Flexibility and Improved Resource Utilization Through Cloud Based ERP Systems: Critical Success Factors of SaaS Solutions in SME

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Abstract The following paper investigates the changes of the critical success factors of ERP implementations caused by the technology "cloud computing" and by the product innovation in the area of system configuration as well as of the provided services. The methodology used is a differential analysis of the classical ERP system SAP R/3 and the on demand solution SAP Business ByDesign. The purpose of this paper is to examine whether the entrance barriers for small and medium-sized enterprises to the ERP market indeed decrease because of the business model "cloud" and the innovative configuration. As a result of these changes in technology critical success factors of ERP implementation in SME are deduced. Furthermore, specific criteria of a value benefit analysis are selected in order to support decision makers of small and medium-sized enterprises whether to implement a SaaS system.

1 Introduction

A trend caused by the progress and the propagation of internet technology as well as by the increasingly available internet bandwidth can lead to a revolution of the IT market [1]. Information systems are offered under the designations cloud computing, on demand solutions or Software as a Service (SaaS) [2]. Thereby, the customer obtains the standard software solution as a service via the internet [1]. The provider is responsible for operating and maintaining the system whereas the user obtains the needed service and pays a monthly usage fee [3]. This Trend

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"[…] has the potential to transform a large part of the IT industry, making software even more attractive as a service and shaping the way IT hardware is designed and purchased" [4].

The authors *Benlian*, *Hess* and *Buxmann* outline the following advantages for such business models [5]:

- A cost advantage caused by the lower total costs of ownership.
- A shorter implementation period enabled through the direct obtaining via the internet.
- Free personnel resources that can concentrate on core business.
- Higher flexibility because of the improved support of processes; consequently a faster response to changes on the market is possible.

Target group for on demand systems is mainly small and medium-sized enterprises (SMEs) since these have lower IT know-how and usually lower resources available compared to large businesses. On demand solutions are especially made for those SMEs that don't want to set up an own IT infrastructure [6]. The existing entrance barriers for SMEs on the ERP market should decrease due to the new web-based business model as well as to the simplified and improved configuration of the standard software [7].

1.1 Are SMEs Able to Overcome the Entrance Barriers?

Within this paper it is examined if the existing entrance barriers [8] to the ERP market indeed decrease for SMEs. In order to determine the critical success factors for a SaaS implementation two ERP systems from the same provider are compared. The classical ERP system is represented by SAP R/3 and the on demand solution by SAP Business ByDesign (ByD).

The following research questions are pursued:

- How do critical success factors of ERP implementation change through the web-based business model "cloud"?
- What impact has the innovation of the ERP product (internet technology and configuration model) on the critical success factors?

1.2 Methodology

Based on the initial situation and the outlined research questions, a literature analysis was carried out in order to identify the critical success factors as well as other influencing factors. Within the research specific criteria of a value benefit analysis were established. This value benefit analysis should guide through a structured decision making process for the system that should be implemented [9].

2 Essential Differences Between the Classical ERP System and the SaaS Solution

The major differences between the classical ERP system and the investigated SaaS solution are the customizability of the ERP solution and the concomitant effect on the implementation expenses and in further consequence on the total costs of ownership (TCO).

2.1 Customizability of the ERP Solution

The customizability of the new solution differs from the classical ERP customizability because of its *business orientation*. That means the user doesn't require any technical know-how in order to configure the system. The technical system configurations are made automatically by the system in the background. Regarding this business oriented customizability the following advantages are stated [10]:

- Simplification of the configuration process due to the central configuration for the entire system and the possibility to configure the system in each product lifecycle stage.
- High transparency through disclosure of the entire range of functions in the solution catalogue.
- Users establish their own solution, with a maximum of control of the implementation by the use of commercial language and without necessity of technical specialized knowledge.
- High degree of decision support by integrated services and current knowledge transfer.

The simplified configuration process leads to a decrease of the implementation time. It also enables a short and friction-free knowledge transfer about in-house expiries between customer and manufacturer.

Nevertheless, the high degree of the standardization of the functions should be considered controversially. On the one hand it is a special advantage of SaaS, because the business processes can be extended according to the demand and the solution can be flexibly adapted to the company's growth [11]. Moreover, a reduction of the expenses for updates or release changes can be realized. This count therefore no longer to a critical success factor during the operation as it does with a classical ERP system [8]. On the other hand, the adaptation possibilities of the solution to the company are limited, because the solution disposes only of predefined functions [1].

2.2 Costs

The TCO of a SaaS model can decrease, in comparison to that one of a classical ERP system, according to *Mathew* and *Nair* over a period of 3 years around up to 60 % [12] . In order to verify this statement it requires of a more exact calculation which must be carried out individually for a company in each case for classical ERP and SaaS solution [2].

The cost trend of a classical ERP solution differs basically from that of a SaaS solution (cf. Fig. 1).

By outsourcing the ERP system as well as by the business oriented implementation the investment and implementation costs of a SaaS solution clearly lie under that of the classical ERP solution [13]. Nevertheless, the monthly expenses for the service rent linearly rise with increasing number in users.

The current expenses of the classical ERP solution are proportional for the number of the users, however, the additional maintenance costs show decreasing marginal cost. The conclusion can be drawn that a SaaS solution is worthwhile only up to a certain number in users.

Table 1 represents those properties of SaaS solution that have a considerable impact on the costs of the software.

3 Critical Success Factors for the SaaS Implementation

Those factors which influence the success of an implementation project decisively are understood as critical success factors. The non-observance of these factors can lead to the failure of the implementation project. The success is measured in the dimensions quality, expenses and duration of the implementation [14]. At this point the most high powered critical success factors are shown. In order to determine the critical success factors for the SaaS implementation those of a classical ERP implementation are investigated by a literature analysis (cf. Table 2)

Fig. 1 Cost trend of classical ERP solution compared to on demand model
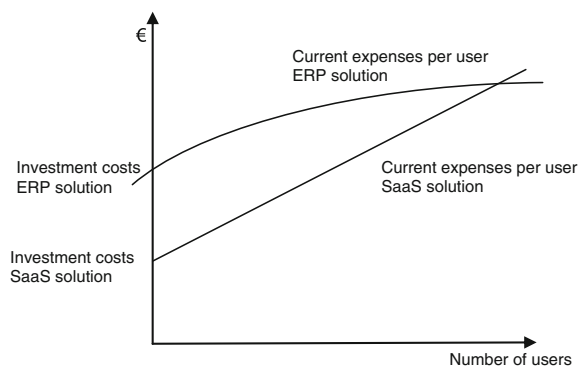
Table 1 Properties, reasons and impact on costs

Properties of SaaS solution	Reasons	Impact on costs
Fast availability	Enabled through the access via internet	Potential to reduce the implementation costs
Lower training expenditure	By intuitive user interface and product innovation in the area of integrated learning environment	Reduction of the training expenses
Simplified configuration	By predefined functions and processes within the Business Adaption Catalogue	Reduction of the implementation expenses and the duration, reduction of consultant's expenses
Predefined functions and processes	Potentials out of using best practice processes	Reduction of development and implementation costs
Outsourcing of the IT infrastructure	New technology "cloud"	Reduction of the IT personnel expenses, the hardware and software costs, and the current operation costs
Flexible extensibility of the solution	Modular structure of the solution's extent	Reduction of the monthly royalty based on the solution's extent
No additional personnel resources required	Outsourcing of operation and maintenance (updates and release changes) to the provider	Lower operation costs

and then reconceived according to the new influencing factors and the technological settings.[1] A detailed description of the critical success factors for the SaaS implementation is explained at *Gerhardter* [9].

Involvement and training of the users

The participation and early involvement of the end users in the implementation project are with a SaaS system implementation of the same meaning as with a classical ERP system. The purpose of involving and training the users is to avoid media disruptions and to ensure the usage of existing tools [8, 15–19] The non-observance of this critical success factor can lead to high training costs during the operation as well to an increase of the TCO. If the users get to know the system early enough, the greatest possible user benefit from the functionalities of the system can be drawn [11].

In a SaaS solution the training expenses can be considerably reduced by the intuitive usability. A stronger involvement is supported by the learning environment integrated in the system [20]. However, for SMEs this still means that they must invest time in the creation of an acceptance among the employees and also include time resources for training purposes.

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[1] The designations of the criteria are defined consistently because each author has its individual designation.

Table 2 Literature analysis: critical success factors of a classical ERP implementation

Criteria	Author					
	v. Arb [8]	Blume [15]	Brand [16]	Umble/Haft/ Umble [17]	Esteves/ Pastor [18]	Siegenthaler/ Schmid [19]
Involvement and training of the users	✔	✔	✔	✔	✔	✔
Project management	✔	✔	✔	✔	✔	✔
Commitment of top management	✔	✔		✔	✔	✔
Clearly formulated project objectives	✔	✔	✔	✔	✔	
Method of the implementation approach	✔	✔	✔	✔	✔	
Technical requirements	✔		✔	✔	✔	✔
Risk of consultancy	✔	✔			✔	✔
Reorganization of business processes	✔	✔		✔	✔	
Time and resource management	✔	✔			✔	✔
Contract drafting	✔				✔	

Commitment of top management

For many projects the low interest in the project or the wrong project appraisal of the top management represents a critical success factor. Consequently, a lacking guidance of the project and a too low support of the project team within the project realization of the top managers can arise [8, 15, 17–19]. With a SaaS implementation in SMEs the importance of this success factor can change due to the enterprise's size. Thus the top management will more likely be actively involved in the project realization. However, should the top management not be involved in the implementation project, this critical success factor is of the same importance as by a classical ERP introduction.

Method of the implementation approach

The decision on the method of the implementation approach, between step by step and big bang, influences decisively the success of the introduction of a classical ERP system as well as of an on demand ERP system. With a gradual implementation the implementation expenses as well as the risks which are connected to all departments with the acquisition of a new solution decrease. [8, 15–19] However, an implementation of the entire solution can bring the following advantages for SMEs [21]:

- Requirements of all scopes of business are fulfilled by the implementation of the completely integrated solution.
- The demand to integrate other systems during the implementation is reduced.
- The system interruptions which appear by the phase wise introduction are decreased.

The decision for one of both methods is dependent on company-specific conditions.

Technical requirements

The technical requirements have changed significantly through the web-based business model. Thereby, the design of the system architecture fades from the spotlight, however, data migration, data quality and interfaces to other systems are still considered as critical success factors. Data migration is easier than before because of the innovative services in the system. However, this is still a critical part of each implementation project.

SMEs only recently worry about the security because of the outsourcing of internal data to third parties and the dependence on the provider in which they thereby proceed [1]. However, according to *Grobman* data are stored more secure in a data centers than on premise at some companies. Further risks are internet fail outs, long responding times, high server utilization and bottlenecks in the capacity of the internet connection. These risks can negatively impact the indirect expenses for downtime [2].

Risk of consultancy

The risk of being dependent on the consultant decreases through the innovative service infrastructure for SaaS systems. The model based development enables high transparency of the processes and further simplifies the adaptability. The authors *Zencke* and *Eichin* state that it is possible to set up the solution without any support of consultants [7]. The degree of the consultants' support is determined by SMEs through the choice of one implementation service model and is dependent on their competences to accomplish an implementation project [14].

Dependency on the provider and drafting of the contract

By the web-based business model a new risk evolves: the dependence on the provider. This dependence correlates with the outsourcing of data as well with the operation of the ERP system. As a consequence the following problems can occur [2]:

- Adaptations of the system are not carried out.
- Important legal or organizational updates are not performed on time or not at all.
- The provider becomes insolvent or does not exist any longer, data could get lost.

The last problem is also with a classical ERP system of certain relevance, however, by far not from the range as with a SaaS model. Against a too strong powerlessness or dependence on the provider SME can protect themselves by effective drafting of the contract. The contract should include responsibilities and approaches unambiguously for the tasks but also for borderline cases. Further the technical and organizational risks for a flawless operation of the system are covered by the provider with the contract [22].

Reorganization of business processes

An implementation requires to examine the existing business processes on efficiency and effectiveness and to carry out organizational restructuring measures. This is about the degree of adaptability of business processes. That means which business processes are adapted to the system and where is the system adapted to

the processes. [8, 15, 17–19] Because SaaS solution is equipped with predefined business processes, necessary change measures of the organization to the system should be carried out. With the system choice should be decided, what extent the company is willing to adapt the processes to the integrated "Best Practice" processes and whether this adaptation implicates measures of process reorganization [2].

The confrontation of the critical success factors of classical ERP and SaaS implementation outlines how far critical success factors have changed due to the web-based business model and the product innovation. Table 3 summarizes the identified critical success factors of a SaaS implementation.

4 Specific Criteria for a Value Benefit Analysis to Determine the Implementation Effort

Based on the differences of classical and on demand ERP implementation specific criteria of a value benefit analysis are derived. This value benefit analysis should enable SME to assess the effort for each implementation and should support the decision-making process. For this only qualitative criteria that evolved from the underlying perceptions, are considered. A universal value benefit analysis cannot be established because the evaluation of criteria is dependent on company specific influences (e.g. financial situation, size, industry, requirements and objectives).

Table 4 represents an exemplary evaluation of the criteria acquired by an expert workshop. The assessment expresses an answer to the question: how important is this criterion in order to draw the best benefit out of the system and to reduce the implementation effort?

For the value benefit analysis the following steps have to be considered [23]:

1. The partial value benefits u_i of the single solutions (classical and on demand) are established and evaluated along an interval from 0 to 100. The lowest value is represented by 0 and the highest by 100. The subjective reason of this evaluation is outlined in the column *reasons*.
2. The weighting g_i for each criterion has to be done. The sum of that has to be 1.
3. The value benefit of each row is calculated by multiplying the partial value benefits with the responding weighting. The sum of this partial value benefits

Table 3 Critical success factors of a SaaS implementation

• Dependency on provider	• Method of the approach	• Project management
• Technical requirements	• Drafting of contract	• Risk of consultancy
• Reorganization of business processes	• Involvement and training of the users	• Clear formulated project objectives
• Time and resource planning	• Commitment of top management	

Table 4 Exemplary evaluation of the value benefit analysis

Criterion	g_i	SAP R/3 u_i	Partial Benefit $g_i* u_i$	Reason for SAP R/3 u_i	SAP ByD u_i	Partial benefit $g_i* u_i$	Reason for SAP ByD u_i
Implementation	0.14	36	5.04		68	9.52	
Strain on personnel resources (impact on personnel costs)	0.2	30	6	High personnel requirement and costs (internal and external), own IT department	70	14	No IT department, lower personnel requirements due to simplified implementation
Risk of dependency on consultants (impact on consultant costs)	0.15	30	4.5	Complex system, high technical know-how required; hence high dependency on consultants	80	12	Easy configuration, task list as implementation guideline, no technical know-how; hence lower risk of dependency
Reorganization measures of business processes—will of change	0.1	70	7	Reference processes can be adapted to company, reorganization measures moderate, due to moderate degree of standardization	40	4	Choice of processes out of predefined functions, high degree of standardization, high reorganizational measures
Training of users technical know-how (impact on training costs)	0.15	30	4.5	High technical know-how required, due to the system's complexity, elaborated customizing, high training effort	80	12	Little training effort through integrated learning area, Help Center, SAP ByD Community, improved usability
System availability—duration of implementation	0.1	20	2	Development, installation, hardware allocation, elaborated customizing	70	7	No installation, available on demand, no extra hardware required
Operation and maintenance	0.15	70	10.5		60	9	
Dependency on the provider	0.2	90	18	Little risk because system on premise and open source code	30	6	High risk due to outsource of business data, less possibilities for own software development
Effort for updates and release changes (impact on TCO)	0.1	50	5	High effort on resources for updates and releases because system on premise	90	9	Due to standardized functions, no effort on resources because of system outsourcing
Overall value benefit	1		15.54			18,52	

builds the entire value benefit for classical ERP system and SaaS solution. The system with the higher value benefit is considered to be the better decision.

The choice of the criteria is based on the following assumptions:

Strain on personnel resources: High personnel requirements increase the implementation effort and leads to a rise of direct and indirect expenses. A higher effort due to the establishment of an IT department occurs.

Risk of the dependency on consultants: An autonomous completion of the implementation project by the company is basically possible for each system. However, the SaaS solution is easier to implement across the simplified configuration and the increased usability.

Reorganizational measures of business processes—will of change: Elaborated organizational alteration measures are directly proportional to the implementing duration, which further increases the implementation effort.

Training of users—technical know-how: The higher the requirements for technical know-how the higher the effort for training.

System availability—implementation duration: The faster the system is available the faster can the company draw a benefit out of it.

Dependency on the provider: A high dependence on the provider can negatively impact the implementation through e.g. long response times on the productive system. This dependency also contains the risk that can occur across the outsourcing of business data e.g. data security.

Effort for updates and release changes: The higher the degree of standardization, the lower the effort for updates and release changes, which further leads to a decrease of the indirect costs.

Consequently, for this exemplary case, the SaaS solution is the better choice regarding implementation as well as the phase of operation and maintenance. However, to support a concrete investment decision for a company, individual weights for the identified criteria have to be determined to ensure a sustainable decision.

5 Conclusion

The new business model and the innovation of the ERP product have influenced the meaning of the critical success factors for a SaaS implementation. From experiences of previous implementation projects, and the deduced new service models as well as by the application of the web-based system architecture new chances arise for providers to establish in the market of SME. The examination about ERP trends in 2011, carried out by the company *i2s Consulting*, outlined that the public consciousness in Austria and Switzerland was sharpened increasingly for SaaS solutions by the market entry of SAP ByD. *I2 s consulting* predicts that by the increasing number of references and the further progress of application of functionalities in the SaaS mode, the spotlight on SaaS solutions will clearly
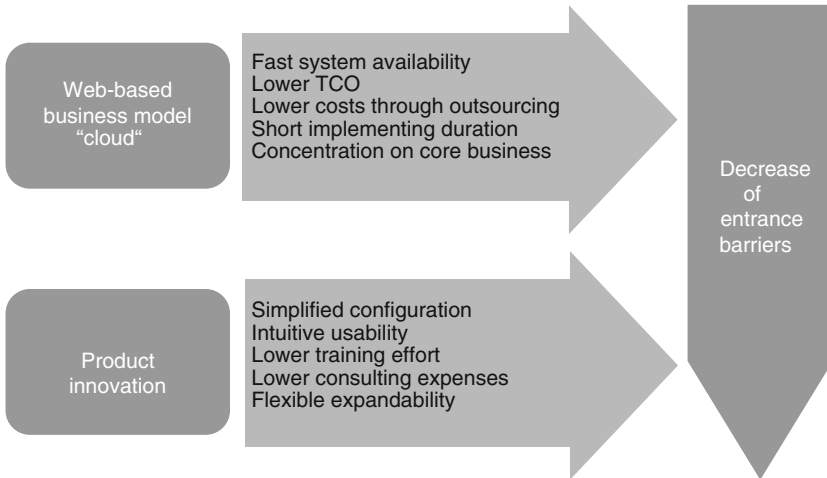
Fig. 2 Decrease of entrance barriers for SME

increase in the ERP sphere within the next 3 years. However, there is still a higher level of acceptance in companies from the service industry than in manufacturing companies. This trend can be presumably put down to the high degree of standardized processes in service industries, because in producing companies the core processes are very company-specific [24].

Also this examination proposes a decrease of the entrance barriers for SME in the ERP market enabled through the business model "cloud" and the innovation in the product area (see Fig. 2).

References

1. Buxmann, P., Hess, T.: Software as a service. In Wirtschaftsinformatik **50**(6), 500–503 (2008)
2. Grobman, J: ERP Systeme On Demand: Chancen, Risiken Anforderungen, Trends. Diplomica®, Hamburg (2008)
3. Saugatuck (2008). Mietsoftware: So profitieren kleinere und mittelständische Unternehmen. SAP AG
4. Armbrust, M., Fox, A., Griffith, R., Joseph, A., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I., Zaharia, M.: A view of cloud computing. Commun. ACM **53**(4), 50 (2010)
5. Benlian, A., Hess, T., Buxmann, P.: Software as a Service: Anbieterstrategien, Kundenbedürfnisse und Wertschöpfungsstrukturen. Gabler, Wiesbaden (2010)
6. Weiss, C.: SAP für KMUs, Business byDesign in Österreich. In Monitor 4 (2011)
7. Zencke, P., Eichin, R.: SAP Business byDesign—Die neue Mittelstandlösung der SAP. In Wirtschaftsinformatik **50**(1), 47–51 (2008)
8. Von Arb, R.: Vorgehensweisen und Erfahrungen bei der Einführung von Enterprise Management Systemen dargestellt am Beispiel von SAP R/3. Bern (1997)

9. Gerhardter, A.: Implementierung von ERP Systemen für kleine und mittelständische Unternehmen im Wandel der Zeit. Bachelorarbeit an der FH Joanneum, Kapfenberg (2011)
10. Hufgard, A., Krüger, S.(2011). SAP Business byDesign: Geschäftsprozesse, Technologie und Implementierung anschaulich erklärt. Galileo Press
11. Walzenbach, M.: Standardisiert aber individuell, http://www.steeb.de/sapbusinessbydesign/wasistbusinessbydesign/kundenindividuell.html
12. Mathew, M., Nair, S.: Pricing SaaS models: perceptions of business service providers and clients. In J. Serv. Res. **10**(1), 51–68 (2010)
13. Türling, F.: Software as a Service: Outsourcing von ERP Prozessen, http://www.erpmanager.de/magazin/artikel_1705_saas_erp_outsourcing
14. SAP AG: Erfolgreich Starten mit SAP® Business byDesignTM: Individuelle Unterstützung für jedes Unternehmen, https://www.sme.sap.com/irj/sme/go/portal/prtroot/docs/library/uuid/c0c505b3f20b2c102fa3d35fa6681991?QuickLink=solution/services/serviceportfoliogolive
15. Blume, A.: Projektkompass SAP®: Arbeitsorientierte Planungshilfen für die erfolgreiche Einführung von SAP®-Software. Vieweg & Sohn, Braunschweig/Wiesbaden (1997)
16. Brand, H.: SAP R/3 Einführung mit ASAP: Technische Implementierung von SAP R/3 planen und realisieren. Addison Wesley Longman, Bonn (1999)
17. Umble, E., Haft, R., Umble, M.: Enterprise resource planning: implementation procedures and critical success factors. Eur. J. Oper. Res. **146**, 241–257 (2003)
18. Esteves, J., Pastor, J.: A Critical Success Factor's Relevance Model for SAP Implementation Project, in: Lau, Linda: Managing Business with SAP: Planning, Implementation and Evaluation, Idea Group, London, pp. 240–261 (2005)
19. Siegenthaler, M., Schmid, C.: ERP für KMU: Praxisleitfaden: Richtig evaluieren und einführen, BPX Edition Dalla Vecchia (2005)
20. SAP BYD Mitarbeiterschulung: Mitarbeiter einfacher und schneller schulen, https://www.sme.sap.com/irj/sme/solutions?rid=/webcontent/uuid/30f70cfe-8426-2c10-c9a5-812b550f29b2
21. Hesseler, M., Görtz, M.: Basiswissen ERP Systeme: Auswahl, Einführung & Einsatz betriebswirtschaftlicher Standardsoftware. W3L, Witten (2007)
22. Wiemann, F.: Wetteraussichten heiter bis wolkig—Cloud Computing Verträge und ihre rechtlichen Fallstricke, http://www.saas-forum.net/blog/gastbeitrag-wetteraussichten-heiter-bis-wolkig-cloud-computing-vertraege-und-ihre-rechtlichen-fallstricke/04082010
23. Vahs, D., Schäfer Kunz, J.: Einführung in die Betriebswirtschaftslehre. Schäffer Poeschel, Stuttgart (2007)
24. i2s Consulting: Business Software Trends: Die Sicht des i2s research, http://erpsurvey.de/blog/2011/02/07/business-software-trends-2011-die-sicht-des-i2s-research/ (2011)