of the Software-as-a-Service firms that would go beyond investigating isolated aspects of SaaS firms' business. Business model concept is principally used to describe a configuration of several elements of business, emerging as choices as a response to the cognitive interpretation of the opportunities of new technologies and of the threats of competitive environment. The authors noticed a convergence of the key elements of a business model in the recent discussion and used conceptualizations of value proposition, activities, structure and revenue logic to investigate changes of software firms' means of conducting business. In particular, the present study examined the changes in business models induced by adoption of cloud computing technology and external pressures. Besides, it compared the business model changes in software product firms and software services firms.

After analyzing an effective sample of 324 software firms, the authors conclude that the software firms adopting cloud computing technologies have generally increased the uniformity of the core offering and pricing across customers and increased their sales activities, in a holistic manner. These findings are in line with the characteristics of SaaS firms in the contemporary literature. With regards to the second research question, the authors conclude that the increased sales efforts of software firms and preferring longer contract are attributed to the increasing environmental dynamism. If present, these forces affect activities and revenue logic for all software firms. The authors also conclude that for all software product firms, the lifecycle dynamics lead to decreasing their customer-specific activities. Finally, the consideration of differences between software product firms and software services firms reveals that both types of firms are adopting cloud computing technologies and standardizing their core offering to transform into SaaS companies. However, these two types of firms are different as to

the software-related adjacent activities. The authors therefore conclude that the different customer needs shall be served by two kinds of SaaS firms, those that embrace cost efficiency approach and those that focus on customer intimacy.

Since this study seems to be among the first to examine the business model changes of SaaS firms, the authors suggest these findings to serve as a starting point for future studies. Besides, some of the acclaimed changes related to SaaS firms' business are yet unclear and this calls for further investigations. Detection of the difference between the SaaS firms originating from software product business and the SaaS firms evolving from software services business clearly has implications for the future studies on SaaS provisioning and adoption by the end-users. That is, the authors assert that for studying SaaS adoption or SaaS as a form of IT outsourcing, the conceptualization of SaaS needs to take into account all the software-related activities by the software firm and offerings to the end-user. The practical implication of the present study is an increased understanding about how the SaaS vendors are changing their business model and consequently how the market of software products and services is evolving. Limiting the survey to Finland may fall short of providing a representative illustration on SaaS business model in a global context. The authors therefore welcome insights from similar studies in other countries.

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