

Impact of Enterprise Resource Planning (ERP) System to the Construction Industry

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Abstract— Enterprise Resource Planning (ERP) system has become a key component of organizations all over the globe giving an edge over competitors. However, the adaptation of ERP systems in construction companies is far behind than other industrial fields. As it is a highly heterogeneous sector with a great diversity of specialties and large disparities in the size of companies, the complexity of interconnecting the projects is significant. Thus, the main objective of this research is to investigate how ERP will impact to the construction industry and establish the aspects to measure the ERP readiness before its implementation. The research was conducted using 210 financial statements from 29 construction companies. It is proved that 90% of the companies who have implemented ERP has gained significant successful rate with their construction activities. Furthermore, it is certified that ERP readiness ratios named Investment/Revenue more than 10% and Intangible Asset/Fixed Asset more than 10% are required to fulfill management and technical requirements respectively for a successful implementation. And also, it is identified that the training cost allocated by the construction companies is much lower than it requires.

Keywords— ERP, Financial ratios, Readiness Scale, Construction industry

I. INTRODUCTION

Many construction companies are embarked upon ERP with the growth of global competition [1]. As construction company has uniqueness on its functionalities it needs specialized ERP vendors as well as specialized systems which is driven by projects [2]. ERP can benefit the company in five main ways called Operational, Managerial, Strategic, IT infrastructure, Organizational [3, 4]. ERP provides two main pros than that of a company which does not have an integrated system. They are (a) A one clear picture of all businesses that comprise with all functions and departments [5, 6]. (b) A enterprise single database where all business transactions are entered, recorded, processed, monitored, and reported [5, 7]. Other than these

two, increasing managerial flexibility, lowering the cost in the entire supply chain (cost and time are main parameters in the long-term running project) [7], shortening the lead time and throughput time, increasing efficiency of communication among functional boundaries [8], improving business productivity (reducing inventories, expanding the product choice, providing more reliable delivery dates), improving quality customer service [9], competitive advantage are some of the uses which can obtain from ERP system [7, 10].

Barriers to the ERP implementation are identified as requirement of high cost and resources, incompatibility of software with the company objective [3], problems with technical advancement and human resources, not having clear objective of using ERP before its implementation, lack of senior involvement, unbalanced combination of team project [1, 10]. However, when considering small construction firms, financial capital, human and technical resources are major concerns [11, 12]. And also, culture, politics, government regulations, management style and labor skills can be considered as indirect determinant factors for the implementation [4, 12-14].

Previous researchers have identified how ERP system can affect to the process of construction companies and the challenges which are faced in the ERP implementation. No previous research has focused on overall financial behavior of companies with the ERP implementation and how to overcome the challenges of implementing with a proper readiness [8, 14-17]. Through this research it is expected to find out the impact of ERP implementation on the growth rate of construction companies with a critical analysis of financial statements. Furthermore, this study suggests the threshold values for readiness factors to be identified by the company owners before the investment on ERP [11, 18, 19].

II. RESULTS

A. Impact of the ERP implementation

As shown in Fig. 1 impact of ERP implementation on the construction companies' growth can be categorized in to five ways with the results. They are (a) Companies who continue growth rate with the ERP implementation, (b) Stagnated companies who increase the growth rate with the ERP implementation, (c) Companies who survive with the ERP

implementation, (d) Companies who loss with the ERP implementation, (e) Companies who gain growth rate without ERP implementation. When sum up the success levels, 90% of the companies who implemented ERP have reached their successful limit. The distribution of the success levels in developed countries and developing countries are shown in Fig. 2 and Fig. 3 respectively. It indicates that 92% of the companies in developed countries and 68% of companies in developing countries have increased their growth rate by ERP implementation. However, only 3% of the total companies have managed to succeed without ERP.

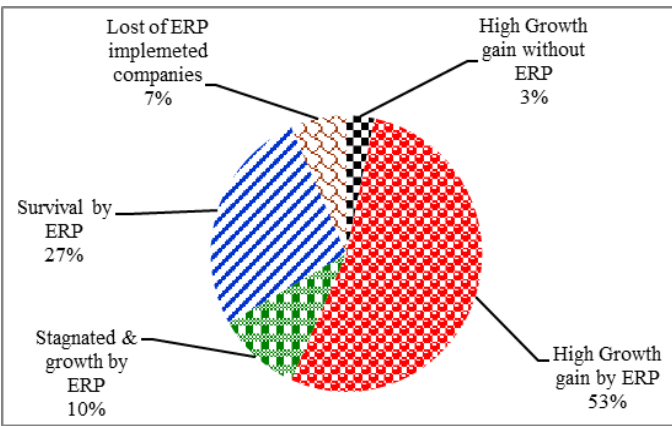


Fig. 1: Impact of ERP on company growth

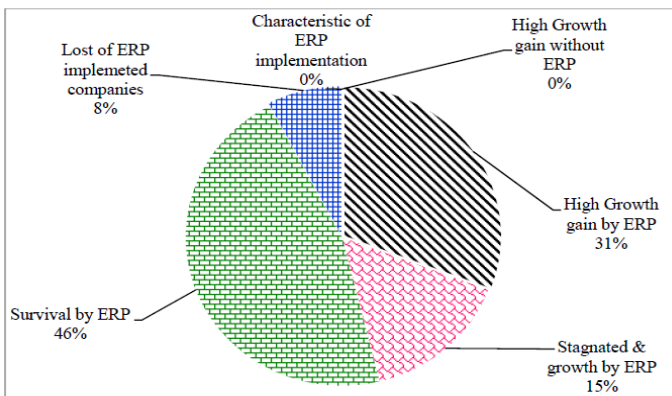


Fig. 2: Impact of ERP on company growth in developed countries

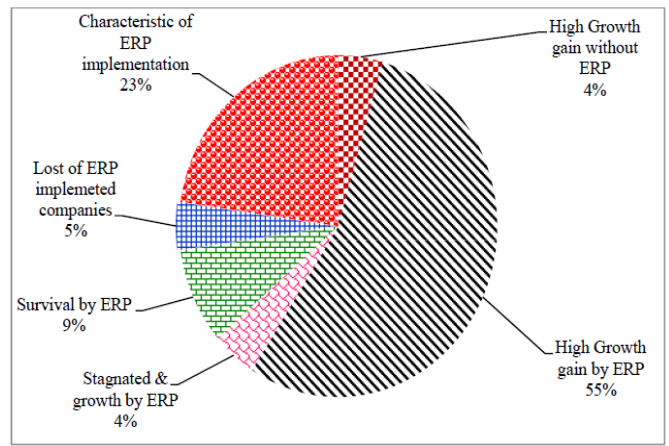


Fig. 3: Impact of ERP on company growth in developing countries

The comparison of growth rates before the ERP implementation and after the ERP implementation are indicated in Fig. 4 (Companies who gained continuous improvement with ERP), Fig. 5 (Companies who have a stagnated growth with ERP) and Fig. 6 (Companies who are surviving with ERP) respectively. As per the Fig. 4, 55% of the companies were supported by ERP to gain high growth rate with the new investment, 10% of companies who have stagnated long period gained its growth after implementation of the ERP (See Fig. 5). Further, around 28% of companies had survived from their bankrupt, losing of profits, negative growth rates, and financial crisis. (See Fig. 6)

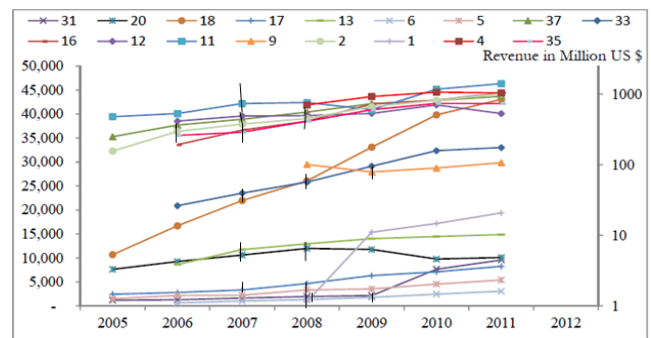


Fig. 4: Companies which gain high growth rate by implementation of ERP

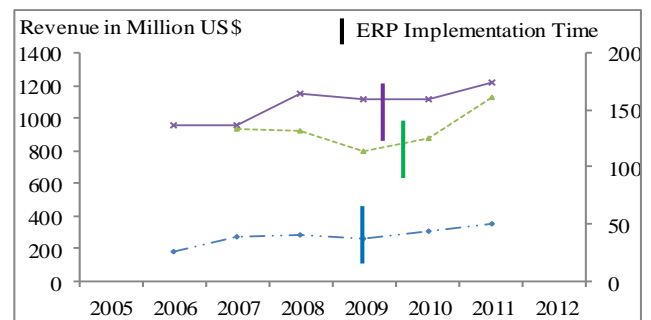


Fig. 5: Companies which gain stagnated growth by ERP

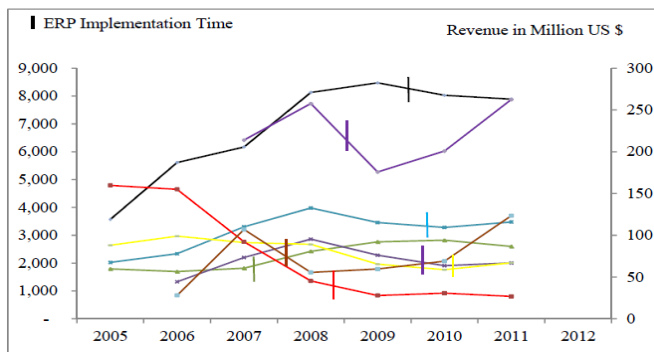


Fig. 6: Companies which survived by ERP

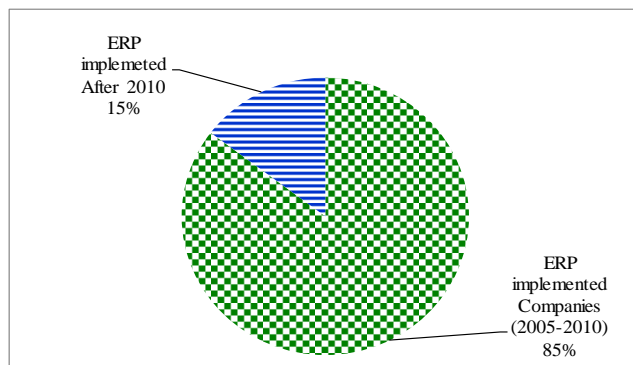


Fig. 8: Trends of ERP implementation

Some other conclusions which arrived from the data analysis are shown below.

- The presence of high capacity database enables a company to store and manipulate a large amount of data. When the company is growing, it is a must to operate an adequate capacity database. Out of 99 companies in the sample, only 29 companies who implemented ERP system consisted of rich data set. Enable to handle a large amount of data can be considered as a positive impact of ERP implementation. Fig. 7 shows the impact of ERP on data storing.

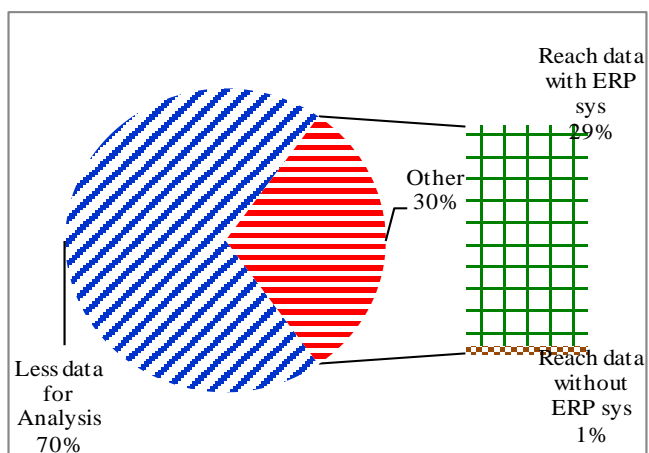


Fig. 7: Impact of ERP on data storing

According to the selected sample, it is attested that considerable numbers of companies have implemented ERP after 2010. While 85% of implementations happened in 2005-2010, 15% of the implementations happened in 2010 (See Fig. 8)

- The sample consisted of 23% large scale and 77% medium scale companies. The effect of ERP implementation may depend on the company size. According to the Fig. 9, 62% of large companies acquired higher growth rate and as per the Fig. 10, 41% of medium sized companies have obtained the high growth rate.

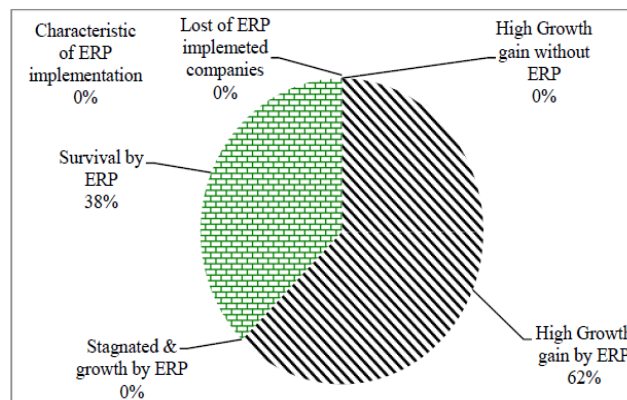


Fig. 9: Results by large companies

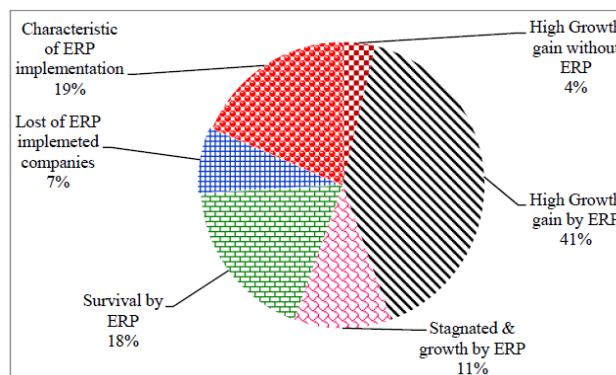


Fig. 10: Results by Medium companies

B. Readiness for the ERP implementation

III. DISCUSSION

When establishing the readiness factors Intangible Asset Investment/Revenue ratio, Training Cost/Revenue, Intangible Asset/Fixed Asset Ratio were considered under three criterions management, technical, and human resources readiness respectively. All companies who have succeeded with ERP have invested more than 10% on intangible assets over their investments as per the Fig. 11. Thus, it is recommended that company should exceed 10% of revenue over intangible asset investments (Management) for proper implementation. And also, 75% of the companies which succeeded with the system exceeded 10% of total assets over intangible assets (Technical) as per the Fig. 12.

This study provides a valuable insight to the impacts of ERP implementation and company readiness to accept the ERP. Research output indicates that companies are unable to deal with huge amount of data unless there is an ERP system. Only 1% has a high growth rate without ERP. Because when the company is growing, it needs efficient and accurate data handling system. Without ERP it is a miracle for highly growing companies to achieve that target. Thus, there is a high impact from ERP for the large companies than medium companies. If there is no ERP, when the company is reaching its maximum operation capacities, it collapses (See Fig. 7). According to the research output, it is assured that 90% (53% high growth, 10% Stagnated to growth & 27% Survival) of the companies have gained financial benefits from ERP implementation. Only 3% of the companies have gain successes without ERP (See Fig. 1). Therefore, it can be concluded that ERP has a positive impact towards the financial conditions of the companies.

On the other hand, ERP is one of the largest investments that a company can involve with. So if there is no readiness to accept to ERP, implementing ERP may lead to a loss. It is noted that the implementation of ERP systems require much capital, technical and human resources. Results have shown that 7% of medium-size construction companies failed in ERP implementation due to lack of these resources. Therefore, it is crucial to identify whether the companies are satisfied with the requirements before the ERP implementation. This qualitative analysis shows the potential to invest on this system. The importance of identifying readiness factors before the ERP implementation for a construction company has analyzed under three criterions named as Managerial readiness, Technical Readiness, and Human resource readiness using ratios Intangible asset investment/Revenue, Intangible asset/Fixed asset and Training cost/Revenue respectively.

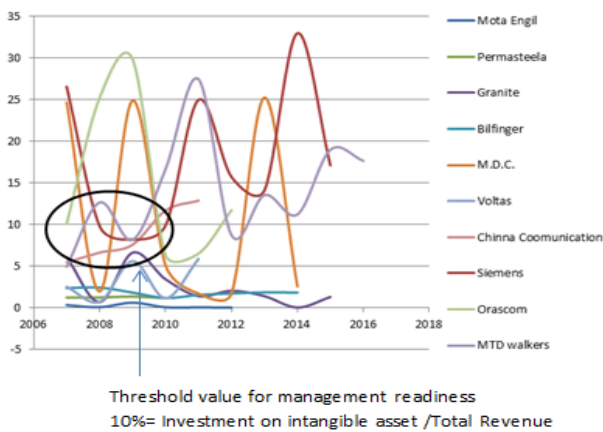


Fig. 11: Intangible Asset/Investment Ratio for management readiness

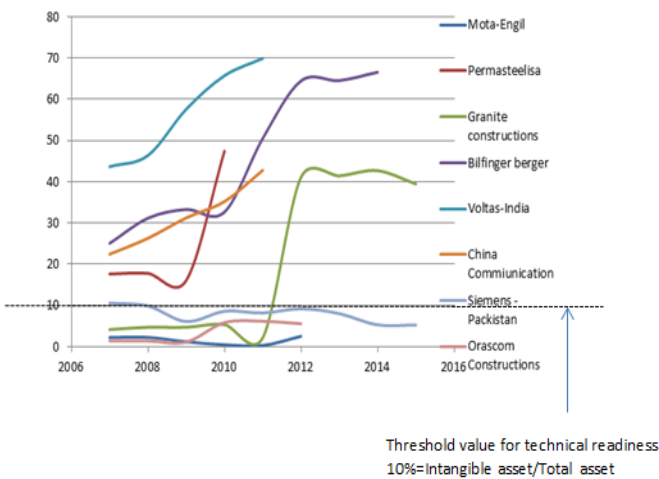


Fig. 12: Intangible Asset/Fixed Asset ratio for Technical readiness

A. . Intangible asset/Investment

Companies in developed countries show a stable Intangible Asset Investment/Revenue ratio while companies in developing countries show a huge variation in Investment on Asset/Revenue ratio from year to year. Having more than 10% (See Fig. 11) of investment on Intangible assets implies that companies are capable of investing ERP. It is a great potential for a company who is going to implement an ERP. The variation can be due to investment policies of the company. If the company even does not have 10% investment from the revenue, the company is not ready to accept the ERP implementation.

Apart from that, if the company intangible investment/Revenue ratio is low it indirectly indicates that the top management doesn't involve with those investments very much. Further, if the Top management does not support with installation with the financial support company is very unlikely to ready for the ERP system implementation. When the investment on intangible assets is comparatively low, it can be concluded that the company is not technically feasible to accept the ERP implementation also.

Moreover, ERP strategies will not match with the goals of the organization if the ratio is well below than the requirement. ERP is not matching with the low-cost culture of a company as it already costs higher itself than the other additional requirements. Thus, both strategies should be aligned with each other to mean a good readiness for ERP.

B. Training cost/Revenue

The training cost of employees is hidden in all most all of the financial statements which were selected for the analysis. It indicates that most of the companies are reluctant to allocate budget on training. That is because top management doesn't like to involve with ERP. But according to the previous literature, staff training is a critical component of ERP implementation [9, 10, 19, 20, 21]. Because of this, even though companies are implemented ERP they struggle for obtaining expected results from the system

C. Intangible fixed assets

This ratio is a measure of software and hardware related to IT sector of a company. It indicates whether the company is having enough technical resources and capability to carry out ERP implementation. Except few companies in developing countries Intangible Asset/Fixed Asset ratio is higher than 10% (See Fig. 16) and that is considered as a point to success. Thus, it is recommended that maintaining over 10% Intangible asset/Fixed asset ratio is a requirement for a company who is going to target of ERP.

This study was conducted according to the quantitative method using secondary data sources such as published materials from a broad range of sources, including National stock exchange's websites, Public Limited Company's (PLC) websites and ERP vendors' websites. Also, journal articles, conference articles and ERP related web sites were referred for the data collection.

IV MATERIAL AND METHODS

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A. Identification of the impact on the growth of construction companies

To identify how the growth rate of construction companies are varied because of ERP implementation, 210 financial reports form 29 construction companies were analyzed. The measurements considered were revenue, expenditure, operation cost, material cost, and inventory before and after implementing ERP. The Fig. 13 describes how the final sample was selected from the initial sample off 594 annual reports from 99 construction companies which are listed in stock exchange. As shown in Fig. 15 it was consisted with Building construction companies (27Nos) City Development (03Nos), Civil construction (20Nos), Communication (01Nos), Electrical (01Nos), Energy (09Nos), Infrastructure (15Nos), Manufacturing (06Nos), Mechanical (9Nos) and Real state (8Nos) (Total of 99 companies). The data was collected from large and medium construction companies from developed countries as well as developing countries. (See Fig. 14)

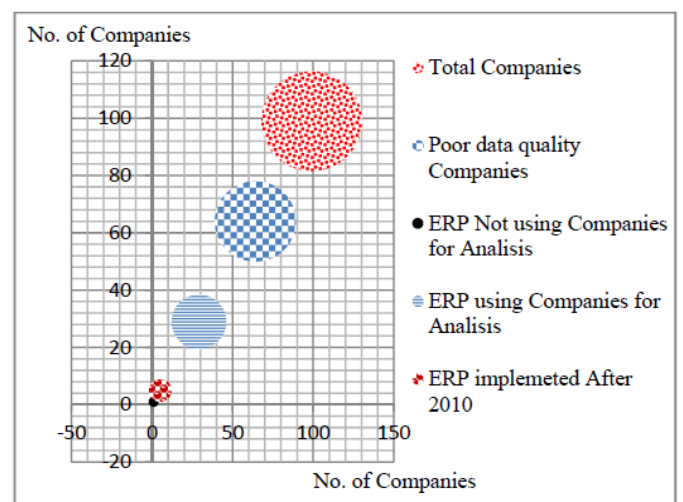


Figure 13: Macro View of data collection

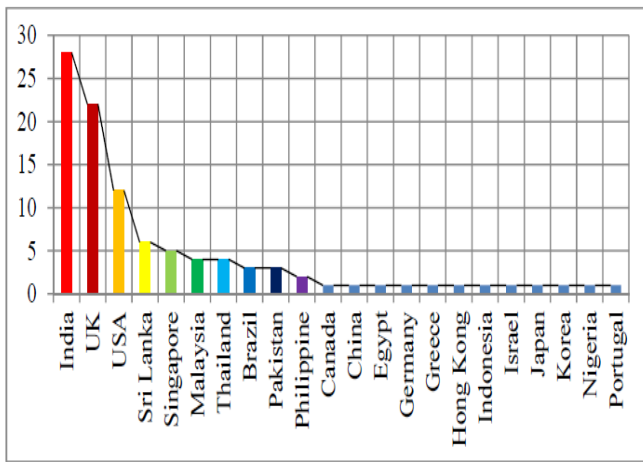


Figure 14: Universal data collection (99 companies)

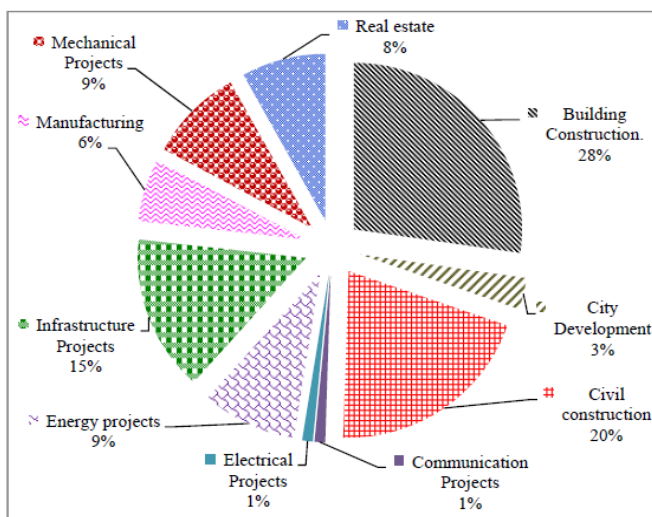


Figure 15: Type of industries used in the sample

B. Development of readiness factors

ERP can be considered as an intangible asset to a construction company. Thus, the effect of ERP is mentioned in the form of Intangible asset in their financial statements. In this research, the readiness of the company is categorized in to three sections. They are Management readiness, Technical readiness and Human resource readiness. Thus, to scale out the management readiness, Technical readiness and Human resource readiness, ratios of Investment on intangible assets/Revenue, Intangible Asset/Fixed Asset Ratios Training Cost/Revenue were used. To develop these readiness factors, companies who were successfully implemented ERP were taken in to consideration from above samples. The numerical values for intangible asset investment, Total revenue, Training cost for employees were obtained from Profit and loss statements and the value of intangible assets, value of total

fixed assets owned by the company were obtained from the balance sheets for that particular year. Then ratios were separately calculated, and the threshold ratios were identified for each company and each year.

V CONCLUSION

This research is carried out with 210 financial reports form 29 construction companies and 90% of the medium and large-Scale construction companies in developing countries, as well as developed countries show an increase in profit and growth rate after the implementation of ERP. Here, 92% growth rate in developed countries and 68% growth rate in developing countries is represented. Thus, it is clear that significant positive impact on organizations can be achieved through ERP implementation.

Further, according to the secondary data analysis of financial statements, it is found that maintaining above 10% for Intangible investment /Revenue is a readiness factor. It implies the management support, technical resource availability and alignment of company strategies with ERP. And Intangible Asset/Fixed Asset ratio more than 10% implies the adequate technical capacity of the company. However, the negligible value for Training Cost/Revenue ratio concluded the incompetency of the staff for the ERP implementation. Thus, for a company to be successful in ERP implementation, they should at least need to full fill this threshold values. The significance of this study can be attributed to the identification of perceived and realistic importance of readiness factors related to the selection and implementation process of ERP.

VI LIMITATIONS OF THE STUDY

- The initial sample of 594 financial statements from 99 companies has reduced up to 210 financial statements from 29 companies because of poor data quality. Because of that, the evaluation was carried out from 210 financial statements only.
- To evaluate Training cost/Investment ratio the data could not be captured from financial statements of the construction companies. This is created due to lack of training on employees by the construction organizations. But the analysis was impossible with the accurate figures.

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