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BEYOND THE ONE-DIMENSIONAL CONSTRUCT OF FAILURE: THE CURIOUS CASE OF ENTERPRISE SYSTEMS FAILURE RATES (19)

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Abstract

In the studies on Enterprise Systems (ES), different failure rates ranging from 50 to 90 percent are often reported. Despite these reported failure rates, ES market witnesses continuous growth. This paper presents a review of ES failure rates and critically analyses the numbers reported within their original context as well as in the context of various definitions of failure. We find that the reported high failure rates are historical, lack a consistent definition and lack an adequate understanding of ES outcomes. We find that ES outcomes are often complex, time-dependent, multi-dimensional and constructionist in nature. Based on this analysis, implications for ES research are discussed.

Keywords: Enterprise Systems, ES, ERP, Failure Rate, Outcomes

1.0 Introduction

In most of the critical factors studies of implementation of Enterprise Systems (ES), sometimes referred as Enterprise Resource Planning, or ERP, different failure rates ranging from 50 to 90 percent are often reported (Amid et al, 2012; Garg & Garg, 2013). However, the global market for ES is consistently witnessing growth with an estimated market size of USD 24.5 billion in 2012 (Gartner Group, 2013 in Columbus, 2013). These two statistics present a particular conundrum for IS researchers. If the failure rates are correct, how can the ES market witness consistent growth? If the ES market in continuously growing, how can it sustain such high failure rates? As Glass (2005, p. 113) puts it - the era of the computing age "would not be possible if we didn't have astoundingly successful software to make all those

computers do the wonderful things they do". This paper presents a review of ES failure rates and critically analyses the numbers reported. In this way, it raises a number of important questions and also points at possible answers.

Section 2 draws a sharp focus on the general concept of failure and associated aspects. As an ES is often considered a specific type of Information Systems (IS), section 3 discusses various definitions offered by scholars for IS failures. Section 4 examines the commonly cited original sources of ES failure rates and puts the estimates in context by discussing the definitions and methodology adopted in such studies. In light of this, Section 5 discusses the nature of outcomes associated with ES implementations and questions if one-dimensional constructs of (outright) failure are sufficient to describe the ES failure phenomena. Section 6 draws imperatives for ES research based on the argument developed earlier. Finally, section 7 concludes the paper.

2.0 The Concept of Failure

Failure is an inherent aspect of complex technological and organisational systems (Cook, 2000; Sauer, 1993). Some high profile examples of such failure include the 1986 disaster at the Chernobyl nuclear plant, the space shuttle Challenger disaster, the loss of NASA's Mars Climate Orbiter, and the Bhopal chemical plant accident. These cases are often construed as an example of outright failure in public discourse, however subsequent research (Faynman, 1988; Hawkes et al., 1987; Kletz, 2001; Sauser et al., 2009) suggests that such failures may be the result of an accumulation of past failure indicators rather than, a single, sudden and clearly distinguishable event. For this reason, this section looks at the concept of failure and its meaning as understood by different scholars.

Failure is a complex concept, having a range of types and meanings, and there is no generally agreed description of its nature (Sauer, 1993). The Technical Council on Forensic Engineering of the American Society of Civil Engineers describes failure as "… an unacceptable difference between expected and observed performance" (Petroski, 1996, p. 51). This definition suggests that failure, in its simplest form, can be described in terms of a comparison of an outcome with an ideal or goal, where the

output in some way falls short of the ideal. In this case failure is an observation about something and not the thing itself. The definition also suggests that failure may be a process, something that can happen temporally, as in the case of becoming bankrupt, a decline, or other act of failing.

Nakamura & Kijima (2011) identify three failure models: (1) *simple linear system failure* (the domino effect) where a small change causes a reaction leading to further reaction along a chain, as in the fall of a line of dominos; (2) *complex linear system failure* (the Swiss cheese effect) an alignment of a number of factors leading to failure; and (3) *non-linear (systemic) failure* where a number of unseen factors coalesce, resulting in failure. Failures are usually found to be multi-causal, arising from complicated, interactive, and interdependent chains of prior activities or events. Furthermore the chain of events that precedes a failure will usually not be a simple linear one (Bignell & Fortune, 1984; Sauer, 1993). Failure of an endeavour is often embedded in a wider system (Eitel, 2004).

Failure can also be understood as a social construct (Bovens & Hart, 1996 in Goldfinch, 2007). Robinson (1994) points out that a project's failure or success is typically defined in relation to a particular group (stakeholders) with its own set of roles, goals, interests, and expectations, which are assessed in the context of an organisation and its political and social environment. The assessment of an outcome as failure is dependent on the values of the person or group making the assessment, what standards are applied to the assessment, and what qualities are regarded as significant (Bignell & Fortune, 1984). An outcome can be viewed as either a success or failure depending on the expectations of diverse groups (stakeholders) with different agenda (Bijker et al., 1987; Hillson, 2011; Wilson & Howcroft, 2000, 2002). These values may change with the time and context of the judgement, and the viewpoint taken (Bignell & Fortune, 1984). Assessment of failure is therefore subjective and context dependent, and is also dependent on the power of the evaluator (Imamoglu & Gozlu, 2008; Wilson & Howcroft, 2000, 2002). Having discussed the concept of failure in its general sense, the next section discusses the concept of failure in the IS context, primarily because the concept of ES failure has often been borrowed from the IS domain.

3.0 Defining IS Failure

Based on a survey and classification of the empirical literature on IS failure, Lyytinen & Herschein (1987) identified four distinct types of IS failure: (1) *Correspondence Failure*: the system does not 'co-respond' to predefined design objectives; (2) *Process Failure*: a failure to produce a system at all or failure to produce a system within planned budgets and timeframe; (3) *Interaction Failure*: failure of the system to meet the needs of its users evidenced by the level of use and the degree of user satisfaction with the system; and (4) *Expectation Failure*: the inability of an IS to meet a specific stakeholder group's expectations. Expectation failure extends beyond the inability of an IS to meet design specifications to a more holistic view of an inability to meet the expectation of groups (Yeo, 2002). Sauer (1993, p. 23) criticises this concept which he says can "in principle accommodate any kind of shortcoming in an information system". However he acknowledges that the concept of expectation failure is useful as it highlights the relevance of different stakeholder groups, makes clear that failure is an evaluation rather than a description, and points out that the satisfaction of interests may vary in degree over time.

Sauer (1993) proposes an alternative definition of IS failure which is consistent with IS deployment as a process unfolding in a complex web of social action. He proposes a model which he describes as a triangle of dependences among (1) *the project organisation* (who develop and maintain the IS); (2) *the supporters* (stakeholders who support the IS in the expectation that it will serve their purposes); and (3) *the information system* itself. Success or failure of the system depends on the support each leg gives to the other along with the effects of exogenous factors such as cognitive limits, the environment, organisational politics, structure, and history. In this model failure occurs when the level of dissatisfaction with a system is such that there is no longer enough support to sustain it. Failure in this case is terminal, and is usually referred to as project abandonment (Ewusi-Mensah & Przasnyski, 1994; Pan, 2005). This terminal view of failure is not inconsistent with the failure as a process (Wilson & Howcroft, 2002) concept as termination is the end result of a failing entity. Sauer's approach also supports the notion that failure of an IS initiative can happen long after the system is successfully implemented from a project management perspective.

Deployment of IS in the organisation is often seen as an implementation project. However, the concept of IS project failure has not been well defined in project management literature and there is no universally agreed definition (Al-ahmad et al., 2009; Hyvari, 2006; Sauer, 1993). Most of the definitions in this regard refer to a project management triangle of cost, scope and time. A relatively recent attempt at defining IS project failure is by Al-ahmad et al (2009) who define IS project failure as any project that is set to support the operations of an organisation, by exploiting the resources of information technology, that fails to deliver the intended output within the originally allocated cost, time schedule, or initially-approved functionality, as well as the project comfortably satisfying the stakeholders and being accepted and largely used by the end users after deployment. This definition captures most of the issues discussed in this section, but also indicates that an IS (and by extension an ES) can be a working system (being used by the organisation), yet can fail on many counts (e.g. scope, time and cost). In the light of discussion above, the next section will examine the failure rates widely reported in the ES literature.

4.0 Examining Failure Rates in ES Literature

In ES related publications, though failure rates cited may be from recent papers, almost all citations relate back to some high profile citations originally made in the previous century. This section locates the first instance of each such citation of ES failure rates and analyses the exact nature of the citation. This process provides a context in which to evaluate the failure rate in question and examine if the original estimates are still valid and, whether they are a true reflection of ES system failure.

The most high profile failure rate citations come from studies by the Standish group. Though many ES studies refer to the Standish Group's famous 1994 Chaos Report, it is important to note that the report itself refers to IS projects in general. The original Standish Group report states that 31 percent of software projects were *cancelled*, 53 percent were *challenged*, and 16 percent were (outright) *successful*. Adding the first two numbers gives a failure rate of 84 percent, but would it be right to classify challenged projects as failures? In recent years, scholars and practitioners have raised concerns about definitions and measurements in the Chaos report (Glass, 2005; Eveleens & Verhoef, 2010), and have stressed that the classification of successful,

challenged and cancelled does not cover all the possibilities, and ignores the fact that organisations are often unconcerned if original estimates are exceeded by a certain amount. We also argue here that since IS/ES projects are not standard brick and mortar projects, a certain estimation error will always be present.

The earliest original citation which specifically refers to ES failure is from Martin (1998) and it portrays a dismal picture of failure rates of around 90 percent. Upon closer investigation, one finds that though the article refers to an earlier Standish Group study, it relies on a personal estimate by the then chairman of the Standish Group:

> *A 1996 study by the Standish Group in Dennis, Mass., found that as costs of technology projects go up, the likelihood of failure increases rapidly. "Once you hit $10 million, the chances of a project coming in on time and on budget are statistically zero," says Jim Johnson, Standish's chairman. He estimates that at least 90% of ERP implementations end up late or over budget.* (Martin, 1998, p. 150)

There are two observations here. Firstly, it implicitly refers to failure as non-conformance to time and budget estimates. Secondly, the figure of 90 percent comes from a personal estimate. Citing this estimate without contextualising it undermines the rigour requirement for academic works.

A related and often quoted citation is Calogero (2000). In his article published in *Sun Server* magazine, the author cites data from the Standish Group, though there is no reference to a specific report or a year. It classifies ES implementation outcomes in three categories - implementations that finished on scheduled time and within planned budget (10 percent), implementation that finished with time and/or cost overrun (55 percent), and implementations which were eventually cancelled (35 percent). Similar to the previous citation, it presents a failure rate of 90 percent if we define failure as non-conformance to time and cost estimates. However, if failure is to be defined as project abandonment, failure rate reduces to 35 percent. A more recent citation of the 2004 Standish report is by Olsen & Zhao (2007), who mention a failure rate of 70 percent. These numbers clearly point out the implications of defining different failure constructs.

A report titled *Getting Value from Enterprise Initiatives*, from the Boston Consulting Group (2000) provides another reference point which quotes a failure rate of 67 percent. The report is based on interviews with more than 100 executives across North America who had responsibility for ES initiatives during 1996-1999. As per the report:

> *Only 33 percent of interviewees judged their initiative as "positive" or "strong positive"... These interviewees affirmed that their initiatives had created sufficient value to justify the effort; had met business objectives, schedules, and budgets; and had achieved tangible financial impact. Many of the initiatives that earned neutral or negative assessments were problematic. Some had been cancelled after wasting substantial investments, other failed to deliver functionality, and some required replacement of a vendor.* (BCG, 2000, p.7)

Of particular note is the fact that the report defines success as value creation for the organisation within time and budget constraints. It pegs ES success rates at 33 percent, higher than the estimates (10 percent) mentioned earlier in this text (which excluded the value creation aspect). However, classifying all the remaining 'problematic' 67 percent projects as failure presents too dismal picture of ES failure.

Another widely cited source is a 2001 survey by Robbins-Gioia Survey (IT-Cortex, 2002) which mentions that 51 percent of the respondents viewed their ES implementation project as unsuccessful. It should be noted that among all the companies surveyed across different sectors, only a total of 36 percent had or were in the process of implementing ES. It clearly demonstrates that the sample size was not exclusively focused on ES implementations and yet its results are cited for ES failure rates. Apart from these, two other widely quoted citations of failure rates are 50-75 percent (Umble & Umble, 2002), and 40-60 percent (Langenwalter, 2000 p. 327). Both of these original citations apparently provide the failure rate based on 'guesstimates'.

Leaving aside methodological objections about such studies (e.g. sample size, distribution of the respondents, reliability and validity of measurements), the timing of these studies raises concerns about their use in present academic work. During the late 1990s and early 2000s, ES were still maturing and most of the organisations had

implemented ES in the anticipation of solving the Y2K[1] problem (Markus & Tanis, 2000; Markus et al, 2000; Nandhakumar et al, 2005; Parr & Shanks, 2000; Ross & Vitale, 2000) and this may have resulted in unusually high failure rates at the dawn of new millennium. It may also be argued though that irrespective of their implementation details, ES are configurational technologies with similar contexts and therefore quoted failure rates should be consistent. However, there is no denying that up-to-date studies on ES implementations would prove to be more useful, especially since now ESs have evolved into new forms such as web-based ES (Grabot, 2014), or Cloud-based ES (Saeed et al, 2012).

We see three reasons behind the narrative of high failure rates in the ES domain. Firstly, in most of the academic research, failure rate in not the central topic of the research. For example, factor studies are focused on identifying critical factors and (occasionally) their management. Failure rates are used just to set the context and often are not verified thoroughly. Secondly, there are high costs associated with accessing industry wide reports, such as the Chaos Report or AMR market sizing reports. Academic researchers often find access to such industry reports prohibitive on cost grounds. This high cost may be a reason for the relative lack of in-depth verification of such failure narratives (Glass, 2005). Thirdly, citing Beer (2000, p. 435) in the context of similarly high failure rate narratives of change programs, Hughes (2011) finds an 'unconscious collusion' between academics, consultants, and managers as an explanation for the paucity of knowledge about '...the processes, values, skills, and context that underlie... failure.' In the following section, we turn our attention to the nature of outcomes associated with ES and associated complexities in the evaluation of failure.

5.0 Nature of Outcomes in ES Literature

As is the case with defining IS failure, ES failure has also been defined in variety of ways. While most of the ES studies are rather unclear about their definition of ES failure, Aloini et al (2007) draw from Lyytinen & Herschein (1987) to classify ES failure on four levels: process failure, expectation failure, interaction failure, and

[1] Y2K was the term given to the problem which could arise as a result of the transition from AD 1999 to 2000 whereby, computer systems, software, and chips using two digits to represent the year (i.e., 99 for 1999) might interpret 2000 as 1900.(Ho & Smith 2001)

correspondence failure. It is clear here that the failure ratio will change depending on the definition adopted as an increase in the scope of evaluation will tend to inflate the reported failure rate. Therefore, Markus & Tanis (2000) stress that the success or failure of an ES is not a monolithic concept and it is multidimensional and relative. It is relative to the time at which it is assessed and is often judged relative to the organisation's unique goals for the system.

Some scholars often take a life-cycle view of ES implementation and use in organisations (Bajwa et al., 2004; Markus & Tanis, 2000; Parr & Shanks, 2000; Rajagopal, 2002; Ross & Vitale, 2000). A lifecycle view stresses that there will be different phases or stages of the process and there are intermediate outcomes of each phase, often drawing from an underlying change mechanism (Van de Ven & Poole, 1995). That is why Grenci & Hull (2004) suggest that one way to evaluate the success or failure of an ES project is to consider it on a life-cycle, stage-by-stage basis. This is important because although an intermediate outcome may influence the final outcome, it need not necessarily determine it (Markus & Tanis, 2000). For example, there have been reports of companies reporting a dip in their performance immediately after going-live (Deloitte, 1998) but eventually most of them recovered from their initial setbacks. Similarly, Wagner et al (2010) and Berente et al (2008) have shown that the eventual fate of a project is determined not by initial reaction after 'go-live' but by the way organisations arrive at a 'working' ES, which may not be the optimal solution as planned, but nevertheless is accepted by all the parties concerned. A measure based on immediate outcomes post go-live is then more likely to classify the project as a failure.

Measurement of ES outcomes itself will be an issue, especially if the organisation has not quantified anticipated business benefits of ES. Ross & Vitale (2000) report that firms without clear performance metrics for their ES implementation were unable to determine whether they were benefiting from the implementation. Furthermore, even if an organisation has quantified the anticipated business benefits, it may be difficult to establish a direct causal link between the business performance and the ES implementation. ES implementations are often undertaken alongside business process reengineering (BPR) and supply chain management (SCM) initiatives. Disentangling the relative effects of ES, BPR and SCM will always be problematic (Hall, 2002).

Grenci & Hull (2004) therefore recommend a narrative approach for evaluating ES success and failure in which emerging issues are to be documented alongside the ES lifecycle to evaluate the entire project in perspective.

An ES interacts with different systems and actors of the organization therefore the perspective that an ES is a deterministic technology is not valid since the outcome of the interaction is only partially predictable (Boudreau and Robey 2005; Grabski et al, 2011). Each ES experience is unique, and experiences may differ considerably depending upon internal and external contextual factors (Lyytinen et al, 2009; Markus & Tanis, 2000; Rajagopal, 2002; Wood & Caldas, 2000). Furthermore depending on the complexity, there may be different types of roll-outs in ES implementations. For example single-site/multisite implementation with phased/big-bang approaches. This may also result in differing views on ES outcomes depending upon the experience of individual organisational units/locations. As Light & Papazafeiropoulou (2008) argue, just because ES exists, we cannot presume that all the concerned parties will appropriate it in the same fashion. There is more to the implementation outcome than a simple classification between outright success and failure. Therefore, outcomes are often mixed at best.

Finally, just like other organisational phenomena, outcomes of an ES implementation can also be argued to be socially constructed; what Pinch and Bijker (1984) term as the social construction of technology (SCOT). Essentially, SCOT argues that technologies are artefacts that bear the imprint of shared understandings developed by the social groups involved in their design, implementation and use. Mayere et al. (2008) assert that the social construct of ES is developed via a two-stage process - first, the incorporation of (so-called) best practices into the ES design, followed by the customisation by the organisation to allow ES to work effectively within the organizational setting. While Kallinikos (2004) argues that ES design itself is not free from the impact of social construction of what is considered ‘optimal’ and ‘efficient’, evaluating ES outcomes itself is an exercise in social construction. For example, even if ES implementation is deemed successful by senior management, perceived net outcome of ES implementation could be viewed by some employees as negative if they perceive ES as a threat to their job (Hall, 2002).

The interpretation of outcomes may also depend upon who is evaluating it. The result of the outcome is often determined from the vantage point of the evaluator (Scott & Wagner, 2003). Wagner and associates (Wagner & Newell, 2004; Wagner et al, 2006) present an interesting example of an ES module development where the implementation was deemed not so successful at the partner university, but the vendor successfully sold the module to the users on the pretext of being developed in partnership with an Ivy-league university. Finally, as Cecez-Kecmanovic et al (2014) point out, the framing of outcomes are representational in nature, and ignore the aspect that such systems as objects of assessment are not given and fixed but themselves are performed as objects as a part of the process of assessment.

In summary then, we note that outcomes of an ES are multi-dimensional, may differ across implementation stages, are difficult to isolate and measure, and more often than not, are socially constructed. Therefore, there is a need to move beyond the one-dimensional constructs of outright success or failure. If we begin to move beyond this conception, then there are certain implications for ES research, which we will attend to in the next section.

6.0 Implications for ES Research

Having discussed the complex nature of defining success and failure in the ES context, we offer two important implications for ES research. The first implication is epistemological in nature. Since ES outcomes are complex, time-dependent, multi-dimensional and multi-level, instead of focusing on a success/failure duality at a single point of evaluation, ES scholars should attend to the range of issues and outcomes encountered at multiple levels in such an exercise (Fincham, 2002; Grenci & Hull, 2004). Concomitant with this multi-level approach, Panorama Consulting, which releases yearly ERP implementation survey, steers clear of talking about success or failure and reports the important ‘issues’ encountered instead. Subsequently, there is no meaning of the term critical success factors or critical failure factors in this context. This is also evident from the fact that there is a high overlap between ES success and failure factors (see for example, Shaul & Tauber, 2013 and Momoh et al, 2010). The outcome neutral term ‘critical factor’ may be much more suitable in this context.

The second implication is more methodological in nature. Since outcomes may differ across different levels of the organisation, an ES research framework should explicitly include the concept of levels in a study, although which levels to choose may depend on the research question and on the preference of the researcher. Also, as noted in an earlier section, evaluation of ES outcomes may vary with time; therefore an ES research framework should focus on following outcomes through time. This may require a shift from cross-sectional/survey instruments to longitudinal studies of ES implementations. As Markus et al (2000, p. 247) state, "ES studies should focus on 'lived experience' of organisations' to follow the process of ES implementation." Indeed, there is no dearth of ES implementation studies that highlight critical factors associated with ES implementations, and one finds that corresponding critical factors haven't changed much over the years (Nah et al, 2001; Finney & Corbett, 2007; Grabski et al, 2011; Shaul & Tauber, 2013). Some studies (e.g. Ifinedo, 2008; Sarker & Lee, 2003) also seek to link a set of factors with certain implementation outcomes but what we lack here is a detailed understanding of how these factors affect the outcomes of the implementation process.

In this regard, it is our contention that, both a process view (Dempsey & McDonagh, 2014; Saxena & McDonagh, 2014) and a practice view (Holohan & McDonagh, 2014; Hughes & McDonagh, 2014) of organising hold promise to support this agenda. While processual view focuses on sequence of events as they unfold over time in context (Pettigrew, 1997, 2012; Van de Ven & Poole, 1995; Langley, 2007), sociomaterial practice view (Orlikowski, 2007, 2010; Orlikowski & Scott, 2008) captures the situated phenomena, focussing on constitutive entanglements of humans and technologies as they are enacted in practice. Both process and practice views explicitly include the concept of levels in their theoretical framework. While capturing sequences of events at different levels and linking them for the purpose of explanation is the hallmark of a processual research (Pettigrew, 1997; Pettigrew et al, 2001; Caffrey & McDonagh, 2015), a practice view focuses on micro level activities of practitioners and their interaction with macro level institutional factors (Jarzabkowski & Spee, 2009; Vaara & Whittington, 2012), and materiality of technology (Orlikowski, 2007, 2010; Orlikowski & Scott, 2008). Finally, Due to their interest in temporal interconnections of events/practices, most process and practice based studies take the form of longitudinal case studies (Pettigrew 1997; Langley,

2007; Sarhan & McDonagh, 2014), a preferred alternative that we outlined for conducting holistic studies on ES implementation. Longitudinal case studies can facilitate both a focus on how the implementation process unfolds (process view), and/or how users implement and appropriate ES in organisations (practice view).

A clarification is in order though. Although we recommend a process and a practice view, we do not undermine the importance of other research frameworks. While survey-based/quantitative studies may continue to isolate variables of interest and posit relationships among them, process/practice based studies will throw more light on the dynamics of how these variables, and relationships among them, contribute to the outcomes of ES implementations. In recent years, we find some excellent examples of the application of process (Kaniadakis, 2012; Williams et al, 2013) and practice (Wagner et al, 2010, 2011) theory in the ES domain. We strongly recommend that further application of process and practice theories in the study of the ES domain may help in uncovering details that are often missed out in single dimensional snap-shot studies of ES phenomena.

7.0 Conclusion

In this paper, we examined the reported high ES failure rates in ES studies and evaluated these in their original context as well as in the context of various definitions of failure. We found that the reported high failure rates are historical, lack a consistent definition and lack an adequate understanding of ES outcomes. These inconsistencies results in a wide range of failure rates reported in ES literature which do not provide an explanation of the high growth rate of the ES industry. We also discussed the complex, time-dependent, multi-dimensional and constructivist nature of ES outcomes. Finally, we discussed the implication for ES research which includes stepping outside the success/failure duality and adoption of a longitudinal view to capture the ES implementation process in its entirety. Towards this aim, we advocate the adoption of a process/practice view of ES implementation in longitudinal studies. We hope that our review will motivate ES researchers to adopt a broader concept of ES outcomes instead of merely branding an implementation as a success or a failure, and to adopt a long term perspective when assessing ES outcomes.

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