Factors Incompatibility of Selection and Implementation of ERP Systems for Construction Organizations - Lessons from Sri Lanka

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Abstract
Information and Communications Technology (ICT) and Information Systems (ISs) compose a critical role in today's organization environment. Enterprise Systems (ESs) such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) systems are the most cutting-edge IS in present corporate world. ERP system bridges the organization's different functions together into single large integrated system and it makes an extra opportunity for growth and increased productivity. Enterprise system usage in manufacturing companies is well established. However, the available studies relating to the use of ERP systems in project based companies such as construction organizations is comparatively low and success rate is also limited. The literature illustrates that there are many factors that affect selecting and implementation of ERP systems.

This research is mainly based on qualitative research methodology. Primary data were collected from construction industry and their Information Technology (IT) experts and ERP implementation project managers though intensive interviews. The objective of using the qualitative research was used to gain an understanding of underlying reasons, opinions, and motivations. It facilitated to find out common and main barriers and their effect to implementation and adaptation of ERPs against factors influencing the selection process. Furthermore, secondary data such as literature was also contributory to the main outcome and results.

Influencing factors that analysis research results reveal new way of rationale for selecting and implementation of ERP systems in construction organizations. The main propositions derived from the study are as follows: higher influencing factors in selecting process are Vendor/Software Reputation, Alignment with Business Function, Cost and C-level Officers' (such as CEO, CFO, COO, CIO, etc.) countenance. Important factors influencing success of implementation and adaptation of ERPs are Being in alignment with Business Function, Support and Training, Usability and User friendliness, Implementation Team, Vendor-Employee Interaction and C-level Officers' countenance. In other words this research illustrates that not only an IT related factors can influence the success of ERP implementation and also non-IT related factors are much significant to success. Beyond that the study also reveals that how to do sensible selection process which assist the success of implementation of ERP.

Keywords
Information Technology, Information System, Enterprise Resource Planning, Construction Organizations, Influencing Factors, Software Implementation

I. Introduction
Most of the manufacturing oriented organizations in the globe have moved on with implementing ERP systems, and some of them are gaining enormous benefits. The Enterprise Systems are typically the largest, most complex, very expensive and most challenging Information Systems (IS) implemented by organizations. ERP systems have significant impact to reduce the role of the individual and departmental ISs dominancy in the past. ERP systems are most popular in Energy, Materials, Capital Goods, Automobiles and Components, Consumer Durables and Apparel, Consumer Services, Transportation, Retailing, Food, Beverage and Tobacco, Technology Hardware and Equipment, Finance, Utilities and many more industries [1]. ERP implementations have so far made more failures than successes in construction companies. Main causes are disparity and inconsistency between the process definitions in the standard ERP applications and business processes of the construction industry [2]. One of the foremost reason to low level success is industry inherited nature of project processes rather than operation processes [3] and also incompatibility of selection factors against actual factors important to implementation of ERP [4].

Cost of Information and Communications Technology has become more and more inexpensive and affordable to many industries [5], Open Source paradigm has become more popular and more advance enough to offset Proprietary Software [6] and frequently arising affordable cutting-edge technologies such as Cloud Solutions are main motivations to the exclusive improvement in IT usage globally in many industries.
The research paper begins by briefly discussing ERP and construction industry and difference between operation and project based organizations. It then presents the research context and methodology. After briefly outlining the research approach, the findings on how selection and implantation factors influence success of ERP is discussed. Based on the data analysis, this qualitative research determines contrast between effective implementation factors and impact factors to selection of ERP systems in construction organization.

II. Enterprise Resource Planning (ERP) Systems
In 1960s Inventory Control Packages were introduced and advanced to Material Request Planning (MRP) in 1970s and MRP II in 1980s. ERP developed from the concept of MRP and MRP II systems since the end of 1980 and the term ERP was invented in the 1990s by the Gartner Group. Built on the technological basis of MRPs and ERP systems with the ability to create enterprise-wide cross-functional business processes and provides real-time availability and accessibility and consistency across the organization [7].

Table 1: Cost, Duration and % of Overruns

YEAR	COST	% OF COST OVERRUNS	DURATION	% OF DURATION OVERRUNS	% RECEIVING 50% OR LESS BENEFITS
2014	$4.5MM	55%	14.3 months	75%	41%
2013	$2.8MM	54%	16.3 months	72%	66%
2012	$7.1MM	53%	17.8 months	61%	60%
2011	$10.5MM	56%	16 months	54%	48%
2010	$5.5MM	74%	14.3 months	61%	48%

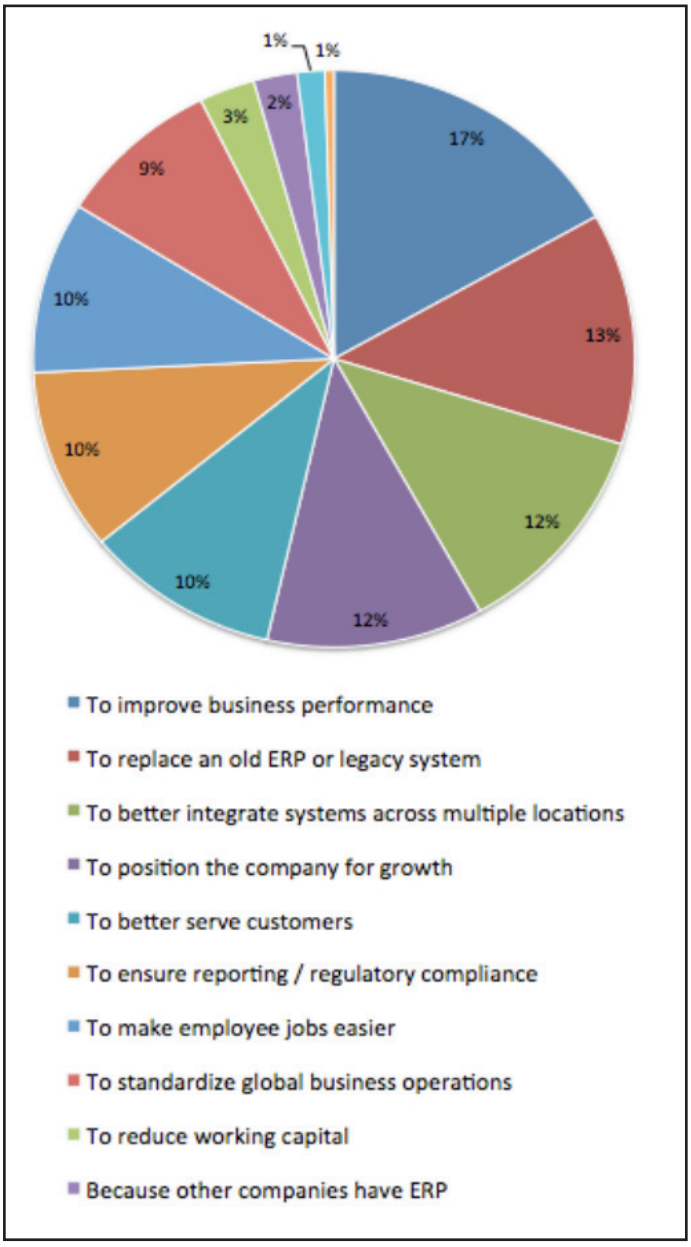

Fig. 1: Reasons for Implementing ERP

Beginning with the year 2000, ERP manufacturers began adding more and more modules and functions such as Add-ons and it gave the birth of the concept of "ERP II". The evolution of the ERP reflects the fact that many non-manufacturing sectors began to adopt ERP systems for the financial business, accounting and others. The ERP extensions include SCM, CRM, APS, and e-Business functionalities [8].

Fig. 1 shows main reason for implementing ERP and Table 1 shows cost, duration, percentage of cost overruns, percentage of duration overruns percentage of receiving less than 50% benefits of last five years [9]. Findings from a one recent market study shows that the global ERP software market to grow at a CAGR (compound annual growth rate) of 7.5% over the period 2011 to 2014 [10] and Global ERP Software Market is Expected to Reach $ 41.69 Billion by 2020 [11].

Table 2: Average Implementation Costs by Industry and Annual Revenue (in Millions)

Average Implementation Costs by Industry and Annual Revenue (In Millions)

Industry/Revenue	Under $50 Million	$50 Million to $500 Million	$500 Million to $1 Billion	$1 Billion to $5 Billion	Over $5 Billion	Average
Construction	$ 0.63	$ 1.46	$ 1.70			$ 1.12
Finance, Insurance, and Real Estate	$ 0.80	$ 1.05		$ 5.00	$ 3.75	$ 2.03
Manufacturing and Distribution	$ 3.16	$ 3.37	$ 12.06	$ 10.00	$ 47.69	$ 8.62
Other	$ 1.10	$ 5.93	$ 1.25	$ 5.36		$ 3.99
Public Administration	$ 1.68	$ 4.30	$ 6.50	$ 0.05		$ 2.56
Retail Trade	$ 1.11	$ 0.68				$ 0.97
Services	$ 0.69	$ 3.99		$ 3.00		$ 1.86
Transportation, Communications, Electric, Gas, and Sanitary Services	$ 1.63	$ 6.31	$ 13.30	$ 26.20	$ 20.53	$ 8.12
Wholesale Trade	$ 0.11	$ 0.98				$ 0.45
Average	$ 1.76	$ 3.59	$ 10.54	$ 13.11	$ 33.65	$ 5.51

Proprietary ERP systems such as SAP ERP, Oracle E-Business Suite, Sage ERP, Infor ERP, ERPProcessPro, Microsoft Dynamics, Epicor ERP and IFS ERP hold largest market share in ERP domain [4], [12], [13]. However, within the last decade Open Source ERP applications are clearly growing and acquiring the ERP market.

Table 3: Average Implementation Duration by Industry and Revenue (in Millions)

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Presently hundreds of Open Source ERPs are available. Some of the leading Open Source ERP systems are Openbravo, ERP5, xTuple, OpenERP, ERPNext, webERP, Dolibarr, Apache OFBiz, Opentaps, PostBooks Adempiere, Odoo and Compiere [4], [14-15].

Table 2 [13] and Table 3 [13] present average implementation cost (USD) and average implementation duration (months) by various industries in year 2010.

III. Factors Influencing Selection and Implementation of ERP System

Selecting an ERP system to use within an organization is a complex decision that has significant economic consequences, thus it requires a proper analysis. [16] has presented fifteen criteria should be addressed in selection process under three categories such as Technology-Related, User-Related and Vendor-Related. Those important fifteen factors are Customization, Real Time Changes, Implementability, Maintenance, Flexibility, User Friendliness, Cost, Systems Requirements, After Sales Support & Training, Reporting & Analysis Features, Vendor Credentials, Internet Integration and Integration with Other Software, Back-up System and Financing Options [16]. [17] has described twenty key success factors in ERP implementation. Those are Team Work, User Involvement, Use of Consultant, Clear Goal and Objective, factors are Top Management Support, Project Budget, Project Time, Organization Maturity Level, Culture Readiness, ERP

Implementation Strategy, ERP Implementation Methodology, Project Management, Change Management, Risk Management, Business Process Reengineering, Data analysis and migration, Communication, Training, Technology Infrastructure and Strong ERP product [17].

IV. Success and Failure of ERP Implementation

According to panorama's ERP research over the past five years, the average cost of ERP implementations has been approximately $6.1 million and in 2014 average cost $4.5 million. Past five years average implementation duration of 15.7 months and in 2014 it was 14.3 months. Those two cost and duration factors give some positive image of success of ERP implementation in the last five years with year 2014. Even Though there is progressive status, indicators show still ERP implementation are not in a content position. In 2014, approximately 55% projects exceeded their planned budgets, and 75% projects were schedule overruns. Post implementation factors such as measurable benefits received also show negative image of ERP implementation success. In 2014 less than 60% of organizations achieved at-least 50% of the measurable benefits they expected from implementing a new ERP system and more than 80% measurable expectations achieved by only around 11% of the organizations in 2014 [18].

V. Construction Industry

World Construction Industry is one of the biggest industries today and it is contributing around 10% of the global GDP and providing almost 7% of the total employed person in the whole world. World Construction Industry consumes major component of energy generation of all over the globe. The resources that are utilized in also staggeringly high and itself consumes 50% of the total world resources. World Construction Industry is the base of the world economy which is achieved through the construction of buildings, bridges, tunnels, roads, railway tracks, harbours, airports, real estate (both residential as well as commercial) development, and specialized construction products (such as architectural products, electrical connections, power plants, decorative items, etc.) etc. [19]. And also construction industry is one of the biggest industries in the most of the countries and truly high position in most of the developing countries.

Even though most of the organizations have successfully implemented and obtained benefits from the ERP systems and have a huge impact on many industries, still usage is significantly low in construction industry. Although some large construction companies have implemented certain modules of ERP system such as Financial Accounting, Material management, Personnel Management and Supply Management, etc. most of the companies do not have adequate usage in Project Management module which is truly relevant to construction industry. Around 48 % of the global large construction firms use ERP systems. However, only 4 % of these firms chose to implement the Project Management modules and only 16% of the respondents are satisfied with their current level of integration [19].

VI. Construction versus Manufacturing

Both Construction and Manufacturing involve labour, machinery and material to produce something for commercial purposes. That means constrained by limited resources (such as people, money, equipment, and time) and so it is planned, executed, and controlled. construction generally refers to the creation of physical structures such as buildings, bridges or roadways and manufacturing typically refers to the production of finished goods sold to distributors, retailers or consumers. Primarily construction based on projects and manufacturing based on operations. The main reasons to low successes in ERP implementation in construction industry is its inherent property of uniqueness of function adhered with project nature [20-22].

Table 5 : Key Changes Between Projects and Operations

PROJECTS	OPERATIONS
Performed by people	
Constrained by limited resources	
Planned, executed, monitor and controlled	
Temporary endeavor - definite beginning and end	Ongoing process
Output is unique	Output is repetitive
High time and low cycles	Low time cycles
High number of component / non-standard outputs	Low number of component / standard outputs
Changes to final product / scope frequently	Changes to final product flow
Purpose is to attain its objective and then terminate	Purpose is to sustain the business
Concludes when its specific objectives have been attained	Adopt a new set of objectives and the work continues
Has time constraints	Has timely targets
Has a specific scope and protects it	Protects the continuity
Pre-defined resources - Estimates	Limited resources and pre-defined price list
New working environment	Inside the factory
Changes are Revolutionary	Changes are Evolutionary

VII. Research Approach and Methodology

A reasonable number of ERP systems were implemented in construction organizations in Sri Lanka within the last decade and majority ERP system implementations are done by large and medium size construction based companies. A group of construction companies were selected for this research study. Qualitative exploratory methodology of in-depth interviews was used to identify experiences and perspectives of relevant industry's IT Experts and ERP implemented Project Mangers from client-end and vendor-end (n=17) in terms of factors influencing ERP selection and implementation. The data were collected over the period of six months. Each interview lasted on an average for about two hours. During the interviews and discussions detailed notes were taken and interviews and discussions were audio recorded for analysis purpose with permission of each individuals.

The research design assists participants to express their inner views and perspectives of 'what' and 'why' a particular factor influenced the selection process and influenced success or failure ERP implementation rather than results obtained using less meaningful labels such as 'yes' or 'no'. Analysis was carried out in four phases and used a coding system to generate similar codes, themes and categories supported by Nvivo 07 software.

VIII. Analysis

Analysis of interview transcripts consisted of four phases. In the initial phase, data were organised by coding, and developing summaries of information based on data gathered by comprehensive interviews. The collected interview data were analysed in the stage two to generate categories, themes and patterns. In the stage three of the analysis process, similar scenarios were identified using relevant literature. Final stage of the study involved writing the research paper. The research findings revealed influencing factors the selection process of ERP. Systems proposed fifteen factors by [16] and sixteen factors by [4]. [17] has proposed twenty and [4] has proposed nineteen factors influencing the successful implementation of ERP systems. The research has defined nineteen factors and all the factors were broadly categorised into Major, Moderate and Minor based in their influence level to selection and successful implementation based on the analysis. Table 5 and Table 6 demonstrate the summary of the analysis for Selection and Implementation processes.

Table 5 : Summary of the Factors Analysis for Selection Process

Major Factors	Moderate	Minor
Vendor/Software Reputation	Level of Customization	Usability and User friendliness
Cost and Financial Options	Availability of Domain Expert	Based Technologies
Align with Business Function	Support & Training	User Agreement and Licenses
C-level Officers' Countenance	Vender-Employee Interaction	Size of the Organization/ Projects
Past Experience in Business Domain	Organization Culture	Implementation team
	Implementation Plan and Duration	Level of Business Process Reengineering
	Additional Functions (Backup, Integration, Reporting & Analysis Features, Real-time Changes)	End-Users Specially Project Managers and Project Staff Interest

Table 6: Summary of the Factors Analysis for Implementation Process

Major	Moderate	Minor
Align with Business Function	Cost and Financial Options	Vendor/Software Reputation
C-level Officers' countenance	Past Experience in Business Domain	Additional Functions (Backup, Integration, Reporting & Analysis Features, Real-time Changes)
Availability of Domain Expert	Organization Culture	
Support & Training	Level of Customization	
Vender-Employee Interaction	Implementation Plan and Duration	User Agreement and Licenses
Implementation team	Usability and User friendliness	
End-Users Specially Project Managers and Project Staff	Based Technologies	
	Level of Business Process Reengineering	
	Size of the Organization/ Projects	

A. Vendor/Software Reputation

One of the factors influencing selecting an ERP system is high level of Vendor/Software Reputation [16]. Same as [4] and [16] explained, this research also identified Vendor/Software Reputation as one of the key influencing factors to the selection process and reflected as the major influence level in construction industry. However, in the implementation stage, the influence of the Vendor/Software Reputation has only a minor impact level to the processes.

B. Cost and Financial Options

[16] discussed the importance of Cost and Financial Options factor in the selection process and [4], [17] identified the importance of Cost factor in the implementation process. However this reveals the same factor in two different impact levels in the selection and implementation processes. Cost and Financial Options are one of the major influencing factors in the selection process and it becomes a moderate factor in the implementation process to be successful.

C. Align with Business Function

One of the factors influencing selection of ERP system is higher level of Alignment with Business Function. [16] implies similar state by evaluating Flexibility and Systems Requirements aspects.

[4], [17] suggest that ERP - Business Alignment is a success factor in the implementation stage. The present study identified that Aligning with Business Function as one of the key factors influencing the selection and also successful implementation process.

D. C-level Officers' countenance

One of a main findings of the present study is C-level Officers' (specially CEO, CIO, COO and CFO's) countenance and support. This research findings revealed that C-level Officers' countenance and supports is one of the major factors influencing the ERP selection and also in successful implementation process. Most of the participants strongly mentioned the importance of the C-level Officers' countenance and support and Align with Business Function in the selection and successful implementation an ERP system.

E. Past Experience in Same Business Domain

[16] discussed the importance of Experience in same Business Domain factor in the selection process and [4] identified the importance of Past Experience in Same Business Domain in the implementation process. Past Experience in Same Business Domain is one of the major influencing factors in the selection process and it becomes a moderate factor in the implementation process to be successful.

F. Availability of Domain Expert, Support & Training and Vender-Employee Interaction

[4] and [16] discussed the importance of Availability of Domain Expert, Support & Training, Vender-Employee Interaction in the selection process and [4] and [17] discussed the importance of those factors in implementation process. One of the key finding of this research is that even though Availability of Domain Expert, Support & Training, Vender-Employee Interaction have moderate impact in the selection process, those three factors have major influence the implementation process. The majority of the participants highlighted importance of those three factors in implementation processes.

G. Level of Customization, Organization Culture and Implementation Plan and Duration

[4], [16] and [17] discussed the importance of Level of Customization, Organization Culture and Implementation Plan and Duration in the selection process and implementation process. One of the key findings of the present research is that those three factors moderately influence the selection process and implementation process too, that mean industry has acceptable knowledge regarding the importance of those three factors in selecting and effective implementation of ERP system in construction organization .

H. Implementation Team and End-Users Specially Project Managers and Project Staff Interest

Implementation Team is a factor influencing a successful implementation processes [4], [17]. Implementation Team and End-Users, specially Project Managers and Project Staff Interest are categorised as minor impact to selection level, however in the implementation stage it become a major impact factor to success. The present study particularly highlighted the importance of End-Users Specially Project Managers and Project Staff Interest to success in such a great level.

I. Usability and User Friendliness, Based Technologies, Size of the Organization/ Projects and Level of Business Process Re-engineering

[4], [16] and [17] discussed the importance of Business Process Reengineering and people factors and Usability and User Friendliness, Based Technologies in selection and implementation stages. Another key finding of the present study is minor level of impact of Usability and User Friendliness, Based Technologies, Size of the Organization/ Projects and Level of Business Process Re-engineering to selection process and moderate impact to ERP system implementation process.

A number of participants strongly endorsed the impact of Size of the Organization/ Projects. They have explained that there is low level of success in huge construction organizations consist of group of companies compared with reasonably large or medium size organizations. There is also lower level of success in very small projects compared to large projects.

J. Additional Functions (Backup, Integration, Reporting & Analysis Features, Real-time Changes)

Additional Functions such as Backup, Integration, Reporting & Analysis Features, Real-time Changes, etc. are considered in selection process and some level impact to implementation process [4], [16], [17]. The research identified that those factors moderately considered in the selection process. However, they have only minor impact to implementation processes and its success.

K. User Agreement and Licenses

User Agreement and Licenses are important factors in the selection process [16]. The present study identified that User Agreement and Licenses are only of minor impact to the selection and implementation processes. Most of the time it is limited to legal advisors concerns and always those legal agreement issues are smoothly resolved in initial stages without affecting the selection process too. .

IX. Conclusion

This research identified 19 factors influencing the selection and implementation process of ERP systems construction organizations. Those nineteen influencing factors were categorised into three broad aspects: Major factors, Moderate factors and Minor factors. The significance of this study can be attributed to the identification of perceived and realistic importance of factors related to the selection and effective and successful implementation process of ERP systems in construction organizations with high level of project oriented processes.

Some of the factors that usually perceived as important in the selection stage are actually not significantly important in the ERP implementation process and its success. On the other hand, some of the factors that were perceived as least important by the construction organizations when they are selecting an ERP solution are identified as significantly important when it comes to the effective implementation process.

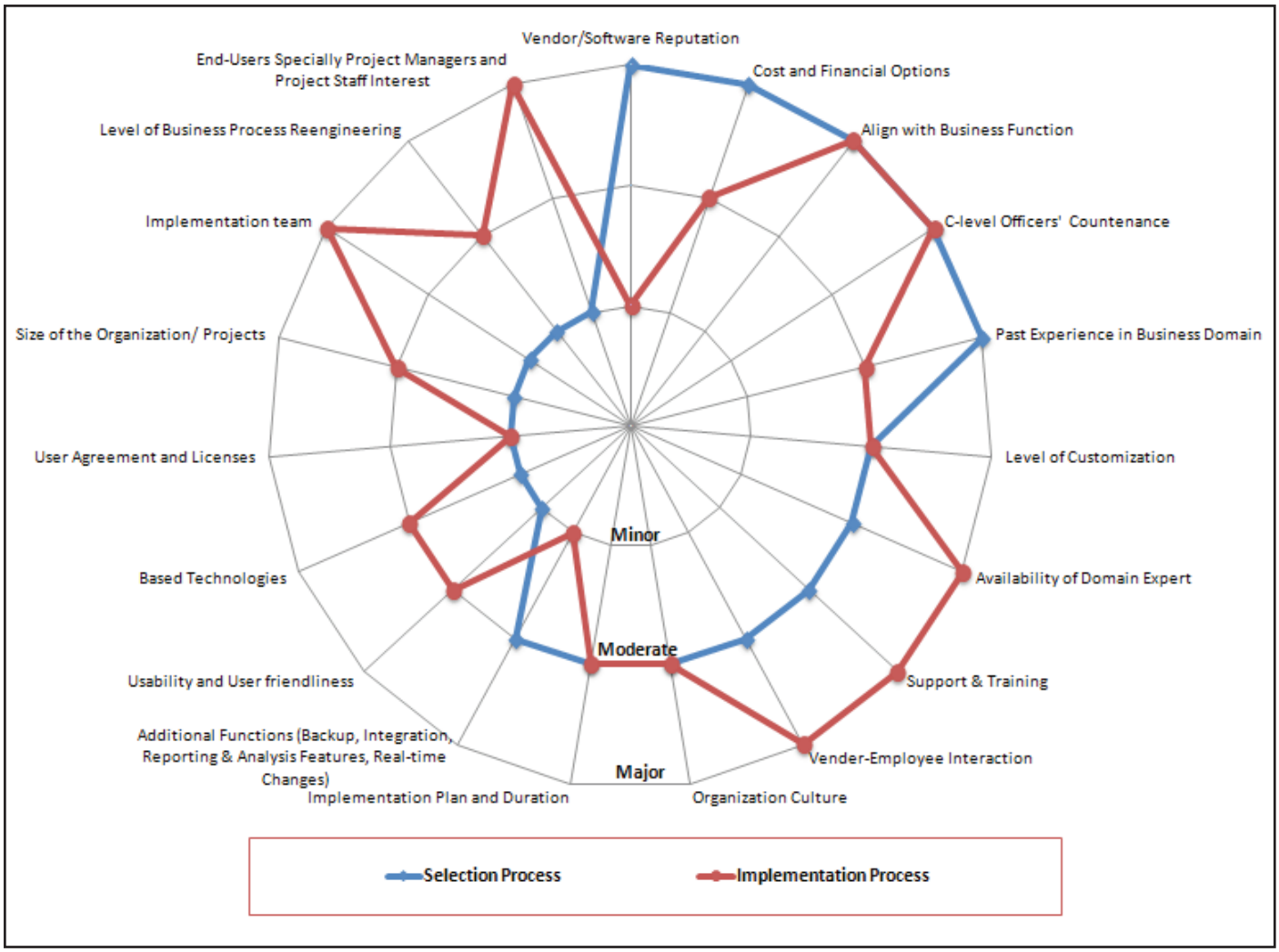

Fig. 2: Factors Asymmetry in ERP Selection and Implementation

Fig. 2 shows Factors Asymmetry in ERP Selection and Implementation in construction industry and it shows that ERP implementation process is influenced by not only the IT and IT Project management related aspects, but also other dimensions such as human factors, finance, organizational culture and strategy need to be considered to ensure successful implementation of ERP solution in a construction organization same as other organization which have gained benefits of enterprise systems.

Therefore, it should be cautiously viewed that the multi-faceted and multi-dimensional influencing factors to success in complex organisational cultures in any project implementation.

References

[1] V. Genoulaz and P. Millet, "An investigation into the use of ERP systems in the service sector," Journal of Production Economics, vol. 99, no. 4, pp. 202–221, 2006.

[2] H. Voordijk, A. van Leuven, and A. Laan, "Enterprise Resource Planning in a Large Construction Firm: Implementation Analysis," Construction Management and Economics, vol. 21, no. 5, pp. 511–521, 2003.

[3] U. Acikalin, M. Kuruoglu, U. Isikdag, and J. Underwood, "Evaluating the Integrative Function of ERP Systems Used within the Construction Industry," presented at the eWork and eBusiness in Architecture, Engineering and Construction, 2009.

[4] S. Nanayakkara, P. Perera, and A. Perera, "Factors Influencing Selection and Effective Implementation of ERP Systems in Medium Sized Organizations in Developing Countries," International Journal of the Computer, the Internet and Management, vol. 21, no. 2, pp. 7–14, 2013.

[5] "ICT for Greater Development Impact," World Bank, Jun. 2012.

[6] J. Lerner and J. Tirole, "Economic Perspectives on Open Source," Advances in the Study of Entrepreneurship, Innovation & Economic Growth, vol. 15, pp. 33–69, 2004.

[7] P. Perera, S. Nanayakkara, and A. Perera, "Benefit of Implementing a National Level ERP system for Health Sectors in Sri Lanka through Stock Optimization," presented at the The Second International Congress of Interdisciplinary Research and Development, Thailand, 2012.

[8] "ERP Systems Market Primer," Focus Research, May 2009.

[9] "2013 ERP Report," A Panorama Consulting Solutions, Denver, USA, 2013.

[10] "Global Enterprise Resource Planning Software Market 2011-2014," Research and Markets, Feb. 2012.

[11] Allied Market Research, "Global ERP SOFTWARE Market (Deployment, Functions, Verticals, End-User and Geography) - Size, Share, Global Trends, Company Profiles, Demand, Insights, Analysis, Research, Report, Opportunities, Segmentation and Forecast, 2013 - 2020," Portland, 2015.

[12] P. Perera, S. Nanayakkara, and A. Perera, "Critical Evaluation on ERP Applications for Defence Sector of Sri Lanka,"

International Journal of the Computer, the Internet and Management, vol. 21, no. SP1, pp. 4.1–4.16, 2013.
[13] "Preview of Panorama's 2011 ERP Report: ERP Implementation Costs Continue to Decline," A Panorama Consulting Solutions, Denver, USA, Jan. 2011.
[14] S. Floyd, "Top Open Source ERP Software," Dallas, USA, Apr. 2013.
[15] T. Herzog, "A Comparsion of Open Source ERP Systems," Vienna University of Technology, 2006.
[16] O. Alanbay, "ERP Selection Using Expert Choice Software," presented at the ISAHP 2005, Honolulu, Hawaii, 2005.
[17] Z. A. Hasibua and G. R. Dantes, "Priority of Key Success Factors (KSFS) on Enterprise Resource Planning (ERP) System Implementation Life Cycle," Journal of Enterprise Resource Planning Studies, vol. 2012.
[18] Panorama Consulting Solutions, "A Panorama Consulting Solutions Research Report," Panorama Consulting Solutions, Denver, State of Colorado, USA, 2015.
[19] D. Castro-Lacouture and M. J. Skibniewsk, "Current state of construction enterprise information systems: survey research," Construction Innovation: Information, Process, Management, vol. 7, no. 4, pp. 310–319, 2001.
[20] A Guide to the Project Management Body of Knowledge, Fourth Edition. Project Management Institute, 2008.
[21] "Project Vs Operational Work," Leadership & Project Management Champions. [Online]. Available: https://leadershipchamps.wordpress.com/2008/02/19/project-vs-operational-work/. [Accessed: 28-Jul-2015].
[22] H. Minavand, V. Minaei, S. E. Mokhtari, N. Izadian, and A. Jamshidian, "Project Managers Vs Operations Managers," IOSR Journal of Business and Management, vol. 12, no. 5, pp. 56–61, Aug. 2013.

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