Designing SaaS for Enterprise Adoption Based on Task, Company, and Value-Chain Context

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Although the positive impact of cloud computing seems obvious for both big and small companies, the adoption rate of services associated with it has not reached the levels that were expected. In the case of software as a service (SaaS), the adoption rates of the different application types are not homogeneous. Some well-established application types, such as enterprise resource planning (ERP) software, have lower adoption rates as compared to other applications, such as customer relationship management (CRM) systems. Understanding the drivers of this phenomenon can help software companies design more successful SaaS applications. In this study, we present a framework that can help software companies evaluate the application-cloud fit, along with two strategies that enhance cloud application adoption.

As with many innovative technologies, cloud computing's impact on business economics and our daily life has captured the imagination of business and technology visionaries worldwide. With a pay-per-use service model, entry barriers for new businesses have fallen as the initial capital investment requirements for developing a new service have disappeared. Cloud computing not only reduces capital requirements and maintenance costs but also helps transfer various risks and responsibilities from the company to the cloud vendor.

Although the positive impact of cloud computing seems obvious for both big and small companies, the adoption rate of services associated with it has not reached expected levels.[1] In the case of SaaS, this adoption is not homogeneous across different applications.[2] For example, some well-established application categories, such as enterprise resource planning (ERP) software—which is one of the more prevalent enterprise systems used in companies—have lower adoption rates than other applications, such as customer relationship management (CRM). In this article, we propose a framework that can help SaaS providers evaluate new public cloud applications,

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helping them select an application's category with a better fit in a cloud deployment, and supporting the analysis and selection of features and go-to-market strategies that can make their offering more attractive.

As the objective of the research is to include a broad organizational context for SaaS adoption, an interpretivist research paradigm has been adopted. The selected qualitative research technique, namely action research, could help explain the adoption problem in a real context and from a broader perspective, including the social context in organizations and not just technical aspects.

Before conducting field research, we carried out a structured literature review to obtain an overview of the state of the art of the research area. The literature search process involved querying several quality scholarly literature databases (Emerald Insight, IEEE Xplore, Science Direct (Elsevier), Springer, Wiley, and AIS Electronic Library). The terms used for searching all databases were "SaaS + adopt*" and "Software + Service + adopt*." We narrowed the initial search results based on titles and abstracts, excluding non-relevant articles for the subject area. This resulted in 155 articles published between 2009 and 2014. These articles were filtered, ruling out work-in-progress conference articles, purely descriptive articles, and those not related specifically to SaaS but rather to cloud as a general technology. The 38 articles that emerged from this filtering process were analyzed, and the most relevant factors that influenced SaaS adoption based on the literature were identified. During our research, this raw factor list was transformed into the Fit framework. The main research technique, action research, was carried out on a startup company launching a new SaaS warehouse management system (WMS). Action research allowed us to analyze the influence on SaaS adoption of identified impact factors, as well as to develop a framework to guide the analysis of SaaS adoption in multiple contexts. Three WMS SaaS implementation projects in different Spanish companies were analyzed, covering the whole adoption process—from the initial sales contact to the system's complete deployment—to gain a better understanding of the adoption process. The companies were a vending services company (< 10 employees), a manufacturing company (< 100 employees) and a third-party logistics company (< 10 employees). As the goal was to develop a new framework, the sample selection was not driven by representativeness; instead, several cases were considered to help form a more solid base for the theory, and the adopted iterative process helped achieve replication, contrast, and theory extension. Multiple methods of data collection where used to improve research quality: individual interviews, internal project documents, and field notes. During the action research phases, a reconceptualization of impacting factors was attained, grouping them based on affinity. Then, the factors were included in a relationship model based on the Rogers diffusion of innovation theory,[3] to gain understanding of the factors' influence mechanism. The Fit framework was developed as an easy-to-use tool to evaluate an application's SaaS fit.

Finally, to complete the framework, open-ended interviews were conducted. Seven managers and IT personnel from different organizations—in traditional software companies, SaaS vendors, and final customers—were interviewed following a script based on the three dimensions defined in the model and the different identified factors. This data source triangulation is a strategy for improving the reliability and validity of the research, and it is especially important in qualitative research to limit bias and establish a valid proposition.

THE SAAS FIT FRAMEWORK

The SaaS Fit framework is based on the Rogers diffusion of innovation theory[3] and provides a tool for evaluating SaaS applications from the perspective of the adoption process. The central concept of the framework is SaaS fit, which measures the suitability of an application's characteristics in a cloud environment.

The SaaS adoption process is influenced by several factors that are categorized based on internal and external contexts and a functional perspective. Adner's work[4] inspired this categorization in which the different ecosystem risks that surround an innovation (such as complements, initiative, and integration) are considered to improve the rate of success. From this perspective, innovation adoption is rarely based only on its technical advantages and economic feasibility; specifically, the underlying social system plays a very important role in the adoption process. Our proposed SaaS Fit framework follows this approach and divides the adoption process factors into three categories: (1) task fit, (2) company fit, and (3) value-chain fit (see Tables 1, 2, and 3).

Task fit represents the dimension that includes factors from the perspective of the application's characteristics. This dimension measures the relative advantage that the application can offer as compared to an on-premise deployment alternative. Advantages include the scalability provided by the elasticity of the cloud, the cost advantage that SaaS adds given its multi-tenant architecture, and the feasibility of multi-company collaboration that a publicly accessible web application can offer.

In the company fit dimension, all factors relate to the compatibility of the SaaS offerings with the company's characteristics. Therefore, this construct should reflect the fit between the SaaS's innovation and the company's values and internal context.

Finally, in the value-chain fit dimension, we include all the factors related to the software value-chain participants and their incentives. First, it is important to understand the different complementary technology groups that support SaaS adoption, just as broadband network performance can impact user experience. Second, regulations establish limits to possible usages. And finally, we consider the incentives of the different actors in the software's value chain.

The SaaS Fit framework is a conceptual framework that identifies the key factors that affect the adoption of SaaS and helps explain how these factors impact adoption rates on different applications' characteristics and context. Our framework can help application providers understand whether a specific application will add greater value in a SaaS deployment model, and it can help select features that enhance the software's relative advantages and context compatibility. The novelty of this framework is that it expands the focus when evaluating an application movement to a cloud environment beyond technical feasibility impact. Considering the application fit with other dimensions as compatibility, value-chain alignment and process are also important for its adoption. As technology adoption is also a social process, an approach based on Rogers's technological adoption and Adner's innovation ecosystem can help complete the adoption analysis.

The framework helps the SaaS provider evaluate how an application fits on a cloud deployment and, thus, increases its business value. For example, high information sharing needs (sharing), applications mobile access (ubiquity), or variable computer resources usage (scalability) are especially well suited for a SaaS deployment. Also, cloud pooling of resources has a positive impact on SaaS cost advantage (cost), especially when the licenses and infrastructure cost are high. Finally, when continuous delivery generates a relative advantage, a SaaS deployment can reduce the cost and complexity of maintaining and updating the application (continuous delivery).

Moreover, the framework supports the analysis of different factors that can hinder the adoption of the SaaS application because of a lack of compatibility with the business context and needs. On one hand, it helps evaluate business external context issues, such as data protection regulations (legal requirement), which establish limits to possible usages or Internet access limitations (broadband network) that can impact user experience. On the other hand, it guides in evaluating business internal context and the compatibility of a new application with legacy systems (IT resources), customer base sophistication (organizational skills), and resilience and response time needs (reliability and support).

However, the SaaS adoption process should not only be centered on technical factors; social factors should also be considered. Several factors related to the market maturity should be evaluated, such as the firm characteristics (firm size), the decision maker's beliefs (management team), and how the rest of the industry is supporting cloud technologies (marketing). Moreover, factors related to the role on the adoption process of different value-chain players and their attitudes towards the technology should be considered. Understanding IT personnel skills (IT staff expertise) and their incentives can help us avoid go-to-market strategies where a company's internal player could stand against the adoption. Also, the incentives of the different actors in the software's value chain should be considered. Actors who perform different value-added activities, including software programming, implementation, and support, may have misaligned incentives, as they may not benefit equally from SaaS adoption. From this point of view, understanding the implementation tasks, the customization needs, and the perceived ease of use are very essential. Implementation tasks impact deployment speed and, therefore, the software's initiative economics and the dependence on the value-chain players. Moreover, an application with simplified implementation tasks (design, customization, data migration, or training) can also encourage trying the software and support a higher adoption rate.

Table 1. Task fit factors.

Factor	Description	Impact
Sharing	Value added by the application's information sharing capabilities, both within a company and between organizations	As SaaS offerings are typically installed on a public server, data privacy and security concerns are raised; however, the impact of these issues may be balanced with information sharing needs, especially when the application helps coordination with outside partners.
Ubiquity	Value added by the application's mobile interface for out-of-the-office access	Access to information resources is rapidly becoming more heterogeneous. Field workers typically need to access applications from anywhere, and corporate policies, such as bring-your-own-device, are changing the device base needed to access information systems.[5] In this scenario, public cloud accessibility and web interfaces can provide important advantages for SaaS applications.
Scalability	Value added by the infrastructure elasticity of the cloud	The elasticity of cloud computing can add value when computing resource needs are variable (for example, when there are distinct patterns in the number of users or when computing power is needed only during specific time intervals such as while running simulation software). The scalability offered by cloud elasticity is an important benefit of this computing paradigm and a main driver of its adoption.[6] When data privacy prevents public infrastructure deployment, but the elasticity of the public cloud is desired due to demand variability, a hybrid deployment should be considered. This presents low-level implementation challenges, such as performance monitoring and cloud management strategies, to allow code mobility between the different environments. In this scenario, cloud bursting strategies[7] should be carefully designed and different techniques evaluated, such as implementing middleware managing software resources and serving as cloud bursting orchestration layer.
Continuously updated application	Value added by the continuous updating and upgrading of the application	When the business logic evolves and the application needs to be continuously adapted, having an updated application is an important requirement. However, in some cases, upgrading the application can have a negative impact on user experience, as users need to re-acquaint themselves with the application after the update.[5]
Ease of use	Advantage added by the application's ease of use	With a polished user interface and simple conceptualization that avoid cognitive distress, user training needs are reduced. Not only can this accelerate deployment and reduce costs, but it can also help during the selling stage to increase testability.
Implementation	Complexity of the tasks and services needed to implement the application	When process re-engineering is required, the relative importance of the application is dismissed and implementation services take a leading role. This scenario reduces two of the most important advantages of cloud computing (cost and fast deployment).[8] Moreover, fast and straightforward implementation gives incentivizes trying the product in a production environment, which affects the adoption decision.[9] Trying the product can impact project economics by reducing implementation tasks and increasing perceived benefits of the application from an early stage. This impacts the adoption rate and therefore increases the market success of the application.
Customization	Value added by the customization capabilities of the application	If customization goes beyond cosmetic or data adaptation, the SaaS multi-tenant architecture does not offer the same possibilities as on-premise implementations. Therefore, SaaS is best suited for standard applications and can have limitations when used in strategically valuable processes in which customization is critical.
Cost	Cost advantages of SaaS and value added by the periodic billing method	When companies deal with new ventures, the conventional large investments in new hardware and software to provide the necessary infrastructure or develop the staff's technical expertise to manage this infrastructure are no longer required with a cloud application.

Table 2. Company fit factors.

Factor	Description	Impact
Integration and IT resources	Characteristics of the IT infrastructure and IT resources	New IT initiatives should be compatible with a firm's enterprise architecture. Implementing an isolated application may not be feasible, and integration with other IT software may be necessary. In this scenario, having a documented RESTful API is required.
Reliability and support	Importance of having a reliable system	Beyond service-level agreements (SLAs), when the strategic value of an application is high, the robustness of the application and prompt support services are important aspects for migrating to the cloud with confidence. When this strategic advantage is driven by data, privacy and security issues arise. In these scenarios, cloud vendor trust and the security of data backups are determinants.[1]
IT staff expertise	Capabilities, knowledge, and limitations of internal or outsourced IT staff	IT staff plays an important role in IT adoption. Understanding their expertise and their perception regarding the benefits of the SaaS application can help shape their standpoint.
Firm size	Size of the firm	While big firms have a more complex decision-making process that can affect SaaS adoption, they tend to be more innovative because they have more resources.[3]
Management team	Attitude and perception of the management team regarding the cloud	The management team is the main decision-maker in IT investments. Its attitude toward the cloud and possible related concerns are therefore important issues to consider when planning, selling, and marketing initiatives. Without top management support, companies are less likely to adopt new technologies, especially in the case of SMEs.[9]
Organizational skills	IT staff skills and attitudes toward change	Employees' computer skills and their attitudes toward change can have a big impact on the success of the adoption process. This factor determines the need for training services and a change management plan. This affects the relative economic advantage of adopting SaaS and adds complexity to the implementation process.

Table 3. Value-chain fit factors.

Factor	Description	Impact
Social influence	The current IT partners and value chain actors' attitude towards cloud computing	Value-chain actors play an important role in educating companies and implementing new technologies. This is an especially important factor, as many companies rely on external IT partners to implement new technologies. Therefore, incentives in the value chain should be carefully analyzed and considered, as pressure from trading partners can be a very influential factor in cloud computing adoption.[10]
Marketing	Cloud industry marketing efforts	Marketing by other cloud services can impact the perceived benefits of the cloud technology and its adoption. Mass media can have a positive impact on the use of cloud services.[1]
Broadband networking	Capabilities of the broadband network	The network used to access the Internet can limit the possibilities of deployment on the cloud. It is important to ensure proper bandwidth for the volume of data transferred. This is not only an issue for developing countries; it can also create serious limitations when using mobile devices and networks.
Legal and industry standards	Characteristics of the regulatory context	In the case of SaaS adoption, the corresponding legal context is especially important for issues related to data security and privacy. This should be considered based on the country, as it may limit cloud infrastructure locations.

SAAS FIT AND DIFFERENT APPLICATION TYPES

The impact of IT on the work environment differs based on different application types. Thus, we have found McAfee's[11] application type categorization to be very relevant to explain differences in adoption rate between applications' categories. Following this approach, we can divide applications into three categories: functional IT, network IT, and enterprise IT.

Functional IT (FIT) includes applications that assist with the execution of discrete tasks. These applications include simulators, spreadsheets, and computer-aided design (CAD) software. Based on our framework, the main driving force behind the adoption of this type of application is scalability. Software that requires high computing power for limited amounts of time, such as simulation or analysis software, can enjoy better economic advantages in a cloud environment. For example, big data is a recent niche that is driving enterprises to adopt cloud environments.[12] We have also found that SaaS providers (such as providing CAD or office suites) are enhancing their applications by developing sharing capabilities within their systems, because collaboration can boost adoption and may become a key selling point.

Network IT (NIT) represents applications that facilitate interaction without imposing usage. E-mail or wikis are examples of applications where use is not imposed by a process, but they affect work by increasing collaboration capabilities. As usage is not compulsory, implementation is not a long and complex process, thus promoting fast adoption. More specifically, NIT does not impose a process; instead, it is a type of application that can be used by adopters in new and innovative ways. This reinvention phenomenon can be very important, potentially increasing the value added by the application.

Enterprise IT (EIT) includes applications that specify and support business processes. The primary application in this category is ERP.[11] The focus of this software category is to integrate all the different processes of the organization into one database, enabling collaboration from the company's monopolistic view rather than for sharing with external entities. Implementation here is typically a long and complex activity with multiple tasks, including analysis, process re-engineering, and migration. Here, fast deployment may not be attainable, and the economic advantage of cloud deployment is diluted by the project's costs.

From our perspective, the above categorization is very relevant to understanding SaaS adoption, as it is based on two of the most important factors affecting IT adoption: collaboration and complexity of implementation. Both factors have multiple effects on the different contexts, including adoption process complexity, compatibility with a company's policies, and value-chain visibility. However, other factors, such as privacy, security, and performance issues, are also important and should be considered in application conceptualization.

The impact of collaboration and complexity is represented in Figure 1, in which application categories are mapped based on these two factors and adoption is more probable in a specific region of the diagram. SaaS providers can use this diagram to place their applications and select the strategies that will have a greater impact on adoption rates for their specific situations.

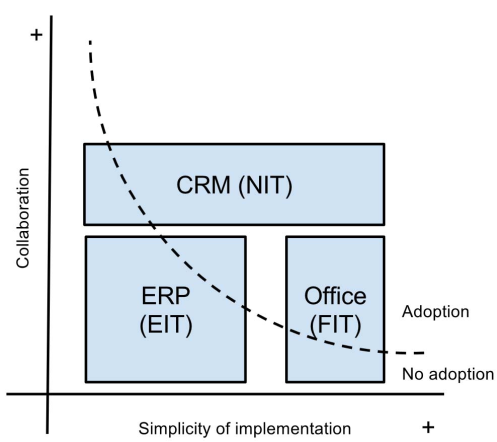

Figure 1. Adoption map for application categories.

Therefore, some application categories are better suited for a cloud environment, as they profit from both enhanced sharing and low implementation complexity. As an example, CRM may be a good candidate for the cloud because of the salesforce mobility. Conversely, ERP software is not as well suited for the cloud, mainly because the implementation process for an ERP is non-trivial, requiring the execution of various tasks, including analysis and process re-engineering consultations, training, migration, configuration, programming, startup, and maintenance. On the other hand, in the case of office applications, scalability is not very important, so SaaS providers such as Google and Microsoft are focusing on collaboration capabilities.

Based on the comparison of these application categories, we have detected two general strategies for improving SaaS applications: reducing implementation complexity and increasing collaboration capabilities.

Reducing Implementation Complexity

In contrast to off-the-shelf software, enterprise software is frequently customized and, thus, implementation is a fundamental activity that has a major impact on the success of the initiative. Implementation is not only about the technical process but also about organizational change and the management of such a change. Therefore, activities in enterprise software projects go beyond the purely technical (such as installation and programming) and include activities in which the entire organization is engaged (such as training and re-engineering).

When implementation projects are simple, SaaS has a positive impact. It facilitates decision-making during the adoption process, as its flexibility and rapid prototyping can support testing and evaluation, which helps users understand the implications of a software initiative.

However, increased implementation complexity directly affects the relative importance of software against total project costs, such that the economic advantages of adopting SaaS are reduced. At the same time, the advantage that comes from the higher implementation speed that the cloud environment provides is diminished as the relative weight of the infrastructure provision is reduced relative to the time consumed by other activities.

Furthermore, from the perspective of the software industry value chain, actors who perform different value-added activities, including software programming, implementation, and support, may have misaligned incentives, as they may not benefit equally from SaaS adoption. In this scenario, in addition to improving the incentives of the distribution channel, reducing implementation complexity can limit the interdependence of the value chain and, thus, limit the impact that non-aligned partners may have on adoption.

Increasing Collaboration Capabilities

The second SaaS application improvement strategy focuses on increasing collaboration scenarios. To generate these opportunities, participation can increase the multiple context use of the application, such as with the development of mobile applications. In addition, opportunities for participation can be created by adding application use cases that support cooperation and the sharing of information, especially with other organizations. This strategy can be further facilitated by encouraging application integration through APIs, including RESTful APIs. Accessing applications outside the context of the organization (such as using the application in front of customers) will increase the visibility of the application and, therefore, have a positive impact on its adoption rate.

CONCLUSION

The conclusion of our research is that the adoption process is a very complex phenomenon, and thus, a multifaceted approach can be helpful in analyzing it. Differences in adoption rate among application categories cannot be explained by cloud characteristics alone. A framework, including company and value-chain perspectives, can expand the focus of our analysis and help explain some of the differences in adoption rate among different application types. However, gaining knowledge of a company's related factors is a difficult task, and new approaches, such as the iterative development of minimum viable products (MVPs), should be considered to gain customer knowledge.

The proposed framework can help SaaS providers evaluate the fit of a new application in a SaaS deployment model, and we identified two general strategies—reducing implementation complexity and increasing collaboration—that will help increase adoption rates for existing applications. Sharing across applications (integration), users (collaboration), and multiple locations (ubiquity) has an impact on both the compatibility of the application and the visibility needed to help share the benefits of the cloud, as interpersonal channels of communication play a vital role in any adoption process.[13]

Finally, understanding the implementation process of an application and assessing its complexity is vital. Implementation complexity and customization diminish the economic advantage of the cloud, given that the relative cost of the infrastructure is reduced as more services are needed. At the same time, they also increase collaboration within the value chain, thus increasing project risks and reducing the testability of an application, making the adoption decision much more difficult.

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