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HOW FAST ARE ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS MOVING TO THE CLOUD?

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ABSTRACT

Enterprise Resource Planning (ERP) systems evolved from traditionally isolated applications such as payroll, billing, purchasing, sales, etc. – that neither shared a common base of data, nor interacted well with one another. The need for an integrated view of enterprise systems led to the development of sophisticated and complex software packages that could be tailored for different organizations and provide different modules (e.g. Human Resources, Financial/Accounting, and Logistics), that would interact with one another and use a common base of data. ERP systems were leased or purchased, tailored and installed as in-house computer systems resisting industry outsourcing trends.

Cloud Computing, and particularly Software as a Service (SaaS), is moving in-house systems to Private and Public Clouds. Sixty percent of the organizations studied already use Cloud services. Customers Relationship Management (CRM) is prominent among the services moved to the Cloud, but close to 20% of the organization respondents moved the ERP modules of human resources and financial/account systems to the Public Cloud. New ERP development is increasingly Cloud-based, while conventional in-house ERP is decreasing.

The factors that are motivating the move to the Cloud as reported by 40% of the respondents are faster access to new functionality, increase in revenue by offering new products sooner, better resource utilization, decrease of IT costs, and decentralization.

Finally, the factors that are hindering the move to the Public Cloud as perceived by over 30% of the respondents are security, regulations, reliability, capability and maturity of Cloud services, in addition to IT governance and SLAs.

Keywords: ERP, Cloud Computing, SaaS, SCM, CRM

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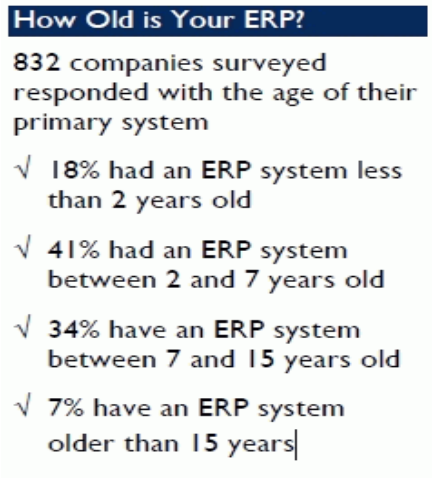
INTRODUCTION

Enterprise Resource Planning (ERP) Systems are large resource intensive IT business projects done traditionally in-house, resisting the trend for IT/IS outsourcing and offshoring [24]:

> "Enterprise resource planning (ERP) systems are software packages composed of several modules, such as human resources, sales, finance and production, providing cross organization integration of information through embedded business processes. These software packages can be customized to cater for the specific needs of an organization. During the 1990s, ERP systems became the de facto standard for replacement of legacy systems in large and particularly multinational companies." [15]

A 2011 study found that there are differences in the age of ERP systems, particularly in mid-sized companies, as seen in Figure 1.



Source: Prouty [16]

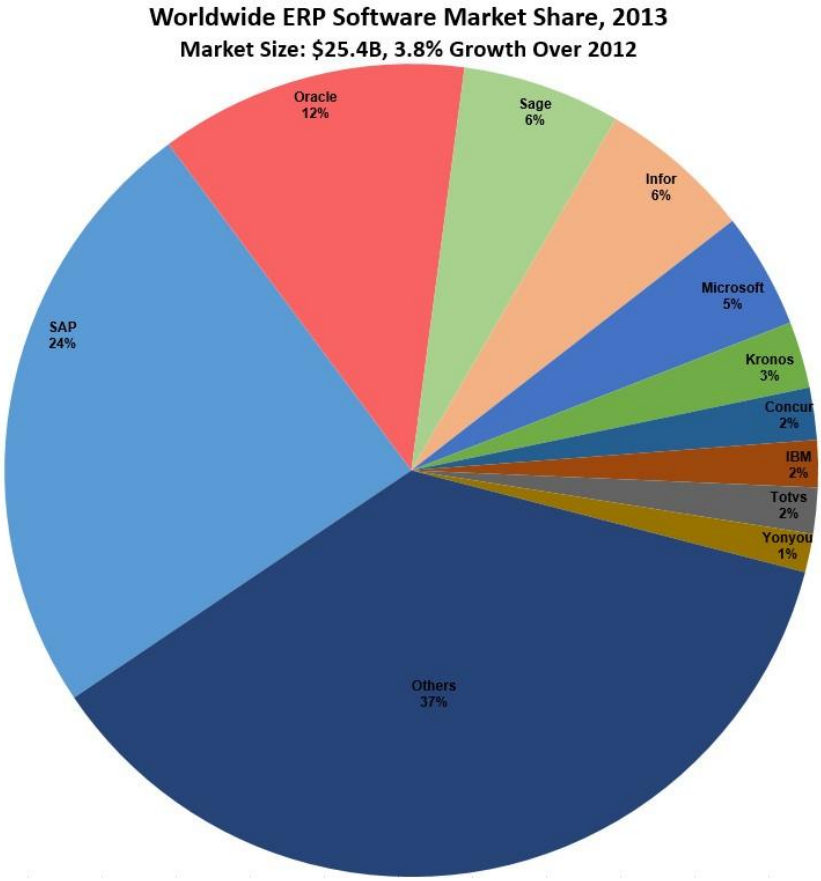
Figure 1: Age of ERP systems

Cloud Computing offers a real possibility of running these systems on the Cloud with the ERP management in-house, but without the need for costly and time-consuming upgrades, maintenance, and capital expenditures, which will be done by the Cloud ERP providers once ERP systems are moved to the Cloud. Businesses have invested large financial and time resources to develop their current in-house ERP systems, but the next upgrade may make the move to the Cloud cost effective. Most businesses choose to move services to the Cloud primarily because of cost savings and better system performance [10].

ERP in the cloud is primarily Software as a Service (SaaS) – "a software delivery model in which software and associated data are centrally hosted on the cloud" [22]. The SaaS market had worldwide revenues of $13.1 billion in 2009, and the market was forecast to reach $40.5 billion by 2014, representing a compound annual growth rate of 25.3%. In 2014, about 34% of all new business software purchases was expected to be consumed via SaaS and SaaS delivery was predicted to constitute about 14.5% of worldwide software spending across all primary markets [12]. Forrester Research found that Cloud-based ERP in 2011 comprised around 2 percent of the market, but was set to grow by about 21 percent annually through 2015 [13].

Moving ERP to the Cloud provides a simple way to implement a two-tier ERP – with one ERP installation for the company headquarters and other local ERP installations for subsidiaries, decreasing the risks of failure, decreasing the overall installation time, increasing the agility of the implementation and updating process [5]. In addition, moving ERP to the Cloud facilitates the mobile access to ERP that is a requirement of the increasing phenomenon of a mobile workforce and mobile customer [18].

ERP system software expenditure continues to grow and the number of players has increased to accommodate the move to the Cloud, adding new providers. The traditional providers – SAP and Oracle – still have the largest market share, as shown in Figure 2.



Source: Columbus [2]

Figure 2: ERP software market share

The growth of Cloud-based ERP systems is projected to be greater than the traditional ERP in-house systems, from 12% in 2014 to 17% in 2017, but they vary by type of ERP system moved to the Cloud as shown in Table 1.

This study examines how fast ERP systems are moving to the Cloud, and the factors that are affecting this movement. The literature identifies a series of factors that may hinder or facilitate the move of ERP systems to the Cloud. The first bar chart below (Figure 3) shows some of the potential factors facilitating the move in large-size organizations. The second bar chart (Figure 4) shows the reasons why mid-sized companies choose to move to the Cloud.

Finally, recent surveys seem to indicate that CFOs (Chief Financial Officers) support and encourage the move of ERP to the Cloud:

> "The reality is that CFOs not only understand the cloud's benefits, but are embracing it faster and more broadly than many originally thought possible, including new services such as enterprise resource planning (ERP) in the cloud." [14]

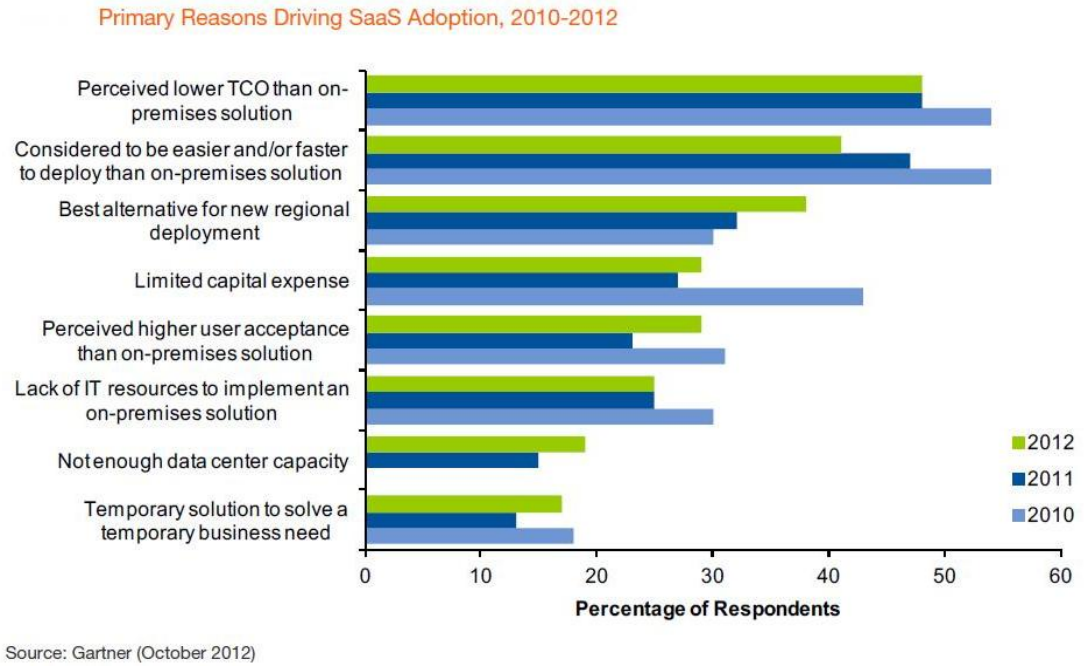
Table 1: Growth of ERP systems

Table 1. SaaS Revenue Within Enterprise Software Sizing, 2011-2016 (Percent)

	2011	2012	2013	2014	2015	2016
Business Intelligence	5	6	7	8	10	11
Customer Relationship Management	35	39	42	44	46	48
Digital Content Creation	6	7	9	11	15	17
Enterprise Content Management	6	8	10	11	11	12
Enterprise Resource Planning	8	10	12	14	15	17
Office Suites	2	3	3	4	5	6
Project and Portfolio Management	17	20	26	29	31	32
Supply Chain Management	16	18	21	23	26	28
Web Conferencing, Teaming Platforms and Social Software Suites	70	69	69	68	67	65
Other Application Software	7	8	9	10	11	13
Total	12	13	15	17	18	20

Note: Dark green equals high level of SaaS adoption, and dark red equals low level of SaaS adoption.

Source: Gartner (October 2012)



Source: Gartner (October 2012)

Figure 3: Factors facilitating the move to the cloud (large organizations)

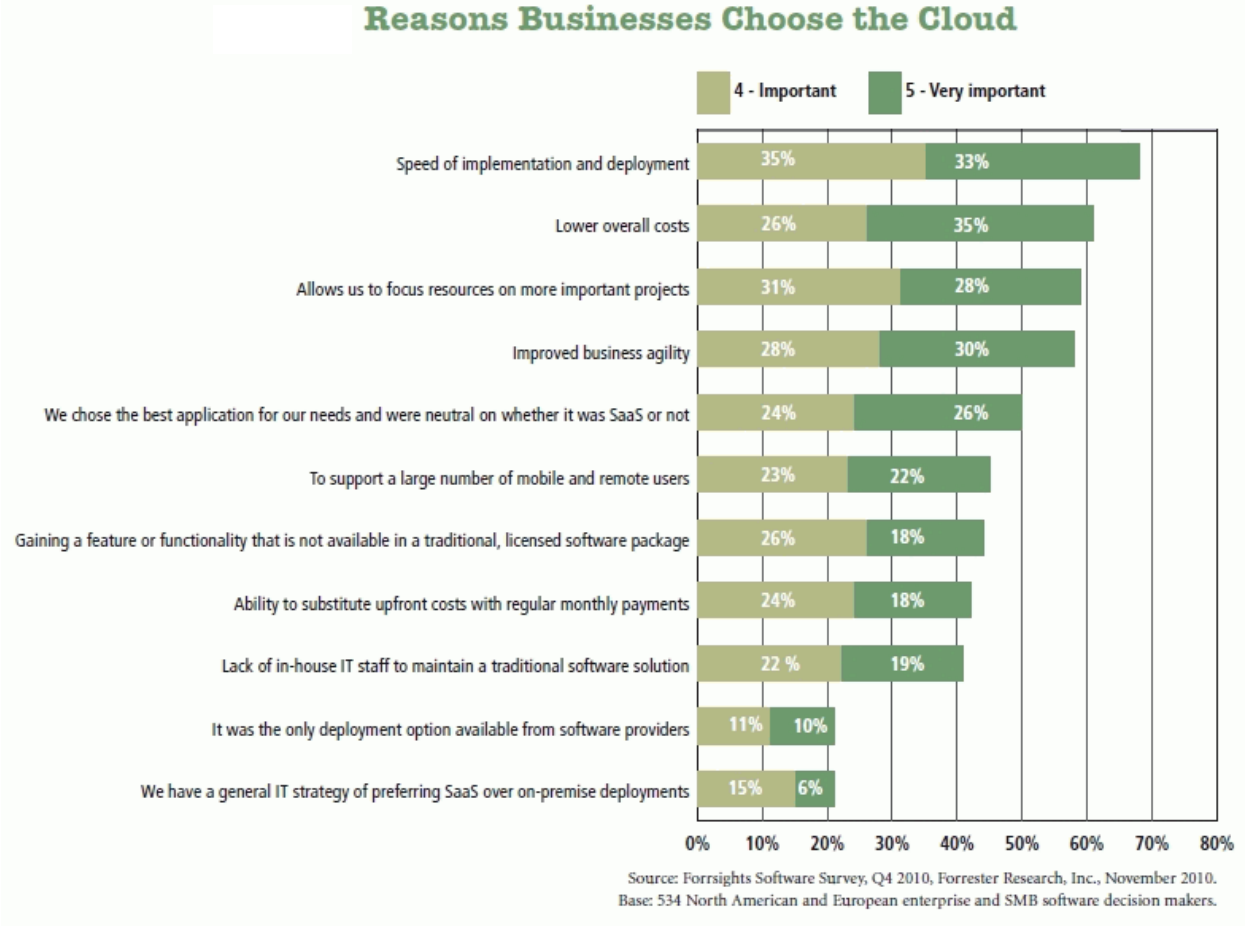


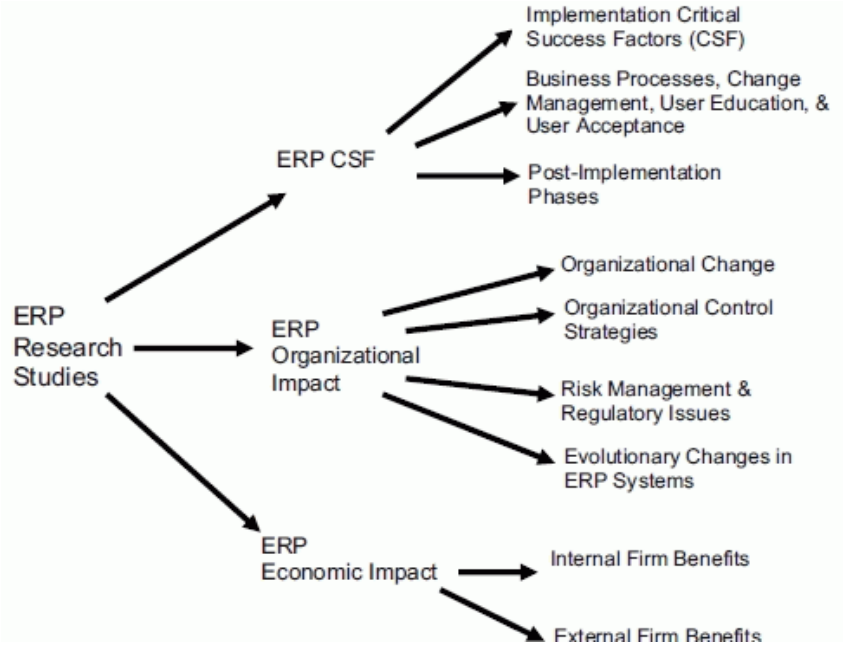
Figure 4: Factors facilitating the move to the cloud (mid-sized organizations)

RESEARCH QUESTIONS

There is extensive research on ERP systems, as evidenced by 885 peer reviewed journal publications from 2000 to 2009, with many more in recent years. The main streams of these published journal articles were [20]:

- Implementation -- criteria to select the ERP system provider, strategy to be used, process reengineering prior or simultaneously, and critical success factors (CSF).
- Optimization and post-implementation – process improvement, maintenance, benefits.
- Management and organization – functional vs IT vs providers relations and arrangements.
- ERP, SCM and CRM integration – how can ERP be connected to Supply Chain Management (SCM) and to Customers Relationship Management (CRM) software and processes.
- Education and training – academic and professional development of ERP skilled personnel.

Another way to look at the major streams of ERP research is summarized in Figure 5.



Source: Grabski, Leech, & Schmidt [6, Figure 1].

Figure 5: ERP research streams

The present study goes beyond the scope of traditional ERP research using the results of a large scale survey to analyze how large organizations are approaching the process of moving ERP to the Cloud: how fast they are doing it, and to what extent they plan to do so. In addition, the study attempts to identify what factors may hinder or facilitate the move of ERP to the Cloud. The study's overall research questions are:

1. How fast are ERP systems moving to the Cloud?
2. What factors may be hindering or facilitating ERP systems' move to the Cloud?

RESULTS AND CONCLUSIONS

We used secondary data to answer the research questions, since we were not able to obtain direct data from large organizations. The analysis and conclusions of this study are based on Fauscette's [4] study of IDC's CloudTrack Survey of 1,109 respondents of large size organizations regarding the move of ERP to the Cloud. Fauscette studied ERP as another type of SaaS and an evolutionary process of moving traditional internal software systems to the Cloud. Organizations initially learned to use SaaS through CRM, which in the study results are still the dominant form of software services moved to the Cloud.

How fast are ERP systems moving to the Cloud?

The speed of ERP systems moving to the Cloud follows the overall pattern of SaaS adoption.

> "Slowly over time SaaS and cloud computing have moved into the mainstream of IT operations and are increasingly becoming preferred alternatives to on-premises deployments. In fact over 60% of companies surveyed by IDC reported that they were already using or had firm plans to use cloud services (IDC's CloudTrack Survey, October 2013, n = 1,109)" [4]

The CloudTrack survey shows that a significant decrease of conventional ERP deployment and increase of private and public cloud deployments is planned, as shown in Figure 6. While both human resource and financial/accounting ERP applications are moving more toward the private cloud than the public cloud, it is interesting to note that most of the increase in public cloud deployment is in the area of ERP human resource applications.

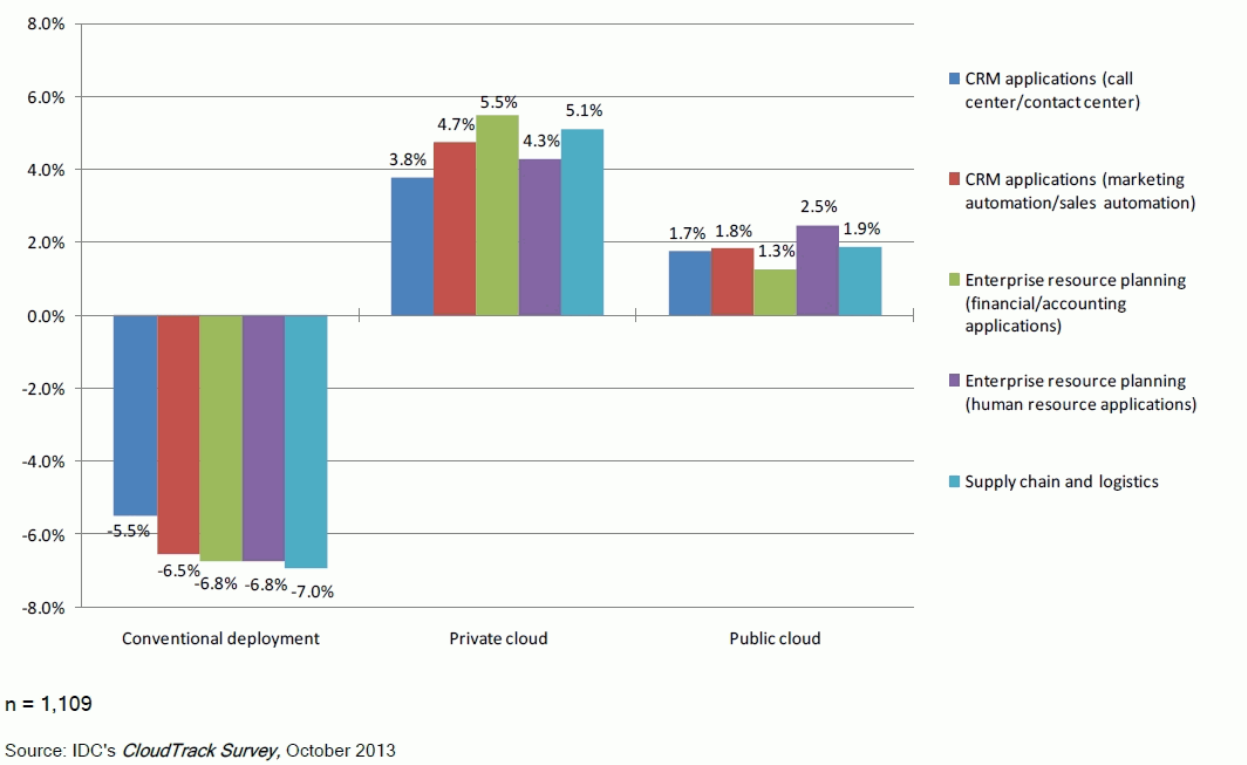


Figure 6: Move of applications to the private and public cloud

ERP applications are already used in the public cloud by a significant percentage of the studied enterprises, although they still lag behind CRM applications, as shown in Table 2.

Table 2: Applications most used by respondents in the public cloud

Most Used Applications	Percent of respondents
CRM applications (marketing automation/sales automation)	21.2%
CRM applications(call center/contact center)	20.9%
Supply chain and logistics	19.6%
Enterprise resource planning (human resource applications)	19.3%
Enterprise resource planning (financial/accounting applications)	18.9%

n = 1,109
Source: IDC's CloudTrack Survey, October 2013 as cited in Fauscette [4].

Significant progress has already been made, but it seems that ERP is moving to private, hybrid and public clouds only as new applications are developed and/or upgraded. It does not seem to be a wholesale decision to move to the Cloud, but rather an incremental move, as needed, dictated by business, financial or technology changes.

What factors may be hindering or facilitating ERP systems move to the Cloud?

As expected from prior discussions, the main factors motivating the ERP move to the Cloud are either faster access to new technology, financial benefits, or agility in developing local IT ERP solutions, as summarized in Table 3.

Table 3: Factors motivating ERP move to the cloud

Top Factors motivating ERP move to the Cloud	Percent of respondents
Get access to the newest functionality faster	41.3%
Increase revenue by enabling us to build new revenue-generating products and services faster	40.5%
Improve resource utilization	40.4%
Reduce the total size of IT budget	40.3%
Give business units more direct control over sourcing their own IT solutions	39.0%

n = 1,109
Source: IDC's CloudTrack Survey, October 2013 as cited in Fauscette [4].

Unexpectedly, human resource issues (IT force displacement) were not seen as a top factor hindering the move to the cloud. Security, regulations, reliability, capability and maturity of Cloud services, in addition to IT governance and Service Level Agreements (SLAs), were seen as the main obstacles of the move to the Public Cloud, as detailed in Table 4.

Table 4: Factors hindering ERP move to the cloud

Top Factors hindering move to Public Cloud	Percent of respondents
Security concerns	49.0%
Regulatory or compliance issues	35.3%
Reliability concerns in terms of service availability	32.9%
Concerns that cloud cannot support the operational/performance requirements of critical applications	32.3%
IT governance issues, including challenges related to defining standard services and SLAs	31.0%
Immaturity of cloud–it is a new technology	30.7%

n = 1,109
Source: IDC's CloudTrack Survey, October 2013, as cited in Fauscette [4].

Conclusions

The ERP move to the Cloud is under way, not as a wholesale decision, but rather as a business, technological or financial need arises. The move to the Cloud, although incremental, is happening whenever new development is required, at the same time that traditional in-house systems development decreases, as seen in Figure 6. One of the factors hindering the move to the cloud is the existing investment in in-house systems, which may explain the incremental nature of this move.

The top factor hindering the wholesale move to the cloud was Security, with nearly half of the survey respondents stating that it was a major factor hindering the move of ERP to the public cloud. This may explain why the greatest growth in ERP in the cloud has been in the private cloud, rather than the public cloud. It is also interesting to note that the relative novelty of Cloud technology and services was one of the top factors hindering the move to the public cloud, despite the fact that 60% of the respondents are already using or planning to use Cloud services.

The use of ERP in the Public Cloud is primarily for Human Resources applications and Financial/Accounting applications as reported by close to 20% of the respondents. Recent growth of ERP use in the Public Cloud has been greater within Human Resources applications rather than Financial/Accounting applications, which are increasing mostly in the use of the Private Cloud. Future research should look further into the reasons why these two categories of ERP applications are increasingly moving to the cloud, and why other ERP applications are not.

A recent study from Price Waterhouse Coopers [1] seems to indicate that Cloud ERP growth has been accelerating in 2015, with revenue of cloud-based and hybrid (cloud and in-house) ERP surpassing traditional in-house ERP. Columbus [3] summarized the factors accelerating this growth as: support of new business models, hybrid ERP systems saving up to six times the amount of capital expenditure over traditional ERP systems, and the increased complexity of business systems extended to the Cloud, among others.

REFERENCES

[1] Clark,N., Dawson,D., Heard, K., and Manohar,M (2015). Beyond ERP: New technology, new options, accessed September 6, 2015, [available at http://www.strategyand.pwc.com/media/file/Beyond-ERP.pdf]

[2] Columbus, L. (2014). Gartner's ERP Market Share Update Shows The Future Of Cloud ERP Is Now, accessed September 6, 2015, [available at http://www.forbes.com/sites/louiscolumbus/2014/05/12/gartners-erp-market-share-update-shows-the-future-of-cloud-erp-is-now/]

[3] Columbus, L. (2015). Five Catalysts Accelerating Cloud ERP Growth In 2015, accessed September 6, 2015, [available at http://www.forbes.com/sites/louiscolumbus/2015/01/27/five-catalysts-accelerating-cloud-erp-growth-in-2015/print/]

[4] Fauscette, M. (2013). ERP in the Cloud and the Modern Business, accessed September 6, 2015, [available at http://resources.idgenterprise.com/original/AST-0111292_ERP_US_EN_WP_IDCERPInTheCloud.pdf]

[5] Gill, R. (2011). The Rise of Two-Tier ERP: What it is and what it means. Strategic Finance, November 2011, 35-40.

[6] Grabski, S.V., Leech, S.A., & Schmidt, P.J. (2011). A Review of ERP Research: A Future Agenda for Accounting Information Systems. Journal of Information Systems, 25(1), 37-78.

[7] Ioannou, G., & Papadoyiannis, C. (2004). Theory of constraints-based methodology for effective ERP implementations. International Journal of Production Research, 42(23), 4927-4954.

[8] Jimenez, D.-Z., & Lee, W. (2011). Buyer Conversations: Coca-Cola Bottling Co. Consolidated's ERP Upgrade Journey - APEJ View. IDC #AP2670107T, April 2011.

[9] Jutras, C. (2010). ERP in SME: Fueling Growth and Profits. Aberdeen Group, August 2010.

[10] Koehler, P., Anandasivam, A., & Dan, M. (2010). Cloud Services from a Consumer Perspective. AMCIS 2010 Proceedings, Paper 329.

[11] Kumar, K., & Van Hillegersberg, J. (2000). ERP Experiences and Evolution, Communications of the ACM, 43(4), 23-26.

[12] Manchester. (2010). IDC: One Third of All Software Delivered via Cloud in 2014, accessed September 6, 2015 [available at http://erpcloudnews.com/2010/08/idc-one-third-of-all-software-delivered-via-cloud-in-2014]

[13] Martens, C., Hamerman, P.D., Moore, C., Magarie, A. (2011). The State Of ERP In 2011: Customers Have More Options In Spite Of Market Consolidation, accessed November 24, 2013, [available at http://www.forrester.com/rb/Research/state_of_erp_in_2011_customers_have/q/id/55901/t/2]

[14] Miranda, S. (2013). ERP in the Cloud: CFOs See the Value of Running Enterprise Applications as a Service. Financial Executive, Jan/Feb 2013, 65-66.

[15] Nazemi, E., Tarokh, M.J., & Djavanshir, G.R. (2012). ERP: a literature survey. International Journal of Advanced Manufacturing Technology, 61, 999-1018.

[16] Prouty, K. (2011). Aging ERP: When Old ERP is Too Old. Aberdeen Group, June 2011.

[17] Prouty, K., & Castellina, N. (2011). To ERP or Not to ERP: In Manufacturing, It Isn't Even a Question. Aberdeen Group, April 2011.

[18] Prouty, K., & Castellina, N. (2011). Mobility in ERP 2011. Aberdeen Group, May 2011.

[19] Sage North America. (2011). ERP and the Cloud: What You Need to Know.

[20] Schlichter, B.R., & Kraemmergaard, P. (2010). A comprehensive literature review of the ERP research field over a decade. Journal of Enterprise Information Management, 23(4), 486-520.

[21] Shaul, L., & Tauber, D. (2013). Critical success factors in enterprise resource planning systems: Review of the last decade. ACM Computing Surveys, 45(4), Article 55, 39 pages.

[22] Software as a service. (2013). In *Wikipedia*, accessed November 24, 2013, [available at http://en.wikipedia.org/wiki/Software_as_a_service]

[23] Sternad, S., Gradisar, M., & Bobek, S. (2011). The influence of external factors on routine ERP usage. Industrial Management and Data Systems, 111(9), 1511-1530.

[24] Wiener, M., Vogel, B., & Amberg, M. (2010). Information Systems Offshoring - A Literature Review and Analysis. Communications of the Association for Information Systems, 27(1), 455-492.

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Regina Bento is a Professor of Management at the Merrick School of Business, University of Baltimore. Born and raised in Brazil, she started her career as a psychiatrist (M.D., Federal University of Rio de Janeiro - UFRJ, 1977), studying the relationship between work and mental health. Interested in learning more about the nature of work and organizations, she went on to pursue graduate studies in administration. After an M.S. in Management (COPPEAD, UFRJ, 1979), she came to the United States for doctoral studies at Harvard and MIT (Ph.D. Sloan School of Management, MIT, 1990). She has been a faculty member at UB's Merrick School of Business since 1991, and before that she taught at COPPEAD/ UFRJ (1980-1983) and UC Riverside (1988-1991). She was also a Visiting Professor at the Sloan School, MIT (1999, 2007) and Associate Director of the Christensen Center for Teaching and Learning at Harvard Business School (2006-2009). Regina has received numerous teaching and research awards, including the USM Regents Award, the highest honor in the University System of Maryland.

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