COST, BENEFIT, AND FINANCIAL RISK (COBEFR) OF ERP IMPLEMENTATION

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ABSTRACT

The purpose of this research is to develop Benefits, Costs, and Financial Risks (CoBeFR) model to show and measure the impact of ERP related decisions, such as degree of business process re-engineering and the level of hardware investment, on the organisational financial value (OFV). OFV is based on current time value of money (i.e. interest rate), financial risk, and net cash flows emerged from ERP system. Financial risk, the sensitivity of the organisation net profit to changes in market conditions, is affected by organisational adoption of ERP system. The main conclusion is that there are interrelated impacts of ERP implementation decisions to the organisational financial value. Therefore, decision maker should look at the implementation decision from a new perspective which is Organisational Financial Value (OFV) perspective

Keywords: ERP, Cost, Benefit, Financial Risks.

1   INTRODUCTION

Since ERP is an integrated set of systems across the organisation, it is expected to have an impact on organisation (Hendricks et al., 2007). Benefits could be tangible, in monetary terms, such as increasing sales and decreasing cost or intangible, in non-monetary terms, such as improved customer satisfaction and improved internal processes (Murphy and Simon, 2002).

ERP system costs millions of pounds in its implementation in consulting, training, buying licenses, business process re-engineering, and software development (Daneva and Wieringa, 2008). Logically, these costs should be rationalized to get support from top management (Murphy and Simon, 2002). Furthermore, ERP has its risks on organisation. Since ERP implementation is a radical transformation and integration of organisation's business practices, failure in implementing ERP could push the organisation out of business (Davenport, 1998). Consequently, the decision related to ERP implementation should not only consider the expected benefits of it but also it should consider its costs and risks.

To combine benefits, costs, and financial risks of ERP implementation, it is proposed to use Net Present Value (NPV) approach. Net Present Value approach is, in itself, not new and it is the most common technique for evaluating ERP systems (Morgan, 2005; Wu et al., 2008). Net Present Value is a ubiquitous technique in valuing assets, determining the fair price of it, based on expected cash flows that are discounted by the required rate of return (Gitman and Zutter, 2012; Rosacker and Olson, 2008). Required rate of return is misunderstood for the current practitioners. It is translated in their minds as the time value of money or the interest on money borrowed. Accordingly, NPV will not be able to address the risk factor (Pindyck, 1993).

This study has used the traditional approach for valuing ERP projects but with using the required rate of return defined by Sharpe (1964). According to Sharpe (1964), the required rate of return from an asset is based on three factors: the free risk rate (time value of money or interest rate), the sensitivity of the earning of this asset to the market conditions (the volatility of the net income), and the market risk premium (the motivation to invest in the current conditions of the market). By this way, risks of ERP projects are integrated in the evaluation process by measuring the impact of ERP

implementation on the incremental firm Cash Flows (FCs) volatility. Other two factors, free risk rate and market risk premium, are not controllable by decision maker but they can affect only the timing of investing in ERP project. At the end, this model could combine benefits, costs, and financial risks into a single equation to show how ERP project could affect the financial value of the organisation. In other words, this model could help us know how ERP can affect the cash flows of the firm across the time with considering the additional risk of implementing ERP.

2   LITERATURE REVIEW

There are different approaches used to evaluate IT Projects. They can be classified into a couple of groups (Rosacker and Olson, 2008): Financial and Economic approaches and Qualitative approaches. Qualitative Evaluation approaches focuses on qualitative models. These approaches are criticized because they mainly depend on ERP software and not on how benefits can be realized from it. Furthermore, these approaches cannot be easily understood by non-IT managers to evaluate ERP Investments (Morgan, 2005). Moreover, these approaches do not address the cost of implementing ERP in depth. As a result, this research will focus on Financial and Economic Models rather than the qualitative models. Financial numbers could be easily understood by top management (Morgan, 2005). In addition, financial numbers enable the top management to prioritize ERP project in the organisation across other projects. Moreover, the ability to evaluate ERP in dollars could make a sense for decision makers and portfolio managers. Consequently, this research will focus on financial and economic measures.

Financial and Economic models are based on financial criteria such as Cost Benefit Analysis, Budgetary Constraint, Payback, Internal Rate of Return (IRR) (Rosacker and Olson, 2008) and Valuation models (Pindyck, 1993). Although these models, except valuation modes, are valuable for managers because it translates the IT projects into monetary term, they do not provide any information regarding the timing of cash flows, financial risks, and project interdependencies. This research project will follow the financial and economic approach but with taking into consideration these missing points through using valuation models.

Information Economics, introduced by Parker and Benson (1987) to value IT Projects, is, basically, nothing but benefit/cost technique that takes into consideration the risk factor. Valuation models have two perspectives: Market reaction perspective (Ranganathan and Brown, 2006) and Fair Value perspective. Market reaction models are more based on the perceptions of investors in the market toward the Information Technology/ERP implementation announcements. Based on efficient market hypothesis, prices reflect the true value of the organisation based on the current available information (Fama et al., 1969). But this is not the case in the real life, stock prices do not necessary reflect the true value of the firm (Malkiel, 2003). Moreover, these models do not focus on the ERP project itself; rather, it focuses on the market condition and investors' perceptions. On contrary, this research focuses on what and how fair value of organisation changes because of taking different decisions in ERP implementation process. Therefore, this research comes to fulfil this research gap.

3   ERP LIFE CYCLE PERFORMANCE

ERP system is a new capability for an organisation to leverage its performance. Like any new IT capability embedded in the system (Thorp, 1998), ERP system decreases the organisational performance due to adaptation problems. According to thorp (1998), organisations need time to realize benefits from new IT capability. In the same vein, ERP system needs time for a full adaptation by the organisation.

As illustrated in **Figure 1**, after a decline in the organisational performance due to incorporating new ERP system, organisation commences to adapt to new system. Once resistance to change reaches to level 0, organisational performance increases until it achieves its targeted performance. Unfortunately, this process is not guaranteed; many organisations could not increase the performance and the performance keeps declining until facing organisational bankruptcy (Davenport, 1998). Therefore, many organisations adopted benefit realisation methodology to manage this process (Breese, 2012)
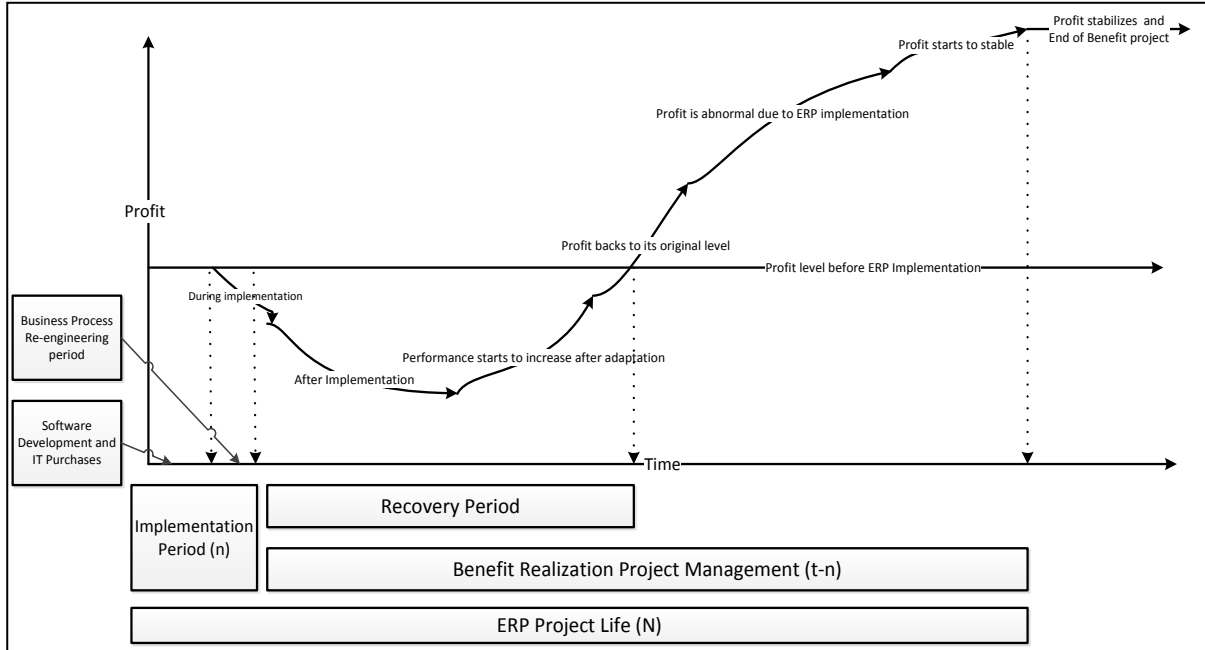
Figure 1: ERP Performance Lifecycle

4 COST, BENEFIT, AND FINANCIAL RISK (COBEFR) MODEL

4.1 Mathematical Representation of the model

Net Present Value (NPV) considers cash inflows, cash outflows, and cost of capital. The essence of NPV is the time value of money. One sterling pound today is higher in value than one sterling pound next year because this pound could be invested and get interest after one year. Using the same logic, one pound after one year should be discounted to get the value of it today. Since calculating the value in the future is by multiplying the current value by (1+r), discounting the future value to get the value today will be by dividing the future value by (1+r). Since this amount could be received after more than one year, and the interest is compounded, the present value today will be calculated by dividing the future sum by $(1 + r)^n$ where (r) is the required rate of return and (n) is the number of years. Therefore, the equation will be

$$\text{Net Present Value} = \frac{\sum_{t}^{N} \frac{(BB_t - AC_t)}{(1 + r_t)^{t-n}}}{(1 + r_t)^{n}} - \sum_{m/12}^{n} \frac{(BPRI + SWI + HWI)}{(1 + r_t)^{m/12}} \qquad \textbf{(4-1)}$$

First, the Present Value of Net Annual Benefit

$$\frac{\sum_{t}^{N} \frac{(BB_t - SRC_t)}{(1 + r_t)^{t-n}}}{(1 + r_t)^{n}} \qquad \textbf{(4-2)}$$

This is the operating net monetary benefit from the ERP but it is discounted by the required rate of return (r) to get the value of these benefits at the go – live phase.

BB_t: **Business Benefits**: it is the estimated monetary benefits in year (t) contingent upon the use of the new, or change in ERP

AC_t **Annual Cost**: it is the expenditure in year (t) needed to run the new ERP services and includes hardware and software maintenance and support staff expenses. It is function of level of hardware purchases, number of modules, and level of customization.

$(BB_t - SRC_t)$ it is the estimated Net Annual Benefit (NAB) in year (t)

t is the year of achieving the targeted benefit.

n is the number of years required for implementation

t-n is the incremental year number after the implementation date.

It is worth to notice that there are 3 stages: recovery stage, growth stage, and stability stage as illustrated in **Figure 1**.

$(1 + r_t)^{t-n}$ is the discounting factor of CF generated in time (t). However, this amount will come after go-live phase, which ends at year (n).

$(1 + r_t)^n$ is the discounting factor of the value of NABs at time (n) today.

r_t is the required rate of return at the year (t) from the IS project derived from Capital Asset Pricing Model (CAPM).

$$r_t = R_F + \beta \times (r_m - R_F)$$ (4-3)

R_F is the risk free return. It is the return that the firm can get from investing in risk free investment (e.g. bank interest rate for savers or treasury bills return)

r_m is the expected return from investing in the average stock market. This considers the current market condition.

$(r_m - R_F)$ is the market risk premium. In other words, how much incremental interest rate is required to motivate normal investor to invest in the market instead of in free risk financial instruments such as banks or treasury bills? This per cent is published in financial journals

β is the relative measure of risk. In other words, it is the new volatility of CF of the firm because of implementing the ERP project.

Second, the initial cost of acquiring/customizing the system

$$\sum_{m/12}^{n} \frac{(BPRI + SWI + HWI)}{(1 + r)^{m/12}}$$ (4-4)

BPRI: Business Process Re-engineering Investment: This cost includes the training cost, consultation fees, and below-average performance (as opportunity cost). It is based on complexity factors such as number of processes, number of people, level of IS readiness, learning curve of the people in the process, and the degree of change required.

SWI: Software Investment: Investments in Software are considered such as investment in software purchases, customization in system fees, training on the software, consultation fees, de-activating the old system, and system configuration expenses.

HWI: Hardware Investment: it is the funds required to invest in infrastructure and additional computers or hardware facilities. m is the number of months required to implement the project.

4.2 Graphical Representation of the model

Graphical representation of the model, as illustrated in Figure 2, describes the components of Net Present Value (NPV) of ERP project. NPV measures how ERP could increase the shareholders' wealth (Gitman and Zutter, 2012). NPV could be expressed as how much the firm could gain in money from the project after covering its initial and operating expenses and covering the cost of finance. As explained earlier, cost of finance depends on time value of money, market condition for investment, and relative financial risk of the project on the organisation's cash flow. Indeed, NPV consists of 3 components: Initial Cost, Net Annual Benefit (NAB), and Required Rate of Return.

Initial cost includes all initial cost required to implement ERP. This cost could be categorized into Software Investment (SWI), Business Process Re-engineering Investment (BPRI), and Hardware Investment (HWI). Software Investment (SWI), investments in purchasing; configuring; deploying; and training, is negatively correlated with Business Process Re-engineering investment (BPRI) (Fryling, 2010) because fewer changes in software will increase the investment in BPR to fit software with the organisation's processes (Brehm et al., 2001). Nevertheless, Hardware Investment (HWI) is assumed to be fixed and not to be subject to economies of scale due to ERP project size (Schwartz and Zozaya-Gorostiza, 2003). Since BPR could be used to minimize Hardware Investment, Hardware Investment is expected to be negatively related with BPRI. SWI and HWI are expected to have impact on annual maintenance cost because the more customization to the system, the more difficulty in maintaining it (Brehm et al., 2001; Fryling, 2010). Moreover, the more hardware used, the more the maintenance cost will be.

Operating Cash Inflow, or Net Annual Benefit (NAB), is the cash generated because of ERP project. As a result, NAB is monetary benefits realized after deducting annual maintenance cost. Actually, business benefits cannot be realized after completion, it takes at least two years to get what

is aimed to from it (Cline and Guynes, 2001). Logically, as illustrated in Figure 2, the performance, business benefits emerged from ERP system, will decline short after implementation, then it will increase across the time to a certain limit and finally stabilized at this level.

Cost of Capital, according to CAPM, consists of free risk interest rate, market rate, and financial risk of the project (Sharpe, 1964). Shareholders push board of directors to make a return on their investment at least equal to free risk interest rate (e.g. banks) adding to it the compensation for the additional relative risk of this investment to the firm current risk level (Gitman and Zutter, 2012). Although ERP project has many risks, financial risks only are considered. According to portfolio theory, the more you invest in divers assets the less the risks you care because if one asset increases the performance to abnormal level, the other asset will have a diverse effect. At the end, the sum effects of different assets are zero in terms of variations from the expected productivity. Consequently, the risks related to ERP project in itself is ignored because it will be compensated by other projects in the organisation or it will be compensated between subprojects in ERP. Nevertheless, ERP project has other type of risk, which is the financial risk.

Risk is a deviation from expectation. Consequently, the higher the deviation, the higher the risk will be. Based on this premise, if ERP project could affect the volatility of cash flow, it will have a financial risk. Volatility is a function of the leverage in organisation performance due to the new asset, ERP project. This leverage is expected because ERP project could increase the performance to abnormal level or decline it to abnormal level. This risk is very high at the beginning of the project but it starts to decline after that. Consequently, the financial risk should decline across the time followed by a decline in the cost of capital.
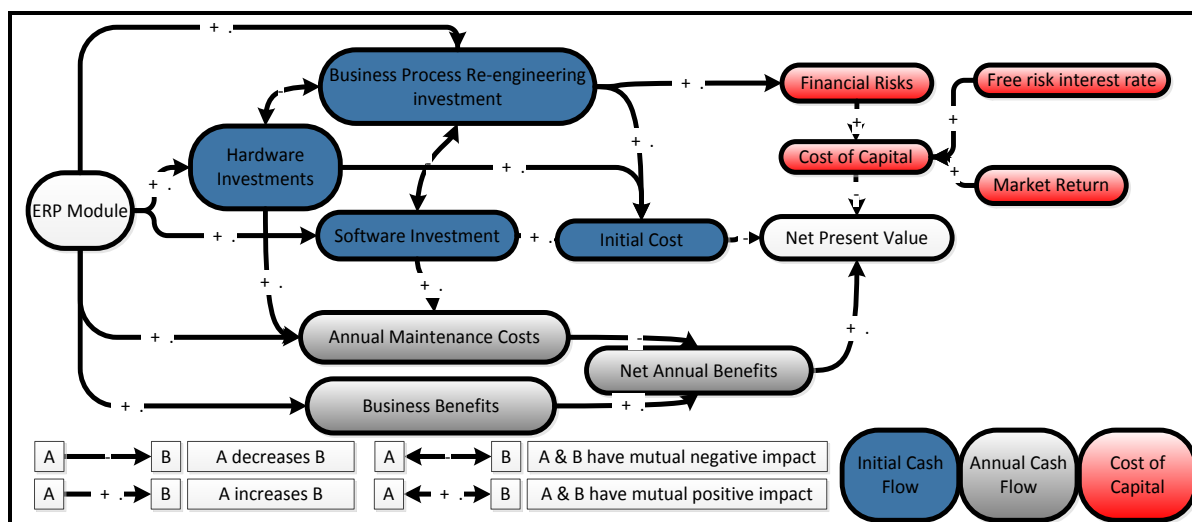
Figure 2: The CoBeFR Model

5   CONCLUSION

Since ERP is a huge project, its business case should be clearly stated. Traditional business case, which puts benefits and costs in a straightforward way, should consider the interrelationships between different cost components and their impacts on benefits emergence. Moreover, cost of finance, with taking into consideration financial risk, should be addressed in the planning process of ERP implementation. The CoBeFR model will help decision makers in identifying the relationships between costs, benefits, and financial risks to see the impact of ERP on the organisation value. The next step in this research is to start working in case studies to modify and enhance the model.