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ANALYSIS OF THE FACTORS INFLUENCING ADOPTION OF SOFTWARE AS A SERVICE IN COMPANIES

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Аннотация

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Название магистерской диссертации	Анализ факторов, влияющих на внедрение программного обеспечения как услуги в компаниях
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Научный руководитель	Сергей Александрович Яблонский, доцент
Описание цели, задач и основных результатов	Целью данного исследования является выработка управленческих рекомендаций для поставщиков программного обеспечения как услуги (Software as a Service, SaaS) для корпоративного использования на российском рынке. Данные рекомендации могут быть использованы при разработке маркетинговой стратеги, стратегии продаж, планировании новых продуктов и формулировании договора об уровне поставляемого сервиса. Для этой цели были выявлены факторы, влияющие на принятие SaaS в российских организациях, и протестирована их связь к намерению принятия SaaS в организациях.
Ключевые слова	Облачные вычисления, программное обеспечение как услуга, принятие инноваций, информационные системы

Abstract

Master Student's Name	Dmitry Orlov
Master Thesis Title	Analysis of companies' software as a service adoption intention factors
Faculty	Graduate School of Management
Major Subject	International Innovation and Technology Management
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Academic Advisor's Name	Associate Professor Sergey A. Yablonsky
Description of the goal, tasks and main results	The goal of this study is to develop managerial recommendations for international vendors and system integrators, which offer Software as a Service for enterprise information systems on the Russian market. Those recommendations can be used to develop marketing, sales, new product and service level agreement strategies. For those reasons factors affecting SaaS adoption were determined and their influence on intention to adoption was examined.
Keywords	Cloud computing, software as a service, innovation adoption, information systems

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1 Introduction

This chapter provides an overview of the current study. First we discuss the background of the research, than present research questions, theoretical framework and key concepts of the study.

1.1 Background of the research

This thesis is built around a relatively new delivery model for enterprise software offerings, Software as a Service (SaaS). Such software offerings are based on web-technologies, are usually delivered as a hosted service over the Internet and typically charge customers a subscription fee instead of up-front license payments. Major research agencies, such as International Data Corporation (IDC) and Gartner, predict blasting growth of the enterprise SaaS market, in Russia, as well as in global. This is correlated to the recent development and spread of Cloud Computing technologies. Even though, today market of enterprise SaaS in Russia is quite small.

SaaS was initially widely deployed for sales force automation and Customer Relationship Management (CRM). Today various SaaS based solutions for different business tasks are available on the market (accounting software, computerized billing, ERP software, invoicing, human resource management, financials, content management, collaboration, document management, and service desk management). But according to Gartner, content, communications and collaboration SaaS offerings dominate the enterprise application market, with customer relationship management products close behind. This is relevant for the global application market, as well as for the local Russian market.

Internet delivery as one of the major characteristics related to SaaS systems has destroyed country borders for international SaaS offerings. This means that Russian enterprise customer can easily use service of SaaS provider from USA or Europe. Major SaaS providers use different

forms of partnership with Russian based integrator companies which mediate relationship between them and Russian enterprise customers.

Innovations in the field of information and communication technology are introduced relatively often, and individuals as well as organizations adopt these innovations. Some of those innovations are more successful on the market then the other due to the rapid adoption. A number of factors influencing multi-stage innovation adoption process were distinguished in a theoretical literature during the last 40 years.

SaaS applications should be considered as innovations for organizations adopting them, as it is a new way of doing business, an organizational innovation. The issue of factors influencing adoption process of SaaS application is not widely studied yet. In our work we will test impact of generalized innovation adoption characteristics on adoption process of SaaS applications.

1.2 Purpose of the present study and research questions

The goal of this thesis is to develop managerial recommendations for international vendors and system integrators, who offer SaaS systems on the Russian market. If the firm aims to have a market success for a provided innovation it should understand potential adopters' needs and factors influencing their decision to either adopt or reject an innovation. Innovation adoption theories offer a set of instruments which help to recognize factors influencing the acceptance of innovations by customers on the market. For this reason we will use innovation adoption theories to examine the emerging market of enterprise SaaS systems and to identify major drivers for adoption of this new model in enterprises. Knowledge of those factors would help providers and integrators of SaaS systems to build their marketing and sales strategies, formulate service level agreements and develop products which would be accepted on the market more rapidly.

This research has international background due to the reason that actual providers of SaaS are located in different countries. SaaS model characteristics allow market relations between the players located in different countries, as the service is provided through the internet. Company which acts only on Russian market may use SaaS product which, for example, is physically located in European datacenter and is provided by German-based company. Major international enterprise software providers such as Microsoft, SAP and Oracle currently have a number of SaaS offerings among their products. Usually international SaaS providers build their sales strategy in partnership with local based system integrator company.

The actual problem SaaS provider face when entering Russian market today is lack of market's familiarity with SaaS model. Today enterprise decision makers don't completely understand benefits the new model provides and are suspicious towards the unexplored risks related to the model. From the conversation with Korus Consulting specialists, a large St. Petersburg based system integration company, I learned that system integrators are trying to sell the SaaS solution without paying attention to the characteristics of the new model.

Though the number of actual implementations of SaaS in Russian enterprises is rather low (IDC, 2010), the SaaS term became a buzz word, and rarely any IT related decision making manager haven't heard of it. The problem this research faces is relation of SaaS model characteristics perceived by decision making units in Russian enterprises to the intention to its adoption. The knowledge of that relation could have been used by system integrators to develop an efficient SaaS marketing, sales and SLA strategies.

There are several unexplored areas the research would try to fill:

- Factors affecting intention to adoption of SaaS systems are not

widely studied yet. Though there were a number of researches targeted to investigate influence of different factors to the innovation adoption, a number of researchers claimed that factors influencing innovation adoption process have different weight and thereby different influence on different stages of adoption process; still most of the studies were built around adoption decision (adoption behavior) stage. The present study examines influence of factors on SaaS adoption intention stage.

- There is a lack of studies devoted to Russian market peculiarities in SaaS adoption. Russian cultural peculiarities should have influence on generalized adoption characteristics. The present study deals with Russian buyers while still examine global SaaS offerings, thus identifying adoption factors weights on Russian market.

Thus the key research question is: What is the influence of perceived SaaS characteristics on the intention to its adoption? This question splits into a number of sub questions:

- What is the influence of perceived relative advantage of SaaS on intention to its adoption?
- What is the influence of perceived compatibility of SaaS on intention to its adoption?
- What is the influence of perceived complexity of SaaS on intention to its adoption?
- What is the influence of perceived trialability of SaaS on intention to its adoption?
- What is the influence of perceived observability of SaaS on intention to its adoption?
- What is the influence of perceived uncertainty of SaaS on intention to its adoption?

The answers to those questions would be revealed through the analysis of a number of hypotheses. Those hypotheses would be formulated further.

1.3 Theoretical framework

Figure 1 is used to visually describe the theoretical framework. It represents organizations located in the Russian market. Big arrow represents the adoption process within the organizations. SaaS providers and system integrators are represented by the framework as well. It is showed that SaaS providers might be located outside of the local market. Also theoretical framework includes the relationship between perceived SaaS characteristics and adoption intention stage of the adoption process.

Figure1. Theoretical Framework.

1.4 Key concepts

Cloud Computing - a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three delivery models, and four deployment models (Fingar, 2010).

Software as a Service - software deployed as a hosted service and accessed over the Internet (Carraro and Chong, 2006).

Adoption process - the process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision (Rogers 1995).

Adoption - a decision to make full use of an innovation as the best course of action available (Rogers 1995).

Intention to adoption - to a consumer’s expressed desire to purchase a new product in the near future (Rogers 1995).

Innovation - an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers 1995).

1.5 Research methods

The empirical part of the study discusses the adoption of SaaS in Russian companies. Based on the literature several hypotheses were formed and tested with the help of a survey data. The survey was targeted to clients of Russian system integration company Korus Consulting. Which approves

they have previously adopted enterprise information systems solutions.

Data was collected during March-April 2011. For the analysis, the collected data was coded into the SPSS – statistical analysis program. The analysis part consists of several different statistical analyses and tests.

2 Innovation adoption studies

This chapter discusses the main concepts and definitions related to the innovation adoption studies. The basic theories of adoption are briefly introduced. After that the intention to adoption point of view is discussed. In the end we briefly go through the issue of factors influencing adoption process.

2.1 Definitions

Rogers (1995) defines diffusion of innovation as “the process by which an innovation is communicated through certain channels over time among the members of a social system. In that special type of communication messages are concerned with new ideas”. While the concept of innovation is defined as (Rogers 1995) “an idea, practice, or object that is perceived as new by an individual or other unit of adoption”. Thus the only requirement for the innovation is to be new for the adopter.

The concept of adoption is defined as (Rogers 1995) “a decision to make full use of an innovation as the best course of action available”. While rejection is “a decision not to adopt an innovation”.

The adoption process concerns a sequence of stages a potential adopter of an innovation passes before acceptance of the innovation. Rogers (1995) defines the adoption process as “the process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision”.

In the present study Software as a Service systems are new for the adopting organizations, so they are considered as innovations.

2.2 Adoption of innovations

The diffusion of an innovation among organizations involves the adoption of the innovation by individual organizations. Adoption requires a choice to adopt or reject an innovation by organization decision making unit. Innovation adoption is best represented by a process which includes a number of stages through which an individual passes, from first awareness to continued use of the innovation (Rogers 1995). While passing through this process, the decision making unit forms perceptions of the characteristics of the innovation (Wood and Lynch 2002) and weights them in a decision related to choice. We can separate intention to adoption and adoption related behavior as variables that represent different stages of the innovation adoption process.

We can distinguish different theoretical models from the literature which are concerned with innovation adoption. Those are studies build on Rogers' (1995) innovation diffusion theory, the Technology Acceptance Model (TAM) (Davis 1989), the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975) or the Theory of Planned Behavior (TPB) (Ajzen 1985). Some of concepts defined in those theories are similar. For example, characteristic of perceived complexity, as defined by Rogers (1995), was represented in the TAM (Davis 1989) as ease of use. In the present study we presented a single framework, accumulating factors from mentioned theories.

2.3 Technology acceptance model

In their work Fishbein and Ajzen (1975) developed theory of reasoned action (TRA) which discusses individual's behavior as a positive function of his/her behavioral intention to perform the behavior. An individual's behavioral intention can be considered as a function of two variables: a person's attitude toward performing the behavior, and a person's subjective norm regarding the behavior (Wu and Wu 2005). TAM was

developed by Davis (1989) and was based on TRA. The objective of TAM is particularly to provide an explanation of the underlying determinants of information technologies acceptance. TAM posits that an attitude toward using an information system is based on two primary antecedent variables - perceived usefulness and perceived ease of use. Perceived usefulness is defined as "the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (Davis et al., 1989). Perceived Ease of Use is defined as the "the degree to which the prospective user expects the target system to be free of effort". Software perceived as being helpful in performing important tasks and easy to use are typically evaluated more highly and often deemed desirable. Although attitudes are relatively stable, they change and can be influenced over time. As argued before, there is evidence from attitude research that a person's attitudes mediate the influence of external variables. In the same line, the TAM hypothesizes that the beliefs are affected by external influences (Davis et al. 1989).

2.4 Relation to Diffusion of Innovations

Innovation diffusion theory and TAM are related to each other with some variables. The determinants of attitude in TAM (perceived usefulness and perceived ease of use), are related to two attributes of the innovation factor in innovation diffusion theory. The Perceived usefulness construct in TAM is relevant to relative advantage in innovation diffusion theory, and the perceived ease of use construct is expressed by complexity (Moore and Benbasat 1991). TAM basically provides the theoretical framework to define linkages among belief, attitude, behavioral intention and behavior. However, it is criticized for not considering the social influence on technology acceptance. Empirical studies have suggested extending TAM by including other variables to improve its predictive and explanatory power (Wu and Wu 2005).

2.5 Innovation adoption stages

There is a number of innovation considering issues the decision-makers face in organizations. These are the choices to innovate or not, to select innovations from a set, to use different methods for implementation and other. Basically the decision-making process involves four steps: (1) the generation of some set of optional actions, (2) a set of consequences is attached to each of options, (3) a rank is attached to each of the consequences of various alternatives, and (4) the decision makers select the first alternative that meets some minimum standard of satisfaction (Zaltman et al. 1984).

Before accepting an innovation a potential adopter goes through a sequence of stages (Frambach and Schillewaert 1999). Rogers (1995) defines the adoption process as “the process through which an individual or other decision making unit passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea, and to confirmation of this decision”. When describing organizational adoption, two main stages (consisting of different substages) are distinguished: initiation and implementation. The actual adoption decision occurs between the initiation and the implementation phase.

In the initiation stage, the organization becomes aware of the innovation, forms an attitude towards it and evaluates the new product or idea (Frambach and Schillewaert 1999). This stage includes the awareness, consideration and intention substages. In the implementation stage, the organization decides to purchase and make use of the innovation. At first, organizations implement innovations on a trial basis to determine if they are practical before commitment is made to the establishment at full-time and in the best course available. If this has been successful, the implementation of an innovation will continue and the innovation becomes systematically used. (Zaltman 1984)

2.6 Intention to adoption

Adoption intention refers to a consumer's expressed desire to purchase a new product in the near future. It relates to the consumer's state of mind before actual purchase behavior has occurred and is based on the information and perceptions the consumer has at that time (Arts et al 2011). Adoption behavior, on the other hand, refers to the acquisition of an innovation (Rogers 1995)

During the past decades there were a number of researches initiated considering factors affecting innovation adoption decisions by decision makers. However, the insights of how influence of those factors differs between adoption stages were limited in number (Arts et al 2011).

Academic research on the adoption of innovations has shown that intentions to adoption do not strictly predict adoption behavior. At different stages of the innovation adoption process, use purposes and situations may be perceived differently, thus affecting the weight of evaluative criteria in the decision process. Consumers may therefore weigh attributes differently in situations of purchase intention and purchase behavior, resulting in an imperfect relationship between intention and behavior (Arts et al 2011).

Not always behavior follow intention, there are several reasons for that. They include consumers' change of intentions over time (Morrison 1979) and the inability of the consumer to predict unexpected incidents that may affect the adoption decision (Morwitz et al. 2007, cited in Arts et al 2011).

Thus it is important to understand factors affecting intention and differences with those of adoption behavior, in order to build successful sales and marketing strategy.

Although the adoption process is consisting of different stages, most studies are focused on the adoption decision, rather than on intentions.

Insight in the extent to which variables affect different stages in the adoption process differently, is still limited (Arts et al 2011).

2.7 Adoption of innovations in organizations

Organizations adopt innovations as well as individuals. However innovation decision process in organizations is more complex than in the case of individuals. Thus, different factors have different roles in those processes (Rogers 1995).

An organization as an adopter differs from consumers in innovative behavior. The personal characteristics determine the innovativeness of consumers and the size and structure function as determinants of organizational innovativeness. Consumers tend to satisfy individuals needs with innovation adoption while organizations adopt innovations in order to carry out value-adding activities, increased efficiency and effectiveness (Frambach and Schillewaert 1999).

3 Innovation characteristics affecting innovation adoption

This chapter discusses innovation characteristics affecting innovation adoption. First we discuss concept and types of innovation, than present an overview of perceived innovation characteristics.

3.1 Concept of innovation

Innovation is defined as adoption of a product, or service that is new to the adopting organization. The adoption of innovation is intended to contribute to the performance or effectiveness of the adopting organization. Organizational change is the adoption of new idea or behavior by an organization. Organizational innovation is the adoption of an idea or behavior that is new to the organization's industry, market, or general environment.

3.2 Type of innovation

There are several classifications of innovations within organizations. The first describes innovations as technical or administrative ones. The second way divides innovations into incremental and radical.

A technical innovation is occurring in the operating component and affects the technical system of an organization (Damanpour et al. 1989). It may include technical equipment and methods of operations. It is suggested that the structure and the processes of the organization as well as the behavior of its members should change for the successful adoption of technical innovations (Damanpour et al. 1989).

An administrative innovation is defined to occur in the administrative component and affect the social system of an organization (Damanpour et al. 1989).

Innovation can be classified into radical and incremental categories, where

incremental innovations are minor improvements in existed technology, while radical innovations are described as fundamental changes in technology. Zaltman (1984) defined radical innovations in terms of existing alternatives: the more an innovation differs from existing alternatives, the higher is its degree of radicalness.

3.3 Perceived characteristics of innovations

Rogers (1995) identifies five perceived innovation characteristics that influence the adoption process: relative advantage, compatibility, complexity, observability, and trialability. Frambach and Schillewaert (1999) have also added uncertainty to the list.

Perceived innovation characteristics drive the adoption process and are influenced by external variables. The perceived innovation characteristics can be considered as beliefs or attitude towards the innovation. Frambach and Schillewaert (1999) found support to propose that perceived innovation characteristics mediate the supplier and environmental influences on adoption behaviors. The perceptions of an innovation by members of an organization's decision-making unit affect their evaluation of and propensity to adopt a new product (Frambach and Schillewaert 1999). In order for organization to consider adoption the perceived benefits of the innovation should exceed the perceived benefits of other options.

Innovation characteristics have a strong but different effect on different adoption process stages. A number of researches were targeted to investigate influence of perceived characteristics to the innovation adoption. Evidences were presented to prove that perceived characteristics influencing innovation adoption process have different weight and thereby different influence on different stages of adoption process Below we discuss different perceived innovation characteristics introduced by Rogers (1995) in more detail.

3.4 Perceived relative advantage

Perceived relative advantage of an innovation is one of the most important factors influencing adoption (Frambach and Schillewaert 1999). It refers to the extent to which the potential adopter perceives an innovation is superior to alternative products, services or concepts (Rogers 1995). According to Rogers (1995) relative advantage can be measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. Thus relative advantage is often expressed in terms of economic profitability, social prestige, productivity, convenience, satisfaction and so on.

Perceived relative advantage is one of the superior factors affecting rate of innovation adoption among organizations. It affects positively both adoption intention and adoption behavior (Arts et al 2011). If the new product or service gained a market perception of more superior, more economically valid solutions for a need or problem it should be adopted rapidly.

3.5 Perceived compatibility

The compatibility of an innovation can be defined as a rate of agreement between the innovation and the existing values of the potential adopter (Rogers 1995). Rogers (2003) claims that an innovation can be compatible or incompatible with socio cultural values and beliefs, previously introduced ideas or client needs for the innovation. Compatibility concerns the similarity of the innovation to an existing product it may eventually supplement, complement or replace (Zaltman et al. 1984). Compatibility may also refer to compatibility with the values or norms, with the existing practices of the adopter. Compatibility is a stronger driver of adoption intention and relative advantage for adoption behavior (Arts et al 2011).

The innovation that is incompatible with the values and norms of the potential adopter social system will not be passed as quickly as idea that is compatible. Adoption of incompatible innovations often requires the prior

adoption of a new system of values, which is a relatively slow process (Rogers 1995).

Eason (1988) differentiates user and organizational compatibility of an innovation, by claiming that as far as user compatibility is concerned, an innovation must offer its services in a way which its users will perceive, at a minimum, as not threatening aspects of their work and will perceive it as positively facilitating goals they wish to pursue. Considering organizational compatibility, an organization at large has goals, policies and structures, the innovation must not only serve immediate task needs but must not impede other aspects of organizational functioning.

3.6 Perceived complexity

Complexity represents the rate to which an innovation is perceived difficult to use or implement (Rogers 1995). Zaltman (1984) defined two different sides of the complexity: complex ideas containing in innovation and complexity of the actual implementation of the innovation. TAM theory discusses complexity in terms of ease of use. The perceived ease of use is defined as the degree to which an individual believes that using a particular system would be free of physical and mental effort. Complexity has a positive effect on intention, but negatively affects adoption behavior (Arts et al 2011).

Lunkuse (2004) claims that technology users perceive as easy to use if it is easy to learn, flexible and controllable. International Standards Organisation defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a given context". Eason (1988) defines usability of a system as the system offering its functionality in such a way that the planned users will be able to master and exploit it without undue strain on their capacities and skills.

3.7 Perceived trialability

Trialability represents the rate to which an innovation can be tried on a limited scale before the actual implementation (Rogers 1995). New ideas that can be tried on will generally be adopted more quickly. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.

3.8 Perceived observability

Observability (also known as communicability, demonstrability or describability) represents the rate to which the results of an innovation implementation are visible (Rogers, 1995). Some ideas are easily observed and communicated to other people, other innovations are difficult to observe or to describe to others. Clearly visible positive results increase chances for an innovation to be adopted.

If the innovation has hardware and software parts, than the software component of a technological innovation is not clearly observed. So innovations in which the software aspect is dominant possess less observability, and usually have a relatively slower rate of adoption (Rogers, 2003). Cultural Lag Theory claims that material innovations diffuse and are adopted more readily than non-material ideas.

3.9 Perceived uncertainty

If the innovation is associated with a high level of uncertainty, attitude towards adopting it would be less (Ostlund 1974, cited in Frambach and Schillewaert 1999). Gerwin (Frambach and Schillewaert 1999) discusses three different types of uncertainty:

- Technical uncertainty is related to the rate to which it is difficult for a potential adopter to determine the reliability and functional possibilities of innovation. Technical uncertainty includes as well the extent to which a better solution is perceived to emerge soon.
- Financial uncertainty is related to the rate to which it is difficult to

determine financial attractiveness of the innovation implementation and related to innovation unexpected costs.

- Social uncertainty is related to the rate of acceptance that the implementation of innovation would lead to the conflict within the potential adopter's immediate environment.

Perceived uncertainty shows a stronger negative effect on intention than on adoption behavior (Arts et al 2011).

A number of researches claimed that it is hard to rationally valuate return on investment in IT systems. In his article, Ermoshkin (2006) claims that there is no single theory or method for valuation of IT efficiency, as information technologies solutions are strictly tied with business processes within organizations. He points out that there are different categories of stakeholders in organizations and IT project might solve different problems for different categories of stakeholders. As those groups of stakeholders have different points of view on the value IT provides, the valuation of IT project would depend on the point of view of the valuator. Thus we can assume that an IT project is successful if it solves problem of some category of stakeholders. Dependent on the category of stakeholders and its point of view, there are different methods and parameters of IT valuation available.

4 Factors affecting adoption of innovation in organization

Several factors have been found to affect innovation adoption in organizations apart from perceived innovation characteristics. These factors are generally divided into structural characteristics of organizations, managerial influence, environmental factors and information processing.

In the innovation adoption literature, characteristics of the potential adopter are in the line with the perceived characteristics of the innovation in the importance for driving of innovation adoption (Frambach and Schillewaert 1999, Rogers 1995).

The following discussion is based on these above introduced characteristics that have been found to effect the innovation adoption in organizations.

4.1 Organization characteristics and structure

There are three main characteristics of the adopter organization that may influence adoption process. These are organization size, organization structure, and organizational disposition innovativeness (Frambach and Schillewaert 1999).

In case of the adoption processes size of the organization is largely correlated with organizational structure, strategy and culture. Some researchers suggest that organizational size is a major determinant in innovation adoption (Frambach and Schillewaert 1999). As the size of an organization increases the more resources exist to expend in innovation adoption and implementation.

A number of researches claimed that the adoption of innovations is affected by the centralization of the adopting organization. Centralization is

defined as “the extent to which decision making responsibility concentrates at the top levels of management” (Grover et al. 1995, cited in Taalikka 2002). Thus, the greater the hierarchy of authority and less participation in decision-making, that exists in the organization, the greater the centralization and vice versa. The effects of centralization on innovation adoption vary in different studies. In some cases the relationship between innovation and centralization has been found positive and in others negative. Formalization is defined as “the extent to which a firm uses rules and procedures for all situations” (Grover et al. 1995, cited in Taalikka 2002) Zaltman, Duncan and Holbek (1973, cited in Frambach and Schillewaert 1999) propose that more formalized and centralized organizations (often the larger firms) are less likely to initiate innovation adoption decisions, but are better equipped to actually implement innovations. The opposite holds for organizations that are highly complex or specialized.

The last characteristic is referred to Morrissons (1996) “Organization Disposition Innovativeness” (ODI) and “Leading Edge Status” (LES), which explain time of adoption in organization. Organizations that pursue an innovation oriented marketing strategy are more likely to adopt innovations.

4.2 Supplier marketing activity

Adoption of innovation in organizations can be significantly affected by supplier marketing activity. There are three major factors related to the supplier marketing activity which affect adoption most significantly. These are the targeting of the innovation, the communication on the innovation, and the activities the supplier undertakes to reduce the risk of adoption for the potential customer (Frambach and Schillewaert 1999). Supplier communication activities play several important roles in the process of adoption: it creates awareness of the innovation, which leads to the further stages of the adoption process (consideration, intention); it also affects the

perceptions of the innovation by potential adopter (Rogers 1995).

The number of researches showed that the reduction of risks associated with early adoption of an innovation can dramatically increase the rate of adoption. Such risks include implementation risk, financial risk and operation risk (Easingwood and Beard 1989, cited in Frambach and Schillewaert 1999).

4.3 Social network

Interconnectedness is the degree to which organizations share information with others (Rogers 1995). The higher the degree of information sharing, the more likely organizations adopt new ideas and products. Aiken and Hage (1971) suggested that interorganizational relationships are positively related to innovations adoption. Due to interorganizational relationship an organization has greater abilities to reach new ideas and information, which increases the motivation towards adoption of innovations.

4.4 Environmental influences

Zaltman (1984) views the organization as an open system in continued interaction with its environment and then defines the organizational environment as “the totality of physical and social factors that are taken directly into consideration in the decision-making behavior of individuals in the organization”. The environment has strong impact on an organization’s ability to adapt and innovate.

Innovation adoption is a means of changing the organization to facilitate the adoption to changing environments in order to sustain or increase organizational effectiveness (Damanpour and Gopalakrishnan 1998, cited in Taalikka 2002)

The potential adopter firm may get an attitude towards adoption from the fact that business partners within their network have previously adopted

the innovation (network externalities).

Competitive pressures are other determinants of adoption. It may be highly important for a company to innovate in order to keep market position on markets with high competition (Frambach and Schillewaert 1999). Generally it is expected that competition would facilitate innovations in the market. When an organizations views more and more companies from the same industry adopting an innovation it feels the need to adopt it in order to remain competitive.

5 Cloud computing technologies

One of the most significant trends in the IT industry nowadays is the emerging of Cloud Computing technologies. Cloud computing has been described as a technological change brought about by the convergence of a number of new and existing technologies. Basically, use of Cloud Computing can be described as an organizational innovation, as it appears as integration of advances in several informational technology fields that were used before. Those fields include utility computing, distributed computing, grid computing, web services, and service oriented architecture (Motahari-Nezhad et al. 2009).

Cloud computing has sparked a huge amount of interest in the IT industry. International Data Corporation suggests that the market for cloud computing services was $16 billion in 2008 and is predicted to rise up to $42 billion a year by 2012 (Gleeson 2009).

The following chapter discusses cloud computing technologies. First we go through definitions related to the cloud computing. Then discuss characteristics of cloud computing, cloud environment roles and cloud delivery models.

5.1 Definitions of cloud computing

There is an uncertainty around meanings of the Cloud Computing term, due to the different perspectives on its use:

- A way to provide compute or storage capacity as a service, provisioned from a parallel, on-demand processing platform that leverages economies of scale
- A delivery model of software as a service for making applications available over the Internet
- The perspective of variable pricing without long term commitments and massive elastic scaling of services
- An infrastructure architecture alternative that can reduce costs

Armbrust et al. (2009) define Cloud Computing as a set of technologies which refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services.

Information Technology Laboratory of the National Institute of Standards and Technology (NIST) Cloud Computing Project has posted the following working definition of Cloud Computing (Fingar 2010): “Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three delivery models, and four deployment models.”

5.2 Characteristics of Cloud Computing

One of the basic characteristic of Cloud Computing is scalable resources. The use of fixed computing resources for each business unit builds the traditional information technology model in an enterprise. The major problem related to this model is under-utilization and waste of computing resources due to unequal distribution of workload and resource fragmentation. Enterprises use adaptive resource distribution techniques to solve this problem. These include employing virtualization to address the under-utilization problem complemented with automation techniques to reduce the significant labor costs of IT operations. This is a type of cloud computing and it is called private cloud as it is privately used by organization (Motahari-Nezhad et al. 2009). This model enables users to avoid over-provisioning and under-provisioning, to improve cost, revenue, and margin, and to provide new business services based on new ways of operating.

There are also other offerings of cloud computing which are dedicated for public use, they are called public clouds. Those are provided by Amazon, Google, Microsoft and Salesforce.com. Some of these clouds are indeed extensions of their private clouds that are offered to the public.

Armbrust et al. (2009) call a Public Cloud a Cloud which is made available in a pay-as-you-go manner to the public; they call Utility Computing the service being sold. Current examples of public Utility Computing include AmazonWeb Services, Google AppEngine, and Microsoft Azure. They use the term Private Cloud to refer to internal datacenters of a business or other organization that are not made available to the public. In their definition Cloud Computing is the sum of SaaS and Utility Computing, and it does not normally include Private Clouds.

5.3 Cloud Environment roles

Cloud Computing in general can be divided into several layers, which are offered as separate services. Motahari-Nezhad et al. (2009) summarize them in the following:

- Infrastructure as a service (IaaS): Hardware resources (such as storage) and computing power (CPU and memory) which are offered as services. Organization can rent these resources rather than spend for purchasing of fixed servers resources and networking equipment. In most cases companies pay for the amount of utility computing resources used, which is metered. As examples in this category, Amazon offers S3 for storage, EC2 for computing power, and SQS for network communication.
- Software as a service (SaaS): In this model, software applications are not purchased as packages but are used as a service with an access through the internet.
- Platform as a service (PaaS): This refers to providing facilities to support the entire application development lifecycle including design, implementation, debugging, testing, deployment, operation and support of rich Web applications and services on the Internet. Examples of platforms

in this category are Microsoft Azure Services platform, Google App Engine (Motahari-Nezhad et al. 2009).

Further we'll use generalized term Cloud Computing describing all the mentioned level. Figure 1 shows the roles of the people as users or providers of these layers of Cloud Computing (Armbrust et al. 2009).

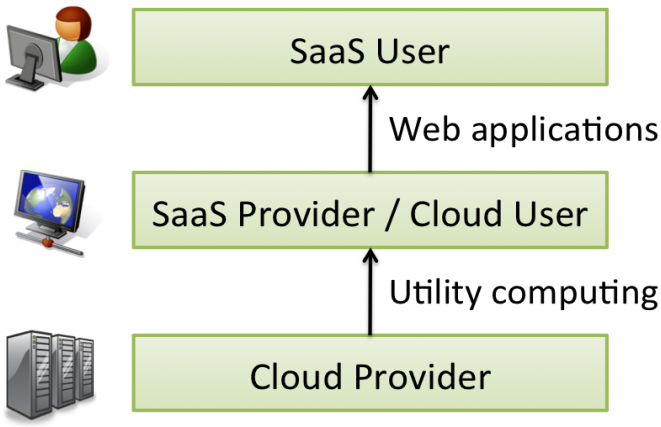

Figure 2. Cloud environment roles.

5.4 Cloud delivery models

There are two primary cloud delivery models: public and private. A third model is a combination of both (IBM Global Technology Services 2010).

A private cloud is the one in which both the consumer of cloud services and the provider of those services exist within the same enterprise. The ownership of the cloud assets resides within the same enterprise providing and consuming cloud services.

A public cloud is one in which the consumer of cloud services and the provider of cloud services exist in separate enterprises. The ownership of the assets used to deliver cloud services remains with the provider.

A hybrid cloud combines multiple elements of public and private cloud, including any combination of providers and consumers, and may also contain multiple service layers.

Integrators—Integrators provide the necessary level of IT literacy to communicate the consumer's IT requirements effectively to the provider. In a public cloud delivery model, the integrator role resides on the consumer side of the equation and retains accountability to the consuming organization for the cloud services provided by an external third party.

Providers—the provider supplies the cloud service and owns the assets required to produce and deliver cloud services to the consumer. In the private cloud model, internal providers deliver services to internal consumers. In a public cloud model, the provider is an external third party, and may provide services to multiple consumers or to a single consuming organization. Providers can also be part of a hybrid service delivery model, in which they supply both public and private cloud services, from different service types.

6 Cloud computing model risks and opportunities

This chapter provides an overview of general risks and opportunities related to cloud computing model. First we go through benefits and then discuss risks. The characteristics provided in this chapter are used to develop measurement scales for the current research.

6.1 Benefits provided by cloud computing model

Armbrust et al. (2009) argue that elasticity – the ability to quickly scale up or down one's resource usage – is an important economic benefit of cloud computing as it transfers the costs of resource over-provisioning and the risks of under-provisioning to cloud providers. Armbrust et al. (2009) provide a few theoretical examples to highlight the importance of elasticity with respect to costs.

The famous graph used by Amazon Web Services illustrating the capacity versus utilization curve has become an icon in Cloud Computing. The model illustrates the central idea around Cloud-based services enabled through an on-demand business provisioning model to meet actual usage.

Cloud computing addresses computing as a utility, providing computing as a service. One attractive cost issue is the ability to pay for services as they are needed, avoiding large up-front expenses for computer system purchases (Armbrust et al. 2009). Another attractive aspect of cloud computing is the savings on space, utilities, and maintenance staff which can be realized by outsourcing computing applications to a cloud computer provider. This practice can also be attractive to organizations interested in green issues, enabling efficient use of power and other utilities by shared use of computing resources.

Motahari-Nezhad et al. (2009) briefly discussed the benefits and risks of using cloud computing from a business perspective. They highlighted the following benefits of using Cloud Computing services: (1) avoiding huge

initial investments in hardware resources and software, (2) reducing ongoing operational, upgrade and maintenance costs, (3) scaling up and down hardware, network capacity and cost based on demand, (4) higher availability compared to in-house solutions for small businesses and individual-consumer maintained resources, and (5) access to a variety of software applications and features offered as SaaS that otherwise the company would have to purchase separately.

There is a common perception that external cloud computing can reduce costs for large enterprises as well as SMBs. In their report Dubey and Wagle (2007) provide an example of how total cost of ownership may differ in sample deployment of customer relationship management software (CRM) in software on premises and software as a service cases. Their calculations showed economy of 1.5 times. They pointed out the following sources of savings with software as a service: reduced deployment time, limited customization, no need in infrastructure and application testing, lower training requirements through simple user interfaces and self-training, no need in ongoing business process change management (vendors monitor customer usage to enhance offering, customers provide feedback to influence feature functionality), reduced costs of ongoing operations, back-end hardware and software (they are included in subscription price), reduced unused licenses by 20%.

However, the cost advantages for large enterprises may not be as clear as for SMBs, since many large enterprises can reap the benefits of significant economies of scale in their own internal IT operations. (Li et al. 2009)

While cloud computing initially appears to be less expensive in terms of upfront costs, the comparison may be much more competitive when total cost of ownership (TCO) — including recurring costs — and potential risks are taken into account. Li et al. (2009) show that migration to an external cloud may entail significant changes or additions to the enterprise network in order to provide acceptable performance to corporate users in regions

with limited bandwidth. Increases in bandwidth may be necessary, and in many countries bandwidth is still very expensive. Kshetri (2010) states that the greatest barrier for adoption and effective utilization of the cloud in the developing economies centers on a low PC penetration and a low bandwidth.

Motahari-Nezhad et al. (2009) pointed out the lack of environments for helping businesses migrate their current applications to the cloud. Other potential risks of using cloud services they showed include: (1) loss of direct control of resources and software, (2) increased liability risk due to security breaches and data leaks as a result of using shared external resources, (3) decreased reliability since the service providers may go out of business, causing business continuity and data recovery issues, and (4) SaaS solutions are mainly built as one-size-fits-all customers, although there are sometimes add-ons to complement the functionality. Also, Motahari-Nezhad et al. pointed out the difficulties of finding and integrating different cloud services for a given set of business requirements. They raised several difficult questions the company should answer before adopting Cloud computing: (1) which functions to move to the cloud in what order, (2) how to ensure a smooth migration process given legacy applications in their environment, and (3) how to find and select service offerings that meet their requirements and establish seamless interoperation between services.

6.2 Risks related to the Cloud Computing model

One of the significant issues caused by diffusion of cloud computing technologies is organizational change, caused by outsourcing of a number of business processes and responsibilities to the public cloud provider. The authority of the IT department is going to be further eroded by cloud computing. Cloud computing is increasingly turning “users into choosers” (Yanosky 2008) who can replace the services provided by the IT department with service offered in the cloud.

Security, legal and privacy issues are widely acknowledged as being important in cloud computing. Khajeh-Hosseini et al. (2010) point out that most of the security and privacy issues in cloud computing are caused by users' lack of control over the physical infrastructure. This leads to legal issues that are affected by a cloud's physical location, which determines its jurisdiction. Khajeh-Hosseini et al. (2010) suggest that most enterprises are likely to be cautious in moving their applications to the cloud simply because they do not really understand the security and regulatory issues involved. Security is about perceptions, many worry about security in the cloud because of a lack of control, while others argue that systems deployed in the cloud could be made as secure as systems deployed in local data centers (Ambrust et al. 2009).

Khajeh-Hosseini et al. (2010) stress compliance as another issue with data migration, which is especially challenging to satisfy when sensitive data is involved. Compliance departments are likely to be conservative in their interpretation of the regulations and will require very detailed evidence that any movement of data outside the enterprise does not have associated compliance risks.

Li et al. (2009) describe attempts of Intel Corporation to develop an enterprise Cloud Computing strategy. In analyzing cloud computing and they attempt to answer two related questions: Which services should Intel move to cloud computing and when? How does Intel map a path to cloud computing from its current environment? Li et al. (2009) assume that today cloud computing is relatively immature, and for large enterprises, the risks of wholesale adoption outweigh the potential benefits. Li et al. (2009) state that standards are lacking for security and for managing service-level agreements (SLAs) that could be used to help ensure compliance with government regulations and Intel standards through independent, third-party audits. They point out that cloud computing services may not provide the levels of reliability, manageability, and support required by large

enterprises. Today, many services are aimed primarily at SMBs and at consumers, rather than large enterprises.

7 Software as a Service in organizations

This chapter discusses issues related to Software as a Service model use in enterprise information systems. First we go through definitions and characteristics of Software as a Service, then discuss adoption of Software as a Service.

7.1 Definitions of Software as a Service

In this chapter we will uncover SaaS term in more details. This thesis is centered on SaaS model of software delivery. In general the idea of SaaS is simple: instead of buying and installing expensive packaged enterprise applications, users can simply access applications over a network, with an Internet browser being the only absolute necessity.

Carraro and Chong (2006) define SaaS as "software deployed as a hosted service and accessed over the Internet." Mäkilä et al. (2010) found out that there are several definitions of SaaS. Based on 17 definitions from different sources they distilled a list of five characteristics that are typically associated with SaaS:

1. Product is used through a web browser.
2. Product is not tailor made for each customer.
3. The product does not include software that needs to be installed at the customer's location.
4. The product does not require special integration and installation work.
5. The pricing of the product is based on actual usage of the software.

Based on their analysis of the Finnish SaaS providers, they found out that those characteristics don't identify correctly pure SaaS businesses if the term SaaS is interpreted strictly. They suggest that the criteria might be redundant and weight of different characteristics is not equal.

7.2 Characteristics of Software as a Service

The key characteristics of SaaS software, according to market research and analysis firm International Data Corporation (IDC), include (Danaiata and Hurbean 2009):

- Network-based access to commercially available (i.e. not custom) software.
- Activities that are managed from central locations rather than at each customer's site, enabling customers to access applications remotely via the Web.
- Application delivery is typically a one-to-many model (single instance, multi-tenant architecture).
- Centralized feature updating, which obviates the need for downloadable patches and upgrades.

In contrast to SaaS, the traditional software deployment approach is called On-Premise. In this case the client is responsible for the business processes including the support and technology behind these. The software applications are based on the client's facilities, and customers get 'unique' codes. Typically a pay-as-you-go model is not used (with the exception of special cases) and the software is delivered on a longer contracts and licenses.

Unlike "on-premise"-software, ecosystems based on the "as-a-service"-paradigm are characterized by the fact that the software is no longer sold to the customer as a product but operated on the infrastructure of the suppliers and therefore provided as a service.

7.3 Adoption of Software as a Service

In September/October 2005, Cutter Consortium conducted a survey of 118 enterprise IT professionals on the use of SaaS products within their companies (Kaplan 2005). The participants represented major industrial sector, government entity, and nonprofit institution, including universities

and medical service providers. Survey showed that almost one-third of respondents were already using SaaS, and another third were currently considering it. Moreover, Cutter's survey found that a substantial proportion of customers were using or considering SaaS alternatives for traditional enterprise resource planning (ERP), human resource management (HRM), supply chain management (SCM), and other application packages.

Kim (2009) pointed out several concerns that the users have regarding the adoption of cloud computing. They include availability, security and privacy, support, interoperability, and compliance. All of the concerns are the same ones that the users have always had even with on-premises computers and software.

Sääksjärvi et al. used the value creation model of Amit and Zott (2001) to analyze the value drivers proposed in the research articles and software industry organization reports of the SaaS concept. They synthesized the benefits and risks of the major stakeholders and discussed the types of value sources covered. They concluded that the promised customer benefits are not easily realized as many of them are at the same time major risks for the provider.

Benlian et al. (2009) empirically examined main drivers and inhibiting factors of SaaS adoption for different application types. Their analysis shows that social influence, the pre-existing attitude toward SaaS-adoption, adoption uncertainty, and strategic value are the most consistent drivers. Their study reveals several important findings. First is that the patterns of decisions on SaaS-adoption vary between application types. Benlian et al. (2009) suggest that IT vendors should address these application-specific drivers to be more successful in converting user companies to SaaS-customers. Applications that can be characterized as less specific (i. e. high level of standardization), less strategic relevant (i. e. supporting less critical parts of the company), and that are associated with

a lower level of adoption uncertainty (i. e. companies bear lower technical and economic risks when outsourcing this application type) are to a higher degree adopted in a SaaS-based setting. For that reason, Office and Collaboration applications with lower levels of specificity, strategic significance, and adoption uncertainty had the highest adoption rates in 2008 and 2010. By contrast, ERP systems with higher levels of specificity, strategic significance, and adoption uncertainty rank among the applications with the lowest SaaS-adoption rates.

Their second finding is that classical economic and strategic theories on IT outsourcing should be complemented by behavioral theories to yield better and more general explanations of IT adoption. Third finding is that firm size does not matter in SaaS adoption. That result is not in sync with the propositions made by previous research studies (Benlian et al. 2009) that smaller and medium-sized enterprises (SME) are generally more prone to adopt on-demand outsourcing options for obtaining fast access to valuable IT resources and capabilities.

8 Enterprise IT systems

Enterprise information technology systems (further I will use “Enterprise systems”) are built from a set of legacy information systems which are tailored to support particular business functions, such as payroll or purchasing (Wangler and Paheerathan 2000). Enterprise systems are designed to solve the problem of fragmentation of information in large organizations. An Enterprise system enables a company to integrate the data used through its entire organization (Davenport 1998). These systems usually consist of a number of modules that include Sales and Distribution, Materials Management, Human Resource, and Financial Accounting among others. An integrated enterprise system is traditionally called an enterprise resource planning (ERP) system. In most of the literature on enterprise systems, those terms have the same meaning. On the other hand, ERP can refer to a packaged software solution from one provider.

Traditionally, these systems are implemented locally after being purchased, which means all the hardware (computers, servers etc.) and physical artifacts are kept and run within and/or by the organization that purchased them. Recent trends in enterprise software deployment allow implementation of ERP systems (or some of its modules) in public clouds.

According to Shin (2006) an “Enterprise Application Software” approach for firms is to purchase application software from outside vendors, rather than develop their information system in-house. As this trend continues, the brand and marketing power of enterprise software vendors and consulting firms become more important factor. Often, enterprise software is provided by combined efforts of enterprise software vendors and consulting firms, and in most cases, the share of consulting firms is larger than of vendors. For example, the majority (up to 60%) of ERP project cost is devoted to setup, installation and customization of the software, services typically provided by outside consultants.

9 Adoption of cloud computing in Russia

According to International Data Corporation (IDC) the market of Cloud Computing in Russia is at the early stage of development although a growing interest to the cloud computing model is noticeable. Indeed, Russia is a large country with a very uneven distribution of qualified experts. This fact alone would be sufficient for the success of the cloud revolution in Russia. Governments, as well as many local companies, could gain great benefits by having access to affordable cloud IT systems. According to IDC the segment of cloud computing in Russia would increase to $113 million by the end of 2014. Major share in this segment, according to IDC, would be taken by products of Microsoft Corporation through the local partners.

The use of cloud computing in Russia was discussed at a seminar organized by the Institute of Contemporary Studies in conjunction with the Institute of the Information Society in June 2010. The main obstacle to implementing cloud, as acknowledged by the majority of the roundtable participants is the lack of broadband access, especially in the regions. Channel with the quality acceptable for the SaaS has a reasonable cost only in Moscow, St. Petersburg and in a limited number of other large cities.

Another potentially dangerous factor for the development of cloud computing in Russia is the Russian legislation. At the moment there is no normal regulation of this particular segment, and the law on personal data puts enormous constraints on the service provider, which, of course, is not conducive to business development. In addition, there are difficulties with payment and problems of integration with domestic products such as 1C.
Data center, network infrastructure and security play a key role in providing services to the cloud data, which today involves far more speed and volume than ever. In Russia there are no developed regulations that ensure data protection. In addition, Russia has practically no normative documents regulating the construction and operation of data centers.

10 Adoption characteristics of Software as a Service

Considering the discussion above, a number of Cloud Computing and Software as a Service models characteristics can be extracted from the literature. Those characteristics are in tight relation with perceived characteristics of Cloud Computing and can be used to develop questions for the survey. In the table below the independent variables influencing adoption, their reported relationship to the adoption are presented and characteristics of SaaS that relate to those variables are presented. We extended innovation adoption literature theories with characteristics of considered technologies extracted from the literature on SaaS and Cloud Computing, thus trying to deduct theoretically Cloud model characteristics that are most affecting adoption of SaaS technologies.

Independend variables	Reported relationship	Cloud computing, SaaS characterisics
Relative or Economic advantage	Positive	Positive: Lower initial investments comparing to on-premise is needed (Mäkilä et al. 2009, Armbrust et al. 2009, Motahari-Nezhad et al. 2009). Cloud computing technologies provide elasticity economic benefit (Armbrust et al. 2009). Use of cloud computing models is reducing ongoing operational, upgrade and maintenance costs (Armbrust et al. 2009, Motahari-Nezhad et al. 2009). Use of cloud computing models results in reduced deployment time (Dubey and Wagle 2007). Use of cloud computing models has lower training requirements (Dubey and Wagle 2007). Negative:

		Use of cloud computing models requires additional investment in bandwidth (Li et al. 2009). Cloud computing model services may not provide the levels of reliability, manageability, and support required by large enterprises (Li et al. 2009).
Compatibility	Positive	Negative: Use of cloud computing models requires changes or additions to the enterprise network (Li et al. 2009). There is a lack of environments for helping businesses migrate their current applications to the cloud (Motahari-Nezhad et al. 2009). Use of cloud computing models leads to organizational change, erosion of IT department authority (Yanosky 2008).
Complexity	Varies	Positive: Cloud computing models are connected with ease in deployment, ease in use comparing to on-premise models (Armbrust et al. 2009).
Trialability	Positive	Positive: Often providers of cloud computing model services offer trial period for free, as pay-as-you-go model enables it.
Observability	Positive	Negative: There is a lack of methods for valuation of IT systems expenses in general (Ermoshkin 2006).

Technical Uncertainty	Negative	Negative: Cloud computing models lead to increased liability risk due to security breaches and data leaks as a result of using shared external resources (Motahari-Nezhad et al. 2009). There are difficulties of finding and integrating different cloud services for a given set of business requirements (Motahari-Nezhad et al. 2009). There is a lack of standards for security and for managing SLAs (Li et al. 2009).
Financial Uncertainty	Negative	Negative: Use of cloud computing model is related to the loss of direct control of organizational resources and software (Motahari-Nezhad et al. 2009). Use of cloud computing model is related decreased reliability since the service providers may go out of business (Motahari-Nezhad et al. 2009). There is a lack of methods for information systems implementation valuation in general (Ermoshkin 2006).
Social uncertainty	Negative	Negative: Use of cloud computing model is related to data migration compliance (Khajeh-Hosseini et al. 2010). Use of cloud computing model may result in vendor lock in.

Table 1. Factors influencing adoption of Software as a Service.

The hypotheses are formulated based on the factors presented in the table. The characteristics of SaaS are used to formulate survey questions.

The major challenge while designing the study was finding the right balance between simplicity of the survey and statistical accuracy. The consultant from the Korus Conuslting suggested limiting the number of questions and simplifying the survey in order to get a higher degree of responses from the Russian company's selection. Taking into account his expert opinion we decided to focus on a limited group of factors influencing innovation adoption in organizations. We decided to examine perceived SaaS characteristics influence on SaaS adoption as a number of researches suggest this group should have the most influence on the adoption process.

The following hypotheses are used in the present research:

H1: Perceived relative advantage of SaaS systems has an influence on intention for its adoption.

H2: Perceived compatibility of SaaS systems has an influence on intention for its adoption.

H3: Perceived complexity of SaaS systems has an influence on intention for its adoption.

H4: Perceived trialability of SaaS systems has an influence on intention for its adoption.

H5: Perceived observability of SaaS systems has an influence on intention for its adoption.

H6: Perceived uncertainty of SaaS systems has an influence on intention for its adoption.

11 Data collection

This chapter describes the process of data collection for this study. First we go through the data collection methods, and then discuss questionnaire design and sampling.

11.1 Description of data collection methods

The research methodology is based around the following steps:

- Theoretical determination of the most major factors influencing intention to adoption of SaaS by organizations. For this goal a number of adoption theories and cloud computing studies were examined.
- Quantitative analysis of correlation between those factors and intention to adopt SaaS in Russian organizations. Due to this goal a sample of Russian companies were questioned.

The sample of survey respondents consisted of about 400 Korus Consulting's clients. Korus Consulting is a St. Peterburg based system integration company. Thus the respondents were at least interested in information systems, due to the fact that they have already invested in it before.

11.2 Questionnaire design

Questions were based on the constructs previously developed in former studies (Wu and Wu 2005, Moore and Benbasat 1991, Benlian and Buxmann 2009, Davis 1989). The measurement of intention was adapted from Davis (1989) and includes two questions. Measurements for innovation factor with relative advantage, compatibility, complexity, observability, and trialability sub-factors were adapted from the instrument developed by Moore and Benbasat (1991), and its extension used by Wu and Wu (2005). Benlian and Buxmann (1991) gave an example of uncertainty construct measurement; it was adapted for current study.

We used 7-point scale (Strongly disagree, moderately disagree, somewhat

disagree, Neutral, Somewhat agree, moderately agree, strongly agree) in all questions except those related to the company information (Ajzen and Fishbein 1980, cited in Benlian and Buxmann 2009). Structured-undistinguished questionnaires are most commonly used in marketing research. The basic characteristics of such questionnaires are fixed wording and fixed order of questions to all the respondents. We used fixed multichotomous alternative for the major part of the questions. Scale questions can measure how much the respondent agrees or disagrees with the question etc. They are easy to apply if the alternatives are the same in numerous questions, this way instruction would only need to be given once at the beginning.

Below we present questions for all the constructs used in the study.

Construct	Survey questions
Intention to adoption	We intend to use SaaS in future. We expect that the company will use SaaS in future.
Relative advantage	Use of SaaS would improve the quality of work in the company. Use of SaaS in the company would make it easier to do the job. Use of SaaS in a company would give greater control over work. Use of SaaS would allow increase of company's efficiency. Use of SaaS would allow decrease of company's expenses.
Compatibility	Saas applications would be compatible with all aspects of company's work. SaaS would fit into employees work style. SaaS applications would be

	compatible with other information systems used in the company. SaaS applications would be compatible with company's organizational structure.
Complexity	Interactions with SaaS application would be clear and understood. Learning to operate SaaS would be easy. Implementation of SaaS within the company would be a very difficult task.
Observability	It’s easy to observe others using SaaS. We have noticed that other companies use SaaS. The advantages achieved with the SaaS would be clearly perceptible.
Trialability	Company is able to try various uses of SaaS. We know what we should do to have a trial of SaaS before making the final decision.
Uncertainty	Use of SaaS would bring technical difficulties in terms of bandwidth. Use of SaaS would bring technical difficulties in terms of reliability. Use of SaaS would bring economic dependencies in terms of pricing model changes. Use of SaaS would bring process dependencies in terms of quality of

	service provisioning.

Table 2. Survey questions.

11.3 Sampling

In the present study, the sample was formed from Korus Consulting client database. All the respondent companies have previously adopted software solutions for the enterprise systems. The sample covered approximately 400 companies.

12 Descriptive analysis

In this chapter we provide a descriptive analysis of collected data and measurement scales implemented in the current study.

12.1 Respondent's personal characteristics

Overall there were 46 filled questionnaires available. The table below represents the positions survey respondents hold in their companies.

Position	Number of respondents
Administrative managers, managing directors, owners	28
Personnel responsible for information technology	1
Financial directors, financial managers	4
Sales and marketing directors, sales and marketing managers	5
Information technology managers	8

Table 3. Respondents positions.

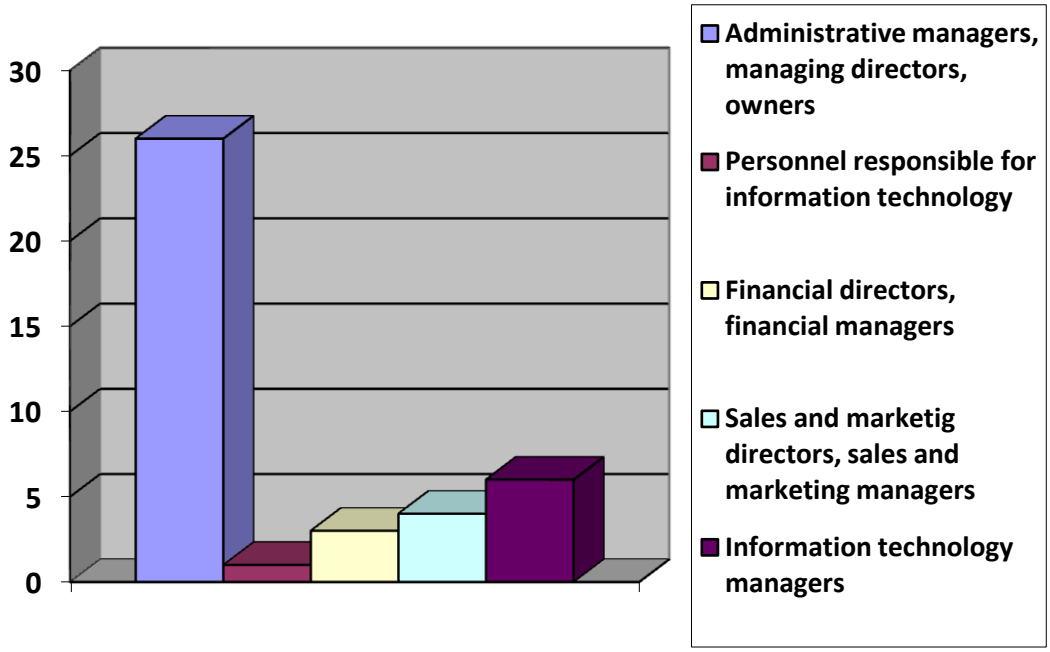

Figure 3. Respondents positions.

Table below shows the status of the SaaS use among survey respondent companies. For the question “Does company use SaaS for corporate information systems” there were only 2 answers “No, and we haven't heard of it”. Filled questionnaires with this status were eliminated from the dataset, as they were not relevant to the study.

Status on the use of SaaS	Number of respondents
Yes	21
Implementing now	3
No, but have heard of it	20
No	2

Table 4. Respondents’ SaaS implementation states.

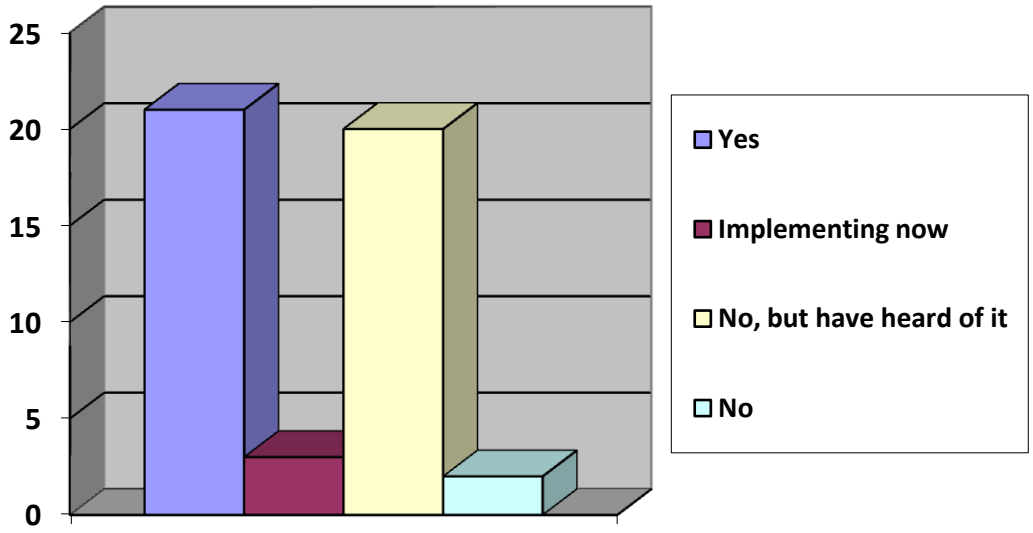

Figure 4. Respondents' SaaS implementation states.

12.2 Measurement scales

We used a summated scale model in the current study. Summated scale is a method of combining several variables that measure the same concept into a single variable in an attempt to increase the reliability of the measurement through multivariate measurement. In most instances, the separate variables are summed and then their total or average score is used in the analysis (Hair et al. 1998, cited in Taalikka 2002). We used a median score of the questions resulted after reductions related to factor analysis. An underlying assumption and essential requirement for creating a summated scale is that the items are unidimensional, meaning that they are strongly associated with each other and represent a single concept (Hair et al. 1998, cited in Taalikka 2002). Summated scales are formed from the statements included in the questionnaire.

Factor analysis aims to perform a meaningful reduction of a number of variables in a dataset based on the associations between those variables. To increase reliability of measurement scale a factor analysis was performed which decreased the size of the dataset.

We applied reliability and factor analyses to confirm the scales of the current study. First the reliability analysis was conducted on the original measurement scale. Than the factor analysis was used. Some reductions were made if the analysis showed that the group of variables that were supposed to measure the same conduct was not included appropriately on the same factor. After that a new reliability analysis was conducted.

After the reliability and factor analyses a linear regression analysis was performed for the refined scales. A linear regression analysis expresses a linear relationship between an interval-scaled dependent variable and a number of independent interval-scaled variables and shows to what extent the independent variables can explain or predict the depended variable.

13 Data analysis

This chapter describes in details data analysis techniques implemented in the current study. First we describe factor analysis and its results. Then we go through the regression model.

13.1 Factor analysis

There are several assumptions to be made before performing a factor analysis. The first one suggests that the interval or ratio variables form the input for factor analysis. Likert scale used in the current study, strictly speaking, produce an ordinal variables Anyway, research has shown that the use of these types of scales in factor analysis does not lead to unreliable result (Janssens et al. 2008).

A factor analysis applying VARIMAX rotation was conducted for scales measuring innovation characteristics. Six factors were extracted and they are presented in Table __. Based on these results, one statement was dropped out from the scale of complexity, one from the scale of uncertainty, two from the observability and three from the compatibility. The analysis showed that some of the presented concepts have deep underlying relation to each other. This is especially related to the groups of complexity and compatibility, and to the groups of complexity and uncertainty.

For all other perceived characteristics, the variables were loading on the correct factor. The statements in the measurement scales of perceived innovation characteristics were mainly acquired from several previous studies, but modified to describe the characteristics of the SaaS solutions. Table below present the original set of constructs for each factor and the number of questions resulted from the reduction after the factor analysis.

Variable	Number of questions before factor analysis	Number of questions after factor analysis
Advantage	5	5
Complexity	3	2
Compatibility	4	1
Trialability	2	2
Observability	3	1
Uncertainty	4	3

Table 5. Number of questions for each construct.

The rotated component matrix resulted from the factor analysis is presented below.

	Component					
	advantage	complexity	trialability	observability	Uncertainty	compatibility
advantage 5	,855					
advantage 1	,824					
advantage 4	,816					
advantage 2	,778					
advantage 3	,756					
complexity1		,837				

complexity2		,801				
trialability 2			,893			
trialability 1			,748			
observability1				,822		
uncertainty2					,825	
uncertainty3					,667	
uncertainty1					,626	
compatibility2						,631

Table 6. Rotated Component Matrix

Before the regression analysis the statistical median of the summated scale concepts were calculated and developed into a single variable for each construct.

13.2 Reliability statistics

A reliability analysis was performed for each set of variables composed in a single factor after a final factor analysis. The table below represents reliability statistics for each factor.

Factor	Number of variables	Chronbach's alpha
advantage	5	0,912
intention	2	0,848
complexity	2	0,882
trialability	2	0,786

uncertainty	3	0,677

Table 7. Reliability statistics.

Analysis shows high reliability of the resulting factor sets.

13.3 Backward elimination estimation in regression analysis

Stepwise regression methods build regression models in which the selections of predictive variables are completed by automatic procedures. Major stepwise regression methods are classified into several categories (Hair et al. 1998):

- Forward selection, which starts with no variables in the model, adding them one by one and including if they are statistically significant.
- Backward elimination starts by including all the independent variables in the model and then eliminating those variables not making a significant contribution to prediction.
- Combinations of the above methods.

In our study we use the backward estimation methods. The backward estimation method has the ability to delete variables at each stage of the process, but once a variable is deleted, there is no chance of revising the action at a later change.

13.4 Regression model for the survey data

Backward elimination resulted in three models. Not all the measurement construct discussed earlier were included in the model. Table below provides summary on those models.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,863	,744	,703	1,03190
2	,859	,737	,703	1,03199

3	,850	,723	,695	1,04544

Table 8. Model Summary.

R square for the third model equals 0,723 which indicate that 72,4% of the variation in the dependent variable may be explained by the variation in the independent variables included in the model. Adjuster R square corrects for the number of independent variables in the regression model. R square should decrease when the number of independent variables is decreased, that is happening in the backward elimination from the first to third model. 0,723 is a relatively good score.

Adjusted R square is noticeably lower than the R square, which may indicate that the results are not reliable enough due to the low response rate.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	114,579	6	19,096	17,934	,000
	Residual	39,398	37	1,065		
	Total	153,977	43			
2	Regression	113,508	5	22,702	21,316	,000
	Residual	40,470	38	1,065		
	Total	153,977	43			
3	Regression	111,352	4	27,838	25,471	,000
	Residual	42,625	39	1,093		
	Total	153,977	43			

Table 9. ANOVA analysis.

The ANOVA analysis for each of the three models provides an insight into the need to reject or accept the following null hypothesis: H0: “Adjusted R Square = 0”, or in other words, the model is not meaningful. In our case the significance of null hypothesis for each of the models equals 0, which

is a good outcome.

Table below provides an insight into the coefficients of our model.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,056	,650		-,087	,931
	advantage	,441	,122	,402	3,599	,001
	complexity	,181	,111	,176	1,630	,112
	trialability	-,092	,092	-,096	-1,003	,322
	uncertainty	,171	,116	,139	1,471	,150
	observability	,232	,102	,227	2,281	,028
	compatibility	,272	,090	,301	3,006	,005
2	(Constant)	-,186	,637		-,292	,772
	advantage	,428	,122	,390	3,513	,001
	complexity	,154	,108	,150	1,428	,161
	uncertainty	,165	,116	,134	1,423	,163
	observability	,217	,101	,213	2,162	,037
	compatibility	,265	,090	,293	2,937	,006
3	(Constant)	,257	,563		,457	,650
	advantage	,415	,123	,378	3,372	,002
	complexity	,215	,101	,209	2,135	,039
	observability	,210	,102	,206	2,062	,046
	Compatibility	,284	,090	,315	3,148	,003

Table 10. Model coefficients.

The resulting regression model can be filled in:

$intention\ to\ adopton =$ 0.415 advantage + 0.215 complexity + 0.210 observability + 0.284 compatibility

In this case complexity should be taken with the -1 coefficient, due to the

fact that two of the three questions for the measurement of complexity construct were formulated in the sense of simplicity of SaaS model, which is opposite to complexity. Answers for the only question with the direct complexity meaning were transferred into the opposite.

The significance of the null hypothesis for the coefficient b0 is 0,650 which mean that it is not meaningful.

13.5 Testing the Hypothesis

The hypotheses are tested based on the results provided by the regression analysis, and the factors that have been affecting the intention to the adoption of SaaS by organization in Russia are recognized.

It was hypothesized that perceived relative advantage, perceived compatibility, perceived result observability, perceived complexity, perceived triability and perceived uncertainty would have an effect on the intention to SaaS adoption. Overall four of six hypotheses were confirmed.

Hypothesis	Status
H1: Perceived relative advantage of SaaS systems has an influence on intention for its adoption.	Confirmed
H2: Perceived compatibility of SaaS systems has an influence on intention for its adoption.	Confirmed
H3: Perceived complexity of SaaS systems has an influence on intention for its adoption.	Confirmed
H4: Perceived trialability of SaaS systems has an influence on intention for its adoption.	Rejected
H5: Perceived observability of SaaS	Confirmed

systems has an influence on intention for its adoption.	
H6: Perceived uncertainty of SaaS systems has an influence on intention for its adoption.	Rejected

Table 11. Hypothesis status

14 Conclusions and Summary

This chapter presents main conclusions and discussions on the factors affecting intention to SaaS adoption in Russian organizations. Also limitations and suggestions for the further research are presented.

14.1 Factors affecting SaaS adoption in Russia

Finally, several conclusions can be developed from the statistical analysis of the survey responds. Those conclusions are used to develop managerial recommendations for system integrators and providers which offer SaaS solutions on the Russian market. An additional report which includes those finding was developed in Russian for the Korus Consulting.

The regression analysis showed that perceived relative advantage, perceived compatibility, perceived complexity and perceived observability have the greatest effect on the intention to adoption of SaaS by organizations in Russia. Moreover, perceived relative advantage, perceived compatibility, perceived observability have a positive effect, and perceived complexity affects intention negatively.

Regression analysis showed that perceived relative advantage is the most sufficient factor affecting the intention to adopt SaaS. The basic suggestion which can be developed from this insight is that SaaS providers should highlight SaaS model benefits when developing marketing and sales strategies.

It is an accepted fact that small and medium enterprises are the major consumers of SaaS solutions for enterprise information systems, which happens to the fact that generally they don’t possess resources needed to successfully deploy wide functionality of enterprise information systems on-premise. But in fact there were no any study that showed that large organizations would not benefit from SaaS use as much as small and medium ones. Today pragmatic large organizations may create a

mainstream market for SaaS solutions, but in order to cross the chasm between early adopters and pragmatics and to get their acceptance, SaaS providers should use different marketing strategy. The use of SaaS results in lower initial investments comparing to on-premise model, provide elasticity economic benefit, and reduce ongoing operational, upgrade and maintenance costs. Those are the main points large organizations can benefit from and are the main reasons for large organizations to adopt SaaS solutions. All those benefits should be highlighted by the side which is trying to offer a SaaS based solutions.

Moreover there are several shortcomings related to the SaaS model. There is a general perception that companies offering SaaS may not provide the levels of reliability, manageability, and support which are required by large enterprises and can be develop on-site with on-premise model. The suggestion to providers would be to communicate to the potential customer that those risks are reduced to minimum. For example, most of Russian decision makers are convinced that SaaS model may lead to the decreased security of organizational private data. But in fact industry experts claim that SaaS based solution provide better security due to the effective security algorithms and method, trained staff and legally confirmed responsibility of the provider. Another step would be the reduction of those risks with the development of directional SLA strategy.

Perceived SaaS compatibility has a sufficient positive effect on intention to adoption of SaaS. Technical compatibility is related to the possibility to easily integrate or transfer data from information systems which are currently in use (generally, on-premise models) to the SaaS solutions. Market knowledge of such solutions should increase SaaS adoption intention rate among organizations.

The fact that in general use of SaaS model may lead to organizational change, erosion of IT department authority and loss of control over information systems is one of the greatest inhibitors of SaaS adoption.

This is related to the low organizational compatibility of SaaS solutions. The suggestion would to develop a product strategy which requires gradual organizational changes in several steps on the side of adopting organizations. We suggest that the first steps would be the use of private or hybrid cloud solutions; the second would be the outsourcing of strategically non-significant processes to the SaaS model based solutions; third is the transition of the major information system elements to the public cloud based solutions. Adoption of incompatible innovations often requires the prior adoption of a new system of values, which is a relatively slow process.

Perceived complexity have a significant impact on the intention to SaaS adoption as well. Simplicity of deployment and use is one of the basic SaaS characteristics. This results in lower consulting and support needs on the adopter side. As this is one of the main profit assets of information system integration company, there is a chance that integrators are not interested in the widespread of SaaS model. As system integrators are the main sellers of information systems they have a significant influence on the customer's perception. In fact several researches claim that supplier market activity is one of the factors influencing innovation adoption process. The suggestion for the SaaS providers would be to develop business strategies which include integrators as resellers and imply profit share in each of the payment transactions. Those transactions can be based on pay-as-you-go, weekly, monthly or yearly payments models.

14.2 Limitations and further research

Current study was limited in opportunity to examine a wide range of factors suggested to affect adoption process. Though we decided to focus only on group of perceived SaaS characteristics and limited the number of questions to 25 the response rate was very low.

The study showed that some of perceived SaaS characteristics affect

intention to its adoption. However, the factors that were not analyzed or were found non-significant might have strong effect on the factors that were found to affect the intention to adoption. The suggestion for the further research would be to focus on other possible factors suggested by theoretical literature.

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Appendix 1. Questionnaire.

Данное исследование проводится с целью выявления отношения руководства российских компаний к Software as a Service (SaaS) приложениям для корпоративных информационных систем.

Software as a service (программное обеспечение как услуга) — относительно новая модель предоставления доступа к программному обеспечению через интернет. Сегодня SaaS системы предлагаются почти всеми известными поставщиками программного обеспечения для информационных систем (Microsoft, Oracle, SAP и др.)

Название компании_____

Ваша должность в компании_____

Использует ли компания SaaS для корпоративных информационных систем

- Да, какое-то время
- Внедряем сейчас
- Нет, но мы знаем про SaaS
- Я никогда не слышал про SaaS

Рядом с каждым из нижележащих выражений отметьте пункт, наиболее точно описывающий ваше отношение к нему.

1 — Абсолютно несогласен

2 — В основном несогласен

3 — В чем-то несогласен

4 — Отношусь нейтрально

5 — В чем-то согласен

6 — В основном согласен

7 — Полностью согласен

Мы намереваемся использовать SaaS в будущем.

Я ожидаю, что компания будет использовать SaaS в будущем.

Если компания будет использовать SaaS для информационных систем, то

- Использование SaaS улучшит качество работы компании.
- Использование SaaS в компании упростит работу сотрудников.
- Использование SaaS в компании позволит лучше контролировать процесс работы.
- Использование SaaS позволит повысить эффективность компании.
- Использование SaaS позволит уменьшить издержки компании.
- SaaS приложения будут совместимы со всеми аспектами работы компании.
- SaaS приложения подойдут к стилю работы сотрудников.
- SaaS приложения будут совместимы с другими информационными системами используемыми в компании.
- Использование SaaS приложений будет совместимо с организационной структурой компании.
- Взаимодействие с SaaS приложением будет ясно и понятно.
- Обучиться использованию SaaS приложения будет просто.
- Внедрение SaaS приложения в компании будет очень сложно реализовать.
- Результат использования SaaS можно будет легко наблюдать.
- Преимущества, достигаемые с помощью SaaS, будут легко различимы.
- Использование SaaS будет связано с неопределенностью в отношении технической надежности.
- Использование SaaS будет связано с технической неопределенностью в отношении пропускной способности интернет-соединения.
- Использование SaaS будет связано с неопределенностью в отношении модели оплаты.
- Использование SaaS будет связано с неопределенностью в отношении предоставляемого поставщиком качества обслуживания.

У компании есть возможность попробовать разные версии SaaS продуктов.

Мы знаем как попробовать SaaS перед тем как принимать окончательное решение.

Мы заметили, что другие компании используют SaaS.