IMPROVING THE PREDICTABILITY OF IT INVESTMENT BUSINESS VALUE

Complete Research

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Abstract

Limitations in our ability to adequately forecast the expected value of IT investments represent a notable impediment to efforts to develop business cases that can be relied upon when making IT investment decisions. This undermines the effectiveness of these decisions and threatens the benefits that a portfolio of IT investments ultimately delivers. Since IT investment decisions have direct implications for the business value generated by IT and for organizational performance in general, this research aims to offer insights that help managers reduce the gap between the expected value of IT investments and the value that these investments actually deliver. Drawing on prior work that suggests the importance of reference classes to overcoming forecast uncertainty, we identify six distinct classes of IT investments. We evaluate the utility of these reference classes using a dataset of 486 post investment reviews (PIRs) from a large international organization. Results of our analysis indicate that cost reduction initiatives deliver more of their expected business value than revenue generating investments. Further to this, the accuracy of forecasts for initiatives that extend existing revenue streams are better than for initiatives that seek to establish entirely new revenue streams. These findings can be used as an input for practitioners seeking to determine the efficiency of their IT portfolio, improve the impact of their investments, or improve the accuracy of their business cases. They can also be used by those seeking to better understand the IT business value assessment process.

Keywords: IT Business Value, Post Investment Review, Portfolio Management, New Product Development, IT Project Estimation

1 Introduction

Information provided by the popular press suggests that while some IT investments create significant organizational value, others ultimately destroy considerable value. Examples of the former situation are the carbon reducing effects of IT systems (Guardian, 2010b) and HPs' life saving healthcare initiative in Kenya (Guardian, 2012). The potential for value destruction can be illustrated by HP's failed implementation of a customer relationship management system that resulted in a GBP 318 million settlement to BskyB (Guardian, 2010a) as well as by the implementation failures surrounding a recent American healthcare initiative (Guardian, 2013). Anecdotal evidence of this sort indicates the presence of considerable variation in the business value derived from IT investments, a view that is supported by academic research that has systematically examined the outcomes of IT investments in thousands of organizations. This research has reported, for example, that the return that organizations derive from IT continues to disappoint (Ashurst, 2008; Peppard et al., 2007), that information system expenditures are largely unrelated to value creation (Aral and Weill, 2007; Bahadur et al., 2005), and that unprofitable organizations may spend too much on their IT (Strassmann, 1999). On the other hand, a significant and growing body of research indicates that investments in IT do, on average, make a positive and statistically significant contributions to organizational output and performance (Brynjolfsson and Hitt, 1996; Van Ark et al., 2008; Jorgenson et al., 2008; Reenen et al., 2010; Tambe and Hitt, 2012; Mithas et al., 2012 and Frey and Osborne, 2013).

Although managers might take some comfort in knowing that, on average, their investments in IT will likely deliver business value, they continue to be confronted with the challenge of discerning between problematic and potentially successful initiatives (Markowitz, 1959, p. 6; Farbey et al., 1999; Cooper, 2001, p. 29; Blomquist and Müller, 2006; Blichfeldt and Eskerod, 2008; Christiansen and Varnes, 2008; Aaltonen, 2010, p. 92 and Martinsuo, 2013). Practitioners must, given the resource constraints being faced by organizations (Ashurst et al., 2008; Killen et al., 2012), identify and commit resources to only those IT initiatives that promise the most value rather than committing funds to a set of IT investments with the hope that these investments will, on average, yield organizational benefits.

Considerable effort has been directed toward better understanding the business value of IT and while numerous methods have been developed to support IT investment decision making, many of these have relied on the use of business cases (Bhaskar and Megharaj, 2011; Berghout and Tan, 2013). For example, work in the area of 'Information Economics' outlines a method for quantifying the potential value of an IT investment (Parker and Benson, 1988, p. 89). The core elements of value identified by this work include potential competitive advantage, management support, and return on investment. More recent efforts have sought to enhance the IT investment decision-making process through analysis and management of IT investment portfolios (Verhoef, 2002; 2003 and Blichfeldt and Eskerod, 2008). Although IT portfolio management has been approached in numerous ways (McFarlan, 1981; Thorp, 1999; Bardhan et al., 2004 and Jeffery and Leliveld, 2004), many of these approaches can be characterized as modifications of portfolio selection theory (Markowitz, 1959, p. 129). As such, they tend to emphasize a need for efficient diversification of the IT investment portfolio. Hence, an important element of the IT investment selection process continues to be the financial case for the value that individual investments are expected to deliver (Seddon et al., 2002; Alkaraan and Northcott, 2006 and Carr et al., 2010).

The accuracy of a business case, defined as the difference between the actual value delivered by an IT investment and the planned value as presented in its business case, is of considerable importance to efforts to understand IT business value. Cost underestimates and benefit overestimates during the formulation of business cases can severely undermine the validity of the financial case for an IT investment (De Reyck et al., 2005). Inaccurate business cases can impede the IT investment prioritization process with good investments potentially being favoured over excellent investments and organizational effort being directed toward the pursuit of investments that appear favourable but actually deliver negative results. Inaccurate business cases can thus undermine the effectiveness of organizational decision making processes aimed at encouraging effective use of capital and fostering optimal IT investments (Ansar et al., 2014).

Although the forecast accuracy of a business case can be determined by comparing the pre investment forecast value of an investment to actual results as determined in a post implementation review, the latter information is often unknown. This is evident in the observation that 'while most firms attempt in some way to calculate the payback of an IT-investment before making it, few actually follow up to ensure that value was achieved' (Smith and McKeen, 2003, p. 439). Survey studies further suggest that less than half of organizations actually assess the value that is ultimately delivered by their IT investments (Jeffery and Leliveld, 2004; De Reyck et al., 2005; Ward et al., 2008; Hubbard and Samuelson, 2009 and Berghout et al., 2011). As such, many organisations have little basis for understanding the accuracy of the financial cases they are using to prioritise their IT investments.

Previous research on forecast quality suggests the presence of significant inaccuracy in IT investment forecasts. This is somewhat surprising given that delivering in accordance with planned cost, time and quality (the iron triangle) 'over the last 50 years has become inextricably linked with measuring the success of project management' (Atkinson, 1999, p.337). Challenges with delivering to planned cost, time, and quality persist to this day with projects exhibiting an average budget overrun of 27% while overruns in excess of 200% are observed in 1 out of 6 projects (Flyvbjerg and Budzier, 2011). Although such inaccuracies are considerable, they are even larger for IT business cases (Eveleens et al., 2012). Some researchers have suggested that only 16 to 30% of IT projects deliver expected benefits (Ashurst et al., 2008; Ward et al., 2007 and Ward et al., 2008) while others have gone so far as to claim that 'benefit-cost ratios are often wrong, not only by a few percent but by several factors' (Flyvbjerg, 2006, p. 3). An illustrative example is that of Hagemeyer, a trading company with annual revenues of EUR 6 billion that sought to introduce a new computer system. This effort threatened the organization's continuity by severely undermining its ability to conduct business' (Guardian, 2003). Although the initial expected business value of this 'new computer system' was not revealed, it would certainly have been far better than the observed outcome. As such, there would seem to be considerable practical merit in efforts to better understand the forecast accuracy of IT investment plans.

From a theoretical perspective, accuracy is a key parameter driving the value of any forecast since it is the degree of accuracy that gives a forecast its utility. The inaccuracy or uncertainty in forecasted values also serves as one of the two key parameters used to define an efficient investment portfolio (Markowitz, 1959, p. 20). Hence, by exploring factors that drive forecast accuracy, this paper offers insights surrounding the construction of efficient IT investment portfolios. Our work thus provides important input for theories based on the work of Markowitz such as that presented by Cho and Shaw (2013) as well as for models described by other researchers including Dos Santos (1991), Bardhan et. al. (2004), and Pendharkar (2014).

Given the importance of financial cases to the selection and prioritization of IT investments and given widely observed limitations in the accuracy of these cases, there would seem to be considerable value in efforts to examine the question of how the accuracy of financial cases for IT investments can be improved. This paper therefore aims to identify key factors that can help organizations better predict the business value that they will ultimately derive from their IT investments. These factors are then used to define six reference classes that can be used to improve the accuracy of business cases (Kahneman and Tversky, 1979 and Lovallo and Kahneman, 2003). This work is of importance to efforts to effectively identify and prioritize valuable IT investment opportunities and the results that we provide are particularly compelling given our reliance on a relatively large dataset that includes pre- and post-investment assessments of the business value delivered by a diverse range of IT investments. We present our research in the following discussion, commencing with a discussion of our theoretical foundations and the resulting hypotheses. We then outline our research method and present our results. Finally, we conclude with a general discussion of the research, its limitations, and its significance for research and practice.

2 THEORY AND HYPOTHESES

Several methods have been proposed to improve business cases and some of these have explicitly sought to enhance human judgement in the estimation process (Ward, 1999 and Baars et al., 2009). For example, the opinions of existing and potential customers have been studied using prediction markets that allow participants to formulate a priori valuations via simulated trading environments that have been constructed to value initiatives in a manner that is analogous to equity markets (Berg and Rietz, 2003). At the micro scale, Goldrath and Cox (1986) split projects into small tasks and asked experts who might be responsible for performing these tasks to create forecasts for them. Openly discussing the resources needed for each work package enabled the optimisation of individual forecasts by permitting the reconciliation of independent predictions to improve forecast quality (Makridakis et al., 2000). Beyond improving judgement, historical data has also be used to improve accuracy. For example, benchmarks permit the re-use of information on similar situations and the construction of extrapolations that build on historical internal data to enhance forecast accuracy (Makridakis and Hibon, 2000). With more advanced statistical methods, point estimates are replaced with means, variances, and correlations between cost and benefits to describe forecasts using probability distributions (Kim and Reinschmidt, 2012). These methods all seek to improve forecast accuracy through the application of internal and/or external data.

Despite the value of accurate forecasts, assembling the internal and external data necessary to construct such forecasts can present many challenges. It is, however, possible to define reference classes that overcome many data availability challenges while nonetheless offering the potential for significantly improved forecast accuracy (Kahneman and Tversky, 1979 and Lovallo and Kahneman, 2003). A reference class encompasses projects exhibiting the same value along some property or dimension and numerous IT reference classes can be created along multiple dimensions. Reference classes for IT investment proposals can, for example, be created based on the type of value that the investment initiative promises. Projects might then be grouped based on whether value comes from reducing organizational costs, improving product quality, improving customer service, creating new markets, improving decision making, or meeting legal requirements (Bedell, 1985, p. 26). Contributions to competitive position, management information quality, and IT architecture coherence as well as dimensions related to the risk of the initiative such as definitional uncertainty, technical uncertainty, and infrastructure risk have also been proposed for creating reference classes (Parker and Benson, 1988, p. 144). In addition, reference classes for turnaround, strategic, factory, and support related projects (Ward, 1990) as well as for system types such as applications (ERP, workflow), communications (TCP/IP, EDI), data management, IT management and security (Weil and Vitale, 2002) have been put forth. Finally, reference classes have been created that distinguish the benefits of an IT investment into cost savings, indirect benefits and managerial benefits (Baars et al., 2009). Prior work has thus served to draw some attention to the potential value of reference classes as a mechanism for improving IT investments without needing to gather the extensive data needed to develop a perfectly accurate forecast.

Although numerous IT reference classes have been suggested, few have been supported with distributional data. One notable exception relates to the construction of reference classes based on IT development methodology. This work did not, however, find significant differences in forecast accuracy across projects that varied in the level of agility evident in their development methodologies (Budzier and Flyvbjerg, 2013). As a consequence, we undertook to identify and empirically test a set of reference classes that could be used by organizations to improve the accuracy of their IT business cases. This effort led us to define six reference classes that can be used to account for why forecast inaccuracy arises and then test the capacity of these reference classes to discern the forecast accuracy of IT business cases.

Our quest for reference classes led us to identify two relevant dimensions based on the different benefit types offered by IT investments. These dimensions were considered relevant because they highlight important differences of considerable relevance to forecast accuracy, they are relatively unambiguous, they are easy to use in daily practice, and they have been highlighted in prior research (e.g. Cho and Shaw, 2013; Ward et al., 2007 and Ward et al., 2008). We mapped each dimension on a separate axis to create four categories of investments. Recognizing that projects in the top left quadrant of our matrix are most likely to foster inaccuracy, we undertook additional effort to subdivide this reference class into two sub-classes to better understand the potential for error in forecasting the value of these IT investments. Nonetheless, we acknowledge that it is, at least in principle, possible for future work to identify sub-classes within each of the remaining quadrants of our matrix. An overview of our reference classes is presented in Figure 1.

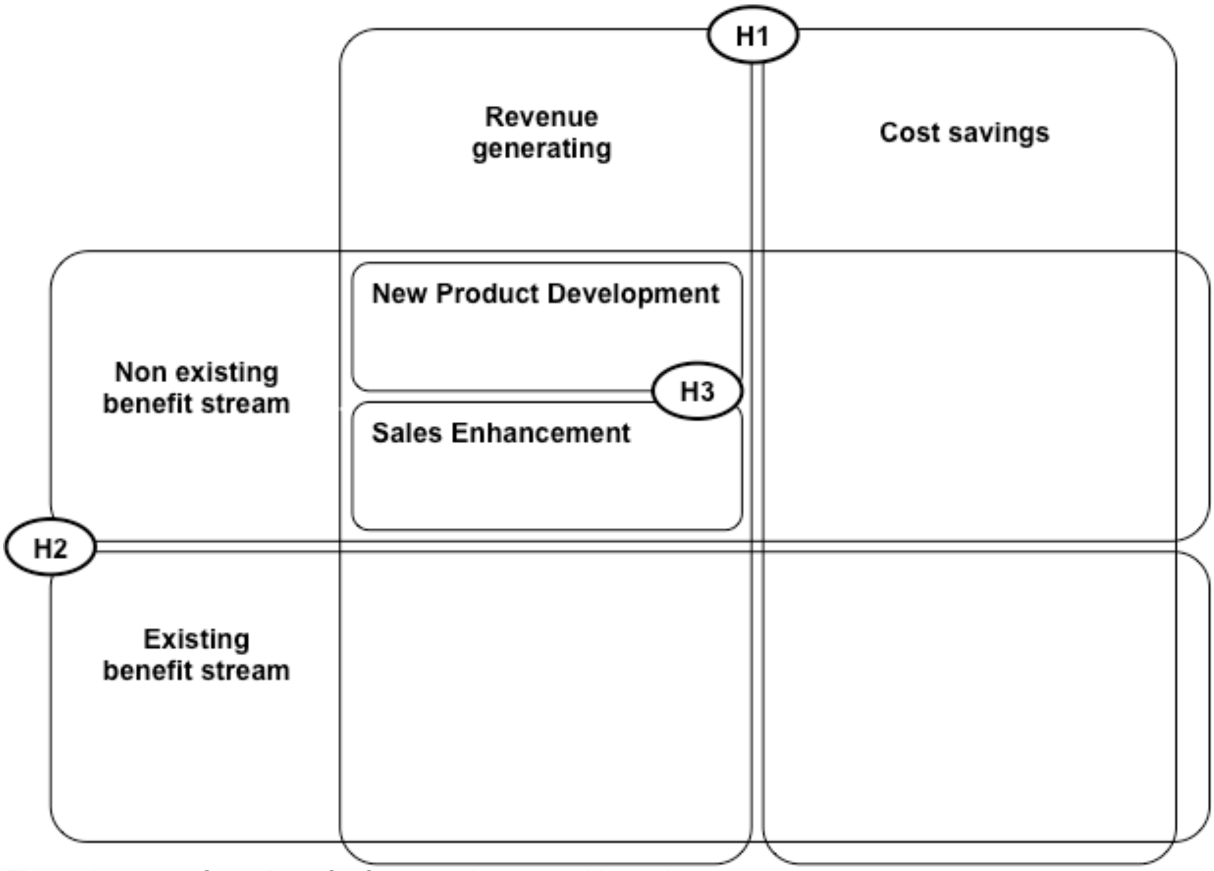

Figure 1. Overview of reference classes and hypotheses

In hypothesis 1 we test differences in the accuracy of forecasts for revenue generating IT initiatives versus initiatives aimed at cost savings. Subsequent to this we examine whether there are differences in the forecast accuracy of IT investment initiatives that enhance the benefits of an existing IT investment versus those that provide a new source of benefits. Finally, hypothesis 3 evaluates differences in forecast accuracy between IT investment initiatives that generate additional revenue by supporting new product development and those that generate additional revenue by enhancing the sales of existing products. Testing these three hypotheses serves to evaluate the potential of our reference classes to provide significant a priori insights into the accuracy of financial cases for IT investment initiatives.

Our first distinction focuses on the kind of financial benefits expected from an IT investment and creates two classes representing the two main forms of financial benefits typically identified in business cases: additional revenues and cost savings (Ward et al., 2007; Cho and Shaw, 2013). The first reference class is defined as IT investments expected to deliver cost savings and the second as IT investments expected to yield additional revenues. While estimating the benefits of both classes of IT investments is problematic, estimating future revenues is generally regarded as being far more challenging with some authors likening the process to looking into a crystal ball (Bower, 1986, p. 12; Laseter et al., 2010). Estimating cost saving potential is seen as less challenging because the costs that are to be saved are typically self-evident and familiar. In addition, the origin of these costs can be examined in depth thereby turning the challenge of forecasting savings into a process of determining expected costs following completion of the investment initiative. The situation is quite different for investments that are primarily expected to generate new revenue. Developing forecasts for these initiatives cannot draw on internal root cause analysis. Instead, it requires an organization to make forecasts of anticipated customer purchase behaviour. The decision to generate revenue is ultimately made outside of an organisation by its customers. As such, the difference between decisions that are internally controlled (cost saving) and decisions that fall outside of an organisation (additional revenue) drives our expectation that more 'guessing' and, as a result, more inaccuracy will be evident in business cases for IT investment initiatives aimed at revenue generation. We therefore hypothesize that:

H1: The business value of an IT investment that is primarily aimed at delivering cost savings is forecasted more accurately than the business value of an IT investment that is aimed primarily at generating revenue.

We identified our second dimension based on an approach to building robust business cases that differentiates between three types of business change: do new things, do things better and stop doing things (Ward et al., 2008). These three types of change can be consolidated by merging the last two types based on the rationale that doing things better and halting things that are currently being done relate to existing practices. This leads us to distinguish between IT investments that focus primarily on extending an existing type of benefit as with an investment to extend the capabilities of an existing customer loyalty system and investments that focus on delivering a new source of benefits as would be the case for the investment needed to develop an entirely new customer loyalty system. We identify these two reference classes, respectively, as 'existing' and 'non-existing' benefit streams.

Greater information is available to improve forecast accuracy when considering investments that extend existing benefits. For example, investment in a capability to ship products faster to customers can generate business value by bringing future revenues forward in time. The revenue effect of this capability can be estimated based on an existing revenue stream. Similar circumstances arise when an investment initiative starts from an existing revenue stream such as when making incremental changes to products or services that are currently in use. The revenue boost expected from these changes can be predicted with some degree of accuracy since current demand for the product or service is known. Some new product development business cases can also be built upon existing revenue streams. Upgrading a successful product from version 10 to 11 can, for example, start from the existing revenues of version 10. The situation is, however, quite different for version 1 of a new product or even for subsequent versions when prior versions have not yet been successful. As has been suggested, 'It is impossible to predict fifth-year sales for something the world has never seen before' (Nagji and Tuff, 2012, p. 72). After 10 earlier releases the forecast for version 11 can be seen as a relatively routine and repeatable effort and it is for this reason that forecast errors tend to be more modest when compared to more novel projects (Taleb, 2007, p. 135). In short, the human judgement needed to forecast new revenues is less capable of predicting the future than the statistical models that can be constructed using historical data to forecast enhancements to existing revenue streams (Makridakis et al., 2000). This leads us to hypothesize that:

H2: The business value of an IT investment that is primarily aimed at extending existing benefits is forecasted more accurately than the business value of an IT investment that is aimed primarily at providing a new benefit.

Hypothesis H1 argues that the business value of IT investments can be predicted more accurately for cost saving than for revenue generating initiatives while H2 argues that business value is more accurately predicted for existing benefit streams than for non-existing benefit streams. In combination these two hypotheses suggest that accurately predicting the benefits of initiatives aimed at creating new revenue streams will be most challenging. As a result, we divided this class of initiatives into two subclasses to obtain more granular insights (comp. Ansoff, 1987 and Nagji and Tuff, 2012). These two sub-classes are new product development and sales enhancement. Prior work has suggested that the forecast accuracy of these two sub-classes might be different because estimates for the benefits from sales expansions 'are more reliable than the estimates of the return from new products' (Bower, 1986, p. 12). This difference is expected in large part because of differences in risk level. New product development holds risks related to customer uptake, product usage, and satisfaction whereas these issues have already been successfully addressed to some extent when pursuing sales enhancement for an existing product. Thus, while new sales channels present challenges, these are typically less risky and we therefore hypothesize that:

H3: The business value of an IT investment that is primarily aimed at providing new revenue streams through sales enhancement is forecasted more accurately than the business value of an IT investment that is primarily aimed at providing new revenue streams through new product development.

3 METHOD

We tested our research hypotheses using a sample of 486 PIRs from a large multinational organisation we will call Z. Z is a multi-billion-revenue company selling products and services to both consumers and enterprises. It is active in Europe, Africa, Asia, and America though most of the PIRs included in our study come from European activities. The sample of PIRs that we used encompassed a time span of more than ten years (June 2003 – February 2014) and a total of over USD 1 billion in investments. The pre investment NPV[1] of all projects included in our sample was positive.

Prior to our research the study organization was routinely performing PIRs though they had not been using the results of these reviews to systematically evaluate the accuracy of their forecast efforts in the way that we present. Rather, PIRs were created or controlled by the finance department and were, in essence, updates to pre investment NPV calculations. In these updates expected project cost is re-

[1] 102 PIRs with a positive pre investment NPV from the Eveleens study (2012) are a subset of the PIRs from this study.

placed by actual project cost while discounted cash flows are updated to reflect actual cash flows and any expected future cash flows in light of the project that the investment initiative actually delivered. Given the value at stake, the study organization was very much interested in understanding how it might use the information that it had to improve the a priori accuracy of its IT investments.

As a starting point for our investigation, we recognized that at a most basic level the accuracy of a business case can be calculated as the difference between expected pre-investment business value and actual post-implementation delivered value. However, this latter value is not always known since the delivered value that is reported in a post investment review is often an estimate. Furthermore, organizations typically calculate the post-investment value of investments before the end of their business case horizons since this provides an important opportunity to learn from the past while simultaneously affording some opportunity to improve the value generated by the initiative being scrutinized. Nonetheless, the difference between the forecasted value of an initiative at the time that a pre-investment business case is prepared and the estimated value at the time of its post investment review (PIR) can be used as a proxy for exploring the accuracy of forecasted value. Thus, in this research we use pre investment NPV (f) and post investment review NPV (r) to construct a ratio (r/f) that serves as an indicator of forecast accuracy (comp. Bower, 1986, p. 12). In constructing this ratio we focused solely on investments with an expected positive business value to avoid ambiguity in ratio construction (comp. Eveleens et al., 2012). We refer to this value as the *r/f* ratio and use it as our dependent variable.

The business case templates of organisation Z provide the data necessary to readily distinguish between investments intended to yield cost savings and those intended to generate revenue. Specifically, this template divides net cash benefits into revenues and cost savings. We thus used this information to divide the investments in our sample into these two groups with investments expecting both cost savings and revenues being allocated based on the source of the majority of expected benefits. Hence, if more than 50% of expected benefits came from cost savings then the investment was allocated to the cost savings reference group. Otherwise it was allocated to the revenue generation group.

Organization Z's business case template did not directly support efforts to distinguish between existing and non-existing benefits and it was therefore necessary to categorize all initiatives along this dimension using additional documentation provided by organization Z. This documentation consisted of files used to support the investment request including key qualitative assumptions of the business case and process documents such as requirements documentation and technical design documents. This documentation was also used to distinguish between new revenue investments that were predicated on enhancing sales and those that were predicated on new product development.

4 RESULTS

An overview of the reference classes including their means and standard deviations is presented in Figure 2.

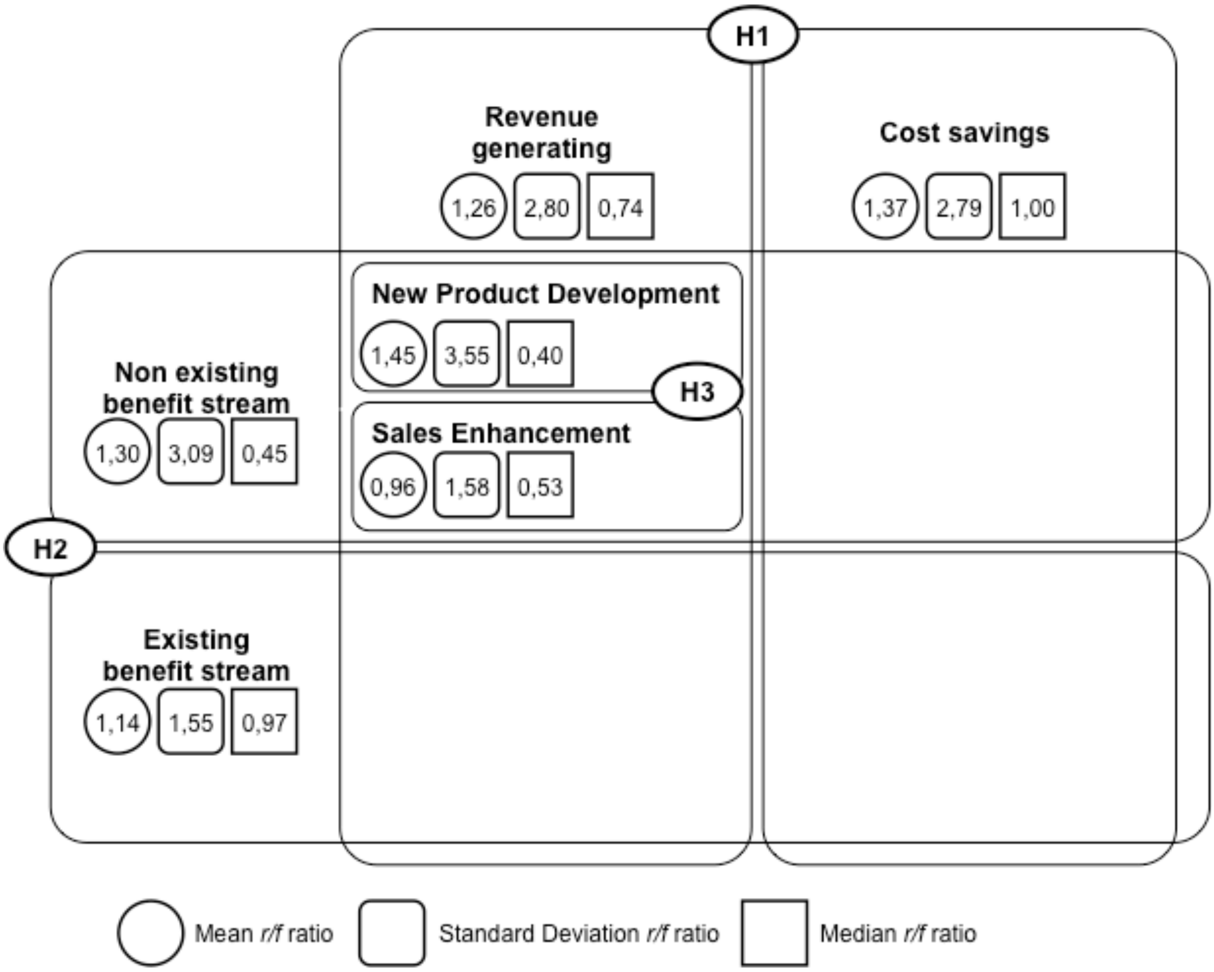

Figure 2. Descriptive statistics for reference classes

Examination of the medians of the reference classes suggests the presence of some differences in forecast accuracy across our reference classes. To formally test our hypotheses we performed a square root transformation of the r/f ratio to better normalize the data in our dataset. This reduced skewness from 4.53 to - 0.72 and kurtosis from 27.24 to 18.19. Hypotheses were then tested with a Welch two sample t-test to test the differences in forecast accuracy across reference classes specified in our hypotheses. In addition, the assumed difference in the accuracy order across reference classes was tested with a Jonckheere Trend test. H1 was accepted in both tests ($p < 0.01$). The effect size was moderate with a Cohens D of 0.24. H2 was also accepted ($p < 0.01$). Again a moderate Cohens D (0.25) was observed. Finally, H3 was accepted ($p < 0.01$) with an effect size of 0.26. Table 1 illustrates in concrete terms how value delivered by IT investment initiatives varied across our reference classes.

	Reference Class					
	Cost saving	Revenue generating	Existing	Non-existing	Sales Enhancement	New Products
Percentage of investments delivering less than 80% of the expected value	31%	52%	34%	58%	59%	57%
Percentage of investments delivering less than 60% of the expected value	24%	47%	25%	53%	52%	54%
Percentage of investments delivering less than 40% of the expected value	16%	38%	10%	46%	40%	49%
Percentage of investments delivering less than 20% of the expected value	7%	27%	6%	33%	18%	40%
Percentage of investments delivering a negative value	7%	15%	5%	18%	2%	26%

Table 1. Percentage of value delivered per reference class

5 CONCLUSIONS AND DISCUSSION

Not all IT investments deliver their expected value. Our study shows that cost saving initiatives tend to deliver more of their expected value than revenue generating initiatives (H1) and that business cases based on existing benefit streams exhibit more accurate forecasts of business value than business cases based on new benefits (H2). Finally we find that the business value of sales enhancement business cases tends to be more accurately forecast than the business value of new product development cases.

Although our sample suggests that 60% of IT investments deliver more than 80% of their expected business value, the outcome of these investments was not always positive. Fully 13% of the investments in our sample exhibited a negative NPV at the time of the post investment review. The underperformance of these 64 investments was easily offset by over performing investments with the top 3 over performing initiatives generating $582m more business value than expected. Further to this, black swans that destroy massive value were notably absent from our sample. None of the 64 investments with a negative NPV at the time of PIR destroyed value that was multiple times the magnitude of the investment and none of these ‘failures’ was so big that it threatened the existence of the organisation. Nonetheless, it is important to recognize that such black swans do exist and should be considered in investment decisions. Exploring the impact of black swans and how our reference classes might be used to protect organizations against these impacts is certainly one promising direction for future research.

The accuracy of IT investment forecasts can be improved with the reference classes that we have presented by applying targeted corrections. Since forecasts on cost savings and improving existing revenue streams tend to be relatively accurate, organizations can focus much of their attention on understanding and improving forecasts for investments related to new products and sales enhancements. One simple approach would be to use the data that we present to formulate correction factors than can be applied to forecasts. This can be done with a practical five-step approach created to combine point estimate data and distribution data to optimise forecast accuracy that has been discussed in prior work (Kahneman and Tversky, 1979 and Lovallo and Kahneman, 2003). One important limitation of this approach is that while it can reduce the expected value of investments significantly, it cannot change the sign of the expected value. As such, an expected positive NPV can be reduced but will not be rendered negative by our correction process. Addressing this limitation would be another interesting research direction as would efforts to test the improvement in forecast accuracy that is generated by alternative approaches. Nevertheless the downward correction that we suggest remains important as it can change the investment mix in a way that creates a more efficient portfolio and can turn a Go decision into a No-Go decision.

Strong corrections to the expected value of non-existing revenue generating investments can initiate important changes for project scope. Reducing the expected benefits to 60% of initial forecast would, for example, typically lead a project team to reduce its requirements. Processes could be scaled back to manage a maximum load of 40% of original expectation. However, in the event of an unexpectedly successful launch, this limitation might hold back sales and work as a self-fulfilling prophecy. Hence, it is important to realize that not all projects deliver only 40% of their expected value. As such, there is considerable opportunity for future research to further refine the initial insights that we have offered.

Finally, it is important to note that the relatively high forecast accuracy of cost saving and existing revenue stream reference classes should not be taken for granted. Achieving accurate forecasts remains hard work and it is in these relatively accurate reference classes where we expect the strongest negative outliers. Failed investments in these classes can disturb operational processes in such a way that they can force an organisation to permanently close its doors. There would, therefore, be considerable merit in research that helps organizations to quickly and effectively identify these outliers from the large majority of unproblematic investments in the "cost saving" and "existing revenue stream" reference classes.

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