Business Model Factors Influencing Cloud Computing Adoption: Differences in Opinion

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Abstract
The paper presents first research findings on cloud provider’s business model factors, impacting cloud computing adoption in organizations. The research has been carried out among organizations in Slovenia. First, research framework and methodology are introduced and investigated provider’s business model factors are clarified. Next, significant differences in opinion about the importance of factors impacting cloud computing adoption are presented from the perspective of companies with previous cloud computing experiences and the companies without previous cloud computing experiences. The paper is concluded with discussions.

Keywords: Cloud Computing, SaaS, PaaS, IaaS, Business models

1 Introduction
The combination of business potential and rapid development of information technology in today’s economic environment affect that cloud computing is becoming a focus of many business leaders as well as leaders in the field of information technologies (Marks in Lozano, 2010, 70). Cloud computing presents a significant turning point in presentation, development, deployment, management, maintenance, and also the billing of information technology services and facilities.

Gartner group estimates (Plummer, 2011), that in 2015 the total market value of cloud computing will reach $ 176.8 billion. Projected distribution of market shares by cloud computing type is as follows: a) Software solutions and services: $ 21.3 billion, b) Platform as a Service: $ 2.4 billion, c) Infrastructure as a Service: $ 19.59 billion. IDC consulting estimated that cloud computing market in Slovenia has reached a value of 11.95 million $ (private and public cloud) in 2010. From this, value of private cloud market has reached over $ 7 million (Rojko, 2011).
Future developments of cloud computing are not yet fully defined. However, cloud computing currently derives a significant shift in the way on how information technology and services are being produced, provided and used. Despite many advantages and promised benefits, resulting mainly in more effective and efficient IT governance and service provisioning in organizations, the adoption of cloud computing isn't that fast as it has been foreseen previously. In order that providers will be able to efficiently offer cloud computing services to organizations; large as well as small and medium-sized, it is necessary to clearly define business models and the most important factors that impact cloud computing adoption.

In the paper we introduce research model, consisting of 40 cloud computing business model factors identified from prior research and interviews with cloud computing providers. These factors are estimated to have a potential impact on cloud computing adoption in organizations. The importance of the factors and their impact on cloud computing adoption was investigated by the survey, conducted in Slovenia. In this paper, we expose the differences in importance of individual factors among companies with previous cloud computing experiences and the companies without previous cloud computing experiences.

2 Research framework - Definition of Cloud Computing Provider’s Business Model Factors

2.1 Definition of Cloud Computing Provider’s Business Model factors

The popularity of the term "business model" started to increase at the end of the 90s (Osterwalder, Pigneur & Tucci, 2005, 6). Literature provides several definitions of the business model. In general, the business model can be defined as logic of organization that reflects its business strategy (Johansson, Malmström, Chroneer, styve, Engstrom & Kåreborn, 2012, 85). Reuver points (2007) that the decisions taken at the stage of setting up a business model for the initial product or service usually vary depending on the level of its adoption in the market and its commercial use and requirements.

For the purpose of our investigation of cloud computing factors, impacting its adoption, we have defined the research model. The research model consists of 4 groups of factors (Figure 1). It presents combination of Osterwalder’s (2004) business model definitions, business model factors identified in the research project from 5th Framework Programme, named E-Factors: A Thematic Network and E-Business Models (E-Factors Consortium, 2003) and other identified factors from field investigation (including interviews with cloud computing providers).
Provider’s capability for Cloud Computing

The first group of factors “provider’s capability for cloud computing” describes the value system configuration that is necessary in order to deliver the product or service, in our case cloud computing services, and to establish and maintain customer relationship. It is composed of the “activity configuration”, in-house “resources and assets” and ”company’s partner network” to fulfil these activities (Osterwalder & Pigneur, 2005).

For the purpose of our research we define the following factors in this group:

**Collaboration with partners**

- *Factor Co-branding*. Co-branding or linked branding is considered as a strategy of joint presentation of two or more independent brands within one service (Erevelles, Stevenson, Srinivasan & Fukawa, 2008).

- *Factor Defined Collaboration with partners* is considered as level of arrangement to cooperation among partners in partner network.

- *Factor Dispute resolution mechanisms with partners* is considered as the definition of potential problem solving means among partners in cloud provider’s partner network.

- *Factor Partner network size* is considered as the number of cloud providers, included in partner network.

**Provider’s Tangible assets**

- *Factor Financial resources of provider* is considered as availability of provider’s financial resources, proving the capability for execution of business and development investments in order to ensure service quality.
• Factor Provider’s Technology, SW and HW is considered as ICT availability (hardware, software solutions, telecommunication equipment and services) for offering cloud computing services.

Provider’s Intangible assets

• Factor Provider’s Reputation is considered as a corporative reputation.

• Factor References and recommendations is considered as the range of recommendations of satisfied customers, expressing positive collaborative experiences with cloud computing provider. They support potential new users in selecting a specific service provider or selecting a specific cloud computing service.

• Factor Knowledge and experiences is considered as a set of data and provider’s behaviour, acquired through education and work.

Value proposition

The second group of factors “value proposition” covers all aspects related to the offering of the company. In our case, the offering relates to cloud services. This comprises not only its services but also the manner in which it differentiates itself from its competitors. Moreover, the ability to offer value to a customer demands a range of specific capabilities. These factors need to be assured in order to deliver the value to the customers (Osterwalder, 2004).

For the purpose of our research we define the following factors in this group:

Customer value / service value for customer

• Factor Economic value of service / cost savings is considered as recognized service value which can be expressed monetarily or from the aspect of cost reduction (i.e. investment, maintenance, better efficiency in source exploitation, etc.).

• Factor Service usability is defined as level of service conformity to the needs, desires and demands of customers.

• Factor Service flexibility is defined as the level of service conformity in regard to customer's needs.

• Factor Service trademark is defined as the label or combination of labels, established for representing cloud computing provider or its service.

• Factor Service added value is defined as standard upgrade of cloud computing service.

• Factor Service connectivity / interoperability is defined as the ability to use the same service through different service providers of cloud computing services.

• Factor Customer support service is defined as the level of customer assistance for using cloud computing services.
Customer relationship management

The third group of factors “customer relationship management” helps companies to define target customers (Osterwalder, 2004). This group also defines strategies of customer data collection, its management and use for customer relationship improvements and creation of desired offer of products and services. Further on, this group also includes factors related to creation of customer loyalty (Osterwalder in Pigneur, 2002).

For the purpose of our research we define the following factors in this group:

Marketing

A group of factors, defined as the usage of different marketing channels to offer cloud computing services: Internet and social media, Events (conferences, workshops, etc.), Direct marketing, Use of partners’ marketing channels, Publications.

Trust building mechanisms

- User authentication or access control is basic, starting element for secure service provisioning.
- System security is considered as the ability of cloud service provider to prevent access to network and data to unauthorized users with suitable tools and technologies (i.e. firewall, virtual private networks, use of safer protocols, advanced encryption techniques, etc.).
- Service quality is not exclusively limited to performance, but it can also be defined with other characteristics, such as security, availability, upgrade possibility, etc.
- Service and system availability are defined in tight relation to their reliability.
- Factor Service recovery is considered as the definition of recovery/restoration process after the service malfunction (due to hacking, loss of power, or an accident).
- Factor Changing the provider trust building mechanism is considered as the definition of procedures to ensure data archive or its transfer to another cloud computing service provider.

Orientation of services to target customers

Focus of cloud computing service by individual segments of target customers in the research is defined according to activity and size of target customer, as well as according to the complexity of their processes and its geographic activity.

Re�venue model & Costs

The forth group of factors “re�venue model & costs” defines revenue model and costs structure. Logic of revenue generation is an indicator of business results and organizational success (Sainio in Marjakoski, 2009, 368). Osterwalder (2004) defines fixed and dynamic pricing models.

For the purpose of our research we define the following factors in this group:
Service billing

- Factor *Service billing pay per use* is defined as means of charging which is based on number of transactions, used disk space, recorded use of other resources, etc.

- Factor *Service billing pay per service* is considered as the means of charging in regard to service use.

- Factor *Service billing based on market price* is defined as the means of charging for the service based on supply and demand.

- Factor *Service billing based on target customers* is defined in the research as means of charging for the service according to customer type, their characteristics, abilities and willingness to pay for the service.

Costs

- Factor *Provider’s hardware costs* is defined as the costs of hardware equipment necessary to provide cloud computing services: servers, computers, processors, hard disks, etc.

- Factor *Provider's software costs* is defined as service provider costs of: application servers, operating systems, software solutions for virtualization and other software solutions providing cloud computing infrastructure, platform and services (Li et al., 2009).

- Factor *Human resources costs* of provider is defined as costs which occur on the account of service provisioning and maintenance, technical assistance, ensuring system security, etc. (Li et al., 2009). The above stated costs originate mostly, and in greatest extent, from salaries of employees.

- Factor *Outsourcing costs of provider* is defined in the research as costs that occur because of the need to involve external services, equipment and infrastructure when providing cloud computing service. This includes costs for providing security, service restoration, additional technical expertise, etc.

- Factor *Collaboration costs* with other cloud computing providers is defined as costs that occur in business cooperation among service providers.

- Factor *Network costs* is defined as the costs of network devices and network equipment, as well as direct costs of energy for network activity.

2.2 Research methodology

The study on the importance of provider’s business model factors for cloud computing adoption was performed under the doctoral dissertation work. The questionnaire has been developed to test three main research hypotheses, related to investigation about the impact of business model factors on cloud computing adoption. The questionnaire was related to all
three types of cloud computing services: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

Beside main hypothesis, we wanted to identify potential differences in opinion on importance of investigated business model factors for cloud computing (SaaS, PaaS and IaaS) adoption. The goal was to identify statistical important differences in opinion among the companies with previous experiences with cloud computing and the companies with no previous computing experiences.

1200 potential cloud computing users (300 micro enterprises, 300 small enterprises, 300 medium enterprises, 300 large enterprises) and 300 potential cloud computing providers (enterprises in the field of Information Technology) were invited to participate in the survey. The questionnaire was tested by 10 participants (6 representatives of cloud computing providers and 4 representatives of potential cloud computing end users). Their recommendations and suggestions were considered in final version of the questionnaire.

In total, 78 companies responded. Table 1 presents descriptive statistics about participating companies from the perspective of previous cloud computing experiences:

<table>
<thead>
<tr>
<th>Cloud service type</th>
<th>Frequency – (Yes) – cloud computing experiences</th>
<th>Frequency – (No) – no cloud computing experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>PaaS</td>
<td>15</td>
<td>63</td>
</tr>
<tr>
<td>SaaS</td>
<td>25</td>
<td>53</td>
</tr>
<tr>
<td>IaaS</td>
<td>16</td>
<td>52</td>
</tr>
</tbody>
</table>

Table 1: Descriptive statistics – previous cloud computing experiences

The paper exposes statistically significant differences in opinion about the importance of identified business model factors for all three types of cloud computing services (SaaS, PaaS and IaaS). The differences were investigated among companies with previous cloud computing experiences and the companies without previous cloud computing experiences.

3 Results

The importance of 40 identified cloud computing business model factors was investigated based on 5 point Likert scale (from 1 – being not important at all to 5 – being very important). Table 2 presents only the factors, expressed as less important (value lower than 3). Other factors were rated as important. As seen in the table 2, provider’s hardware costs for the PaaS cloud computing services, publications in a means of marketing for all three types of cloud computing services, use of partners marketing channels for IaaS and PaaS cloud computing services, service trademark in a means of customer value for all three types of services, collaboration with large number of partners for the IaaS type of service, targeting of cloud computing services based on customer company size for the IaaS type of cloud computing services and targeting of cloud computing services based on geographical location for all three types of cloud computing services were considered as less important for the companies.
Table 2: Opinion on business model factors’ importance – average values

<table>
<thead>
<tr>
<th>Business model factor</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider’s hardware costs – PaaS</td>
<td>2.92</td>
</tr>
<tr>
<td>Marketing / Publications – IaaS</td>
<td>2.82</td>
</tr>
<tr>
<td>Marketing / Publications – PaaS</td>
<td>2.82</td>
</tr>
<tr>
<td>Marketing / Publications – SaaS</td>
<td>2.89</td>
</tr>
<tr>
<td>Marketing / Use of partners’ marketing channels – IaaS</td>
<td>2.82</td>
</tr>
<tr>
<td>Marketing / Use of partners’ marketing channels – PaaS</td>
<td>2.90</td>
</tr>
<tr>
<td>Customer value / service value for customer / Service trademark - IaaS</td>
<td>2.73</td>
</tr>
<tr>
<td>Customer value / service value for customer / Service trademark - PaaS</td>
<td>2.78</td>
</tr>
<tr>
<td>Customer value / service value for customer / Service trademark - SaaS</td>
<td>2.79</td>
</tr>
<tr>
<td>Collaboration with larger number of partners (partner network size) - IaaS</td>
<td>2.99</td>
</tr>
<tr>
<td>Focus of services to target customers / Targeting based on customer company size – IaaS</td>
<td>2.96</td>
</tr>
<tr>
<td>Focus of services to target customers / Targeting based on customer geographical location – SaaS</td>
<td>2.97</td>
</tr>
<tr>
<td>Focus of services to target customers / Targeting based on customer geographical location – PaaS</td>
<td>2.88</td>
</tr>
<tr>
<td>Focus of services to target customers / Targeting based on customer geographical location – IaaS</td>
<td>2.85</td>
</tr>
</tbody>
</table>

Table 3 presents statistically significant differences in opinion about business model factors importance on cloud computing adoption. The differences are presented among companies with previous experiences with Software as a Service and the companies without previous experiences with Software as a Service.
Business Model Factors Influencing Cloud Computing Adoption: Differences in Opinion

<table>
<thead>
<tr>
<th>Business model factor</th>
<th>Independent variable</th>
<th>t</th>
<th>p</th>
<th>M1</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer value / service value for customer / Service usability</td>
<td>Document management</td>
<td>-2.15</td>
<td>0.045</td>
<td>4.27</td>
<td>4.89</td>
</tr>
<tr>
<td>Customer value / service value for Customer support services</td>
<td>ERP</td>
<td>-2.58</td>
<td>0.018</td>
<td>4.20</td>
<td>4.89</td>
</tr>
<tr>
<td>Collaboration with partners / Co-branding</td>
<td>ERP</td>
<td>-2.09</td>
<td>0.049</td>
<td>2.87</td>
<td>3.78</td>
</tr>
<tr>
<td>Assets / Intangible / Knowledge and experiences</td>
<td>Customer relationship management</td>
<td>2.886</td>
<td>0.011</td>
<td>4.82</td>
<td>3.92</td>
</tr>
<tr>
<td>Marketing / Internet and social media</td>
<td>Group work</td>
<td>2.243</td>
<td>0.035</td>
<td>4.45</td>
<td>3.23</td>
</tr>
<tr>
<td>Trust building mechanisms / User authentication</td>
<td>Customer relationship management</td>
<td>3.000</td>
<td>0.007</td>
<td>4.75</td>
<td>4.00</td>
</tr>
<tr>
<td>Trust building mechanisms / User authentication</td>
<td>Document management</td>
<td>-2.35</td>
<td>0.028</td>
<td>4.13</td>
<td>4.78</td>
</tr>
<tr>
<td>Trust building mechanisms / Service quality</td>
<td>Customer relationship management</td>
<td>2.165</td>
<td>0.049</td>
<td>4.92</td>
<td>4.33</td>
</tr>
<tr>
<td>Trust building mechanisms in case of service recovery</td>
<td>Document management</td>
<td>-2.22</td>
<td>0.038</td>
<td>4.40</td>
<td>4.89</td>
</tr>
</tbody>
</table>

Legend:
M1 – average on factor importance / companies without previous cloud computing experiences, M2 – average on factor importance / companies with previous cloud computing experiences, t- value, p – statistical significance

Table 3: Difference in opinion on importance of business model factors impacting cloud computing adoption according to previous experiences with Software as a service

Results of the t-test show statistically significant differences in opinion on the importance of the factors, presented in Table 3.

We can therefore claim that companies with previous experiences with Software as a Service estimate the following factors as more important compared to companies without previous experiences with Software as a Service: Service usability, Customer support services, Co-branding or linked branding, User authentication, Service recovery definition and restoration in case of detected problems.

On the other hand, we can claim that companies without previous experiences with Software as a Service (specifically experiences with Customer relationship management services), estimate following factors as more important compared to companies with such experience: User authenticity evaluation and Quality assurance as more important compared to companies with such experience.

Table 4 presents statistically significant differences in opinion about business model factors’ importance on cloud computing adoption. The differences are presented among companies.
with previous experiences with Platform as a Service and the companies without previous experiences with Platform as a Service.

<table>
<thead>
<tr>
<th>Business model factor</th>
<th>Independent variable</th>
<th>t</th>
<th>p</th>
<th>M1</th>
<th>M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer value / service value for customer / Service value added</td>
<td>Software development</td>
<td>2.515</td>
<td>0.029</td>
<td>4.00</td>
<td>2.25</td>
</tr>
<tr>
<td>Customer value / service value for customer / Customer support services</td>
<td>Data warehousing</td>
<td>2.206</td>
<td>0.052</td>
<td>5.00</td>
<td>4.45</td>
</tr>
<tr>
<td>Focus of services to target customers / Targeting based on customer process complexity</td>
<td>Software development</td>
<td>3.245</td>
<td>0.008</td>
<td>4.11</td>
<td>2.00</td>
</tr>
<tr>
<td>Collaboration with partners / Defined collaboration with partners</td>
<td>Data warehousing</td>
<td>4.977</td>
<td>0.000</td>
<td>5.00</td>
<td>3.69</td>
</tr>
<tr>
<td>Collaboration with partners / Defined dispute resolution mechanisms with partners</td>
<td>Data warehousing</td>
<td>4.168</td>
<td>0.002</td>
<td>5.00</td>
<td>3.92</td>
</tr>
<tr>
<td>Assets / Intangible / References &amp; Recommendations</td>
<td>Memory capacity</td>
<td>3.237</td>
<td>0.008</td>
<td>4.83</td>
<td>3.14</td>
</tr>
<tr>
<td>Assets / Intangible / Knowledge and experiences</td>
<td>Software development</td>
<td>2.892</td>
<td>0.014</td>
<td>4.78</td>
<td>3.40</td>
</tr>
<tr>
<td>Marketing / Use of partners’ marketing channels</td>
<td>Migration of software solutions</td>
<td>2.854</td>
<td>0.015</td>
<td>4.70</td>
<td>3.25</td>
</tr>
<tr>
<td>Service charging/billing / Based on service usage</td>
<td>Software development</td>
<td>2.286</td>
<td>0.052</td>
<td>3.89</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Data warehousing</td>
<td>2.93</td>
<td>0.014</td>
<td>5.00</td>
<td>4.08</td>
</tr>
</tbody>
</table>

Legend:

M1 – average on factor importance / companies without previous cloud computing experiences, M2 – average on factor importance / companies with previous cloud computing experiences, t-value, p – statistical significance

Table 4: Difference in opinion on importance of business model factors impacting cloud computing adoption according to previous experiences with Platform as a Service.

We can claim that companies without previous experiences with Platform as a Service recognize exposed factors as more important for cloud computing adoption compared to companies with previous experiences with Platform as a Service.

Table 5 presents statistically significant differences in opinion about business model factors’ importance on cloud computing adoption. The differences are presented among companies with previous experiences with Infrastructure as a Service and the companies without previous experiences with Infrastructure as a Service.
Results of t-test show statistically significant differences in opinion on the importance of the factors presented in the table 5. We can claim that companies without previous experiences with Infrastructure as a Service recognize exposed factors as more important for cloud computing adoption compared to companies with previous experiences with Infrastructure as a Service. The only exception is the factor Billing according to service use.

### 4 Discussion

With the introduced research model, we emphasized a selection of 40 factors, considered influential to affect adoption of different types of cloud computing services (SaaS, IaaS, PaaS). The paper emphasizes differences in opinion on importance of these factors for cloud...
computing adoption in organizations. Differences in opinion were investigated based on previous experiences with each type of cloud computing services. Companies with previous experiences with Software as a Service considered service Usability, Customer support services, Co-branding, User authentication and Trust building mechanisms in case of service recovery as less important compared to the companies without previous experiences with Software as a Service. On the other hand, companies without previous experiences with Software as a Service defined as of higher importance the following factors: Knowledge and experiences of provider, Internet and social media channels for marketing, User authentication and Service quality in a scope of trust building mechanisms.

Companies with previous experiences with Platform as a Service considered the following factors as more important compared to the companies without previous experiences with Platform as a Service: Service value added, Customer support services, Service targeting based on customer process complexity, Collaboration with partners among cloud computing providers, Defined dispute resolution mechanisms with partners, Intangible assets in a means of References and Recommendations of provider, Intangible assets in a means of Knowledge and Experiences of provider, Use of partners’ channels for marketing means and Service billing based on service use (pay per service).

Companies with prior experiences in Infrastructure as a Service considered the following factors as more important compared to the companies without previous experiences in Infrastructure as a Service: Service flexibility, Service added value, focusing of service to customer company size, Customer process complexity, and Customer geographical location, Defined collaboration with partners in provider network, Tangible assets for cloud IaaS provision (technology, SW, HW, network, etc …), and Intangible assets of provider in a means of References and Recommendations. The only exception is Billing of the service based on service use (pay per use).

Survey results are useful for cloud computing providers. They provide the information about which factors users and potential users are the most sensible about. Research results have shown that factors related to Trust building mechanisms as for example in our case user Authentication, System security, Service quality, Service and system availability, Service recovery, and Provider shift trust building mechanisms are the most important and customers are the most sensible about them. Field investigation in Slovenia has shown rather slow adoption of cloud computing services in Slovenian market. Many companies are not yet aware of cloud computing and its potential business benefits (this can be observed also from low survey response). There is a huge potential for cloud computing adoption, especially for SMEs, who could avoid all the difficulties with information technology infrastructure and software maintaining, resulting in lower costs and increased focus to the core business. From this perspective providers should promote and address potential users in an understandable way and present business models, suitable for the companies of different size, different business type and geographical focus.

Investigated provider's business model factors could also be classified in so-called organizational business model factors. They are mostly defined by the service provider. For the future research, it would be recommended to include environmental factors (impact of competition, influence of business partners, legislation, economic characteristics, etc.) into the
research model and investigate their impact or their importance for cloud computing adoption in organizations.

References


