NUI MAYNOOTH

Ollscoil na hÉireann Má Nuad

The IT Capability Maturity Framework:
A Theory for Continuously Improving the Value Delivered from IT Capability.

Martin Curley

Dissertation submitted for award of Ph.D.

National University of Ireland, Maynooth

Supervisor: Professor John Hughes

Department of Economics, Finance and Accounting,
Faculty of Social Sciences

September 2008

Abstract

The IT Capability Maturity Framework;
A Theory for continuously improving the Value delivered from IT Capability.

Martin Curley

Organizations and their Chief Information Officers (CIOs) face significant challenges in meeting increasing demand for IT services in the face of numerous challenges such as cost pressures, complexity, demand for innovation and increasingly the requirement to demonstrate value from IT investments. Research shows that CIOs struggle to capture and state the return from their IT investments and that there is no all encompassing IT improvement framework which is value focussed and comprehensive across the full spectrum of IT capability activity. Using a hybrid research approach involving a design science research methodology with an initial case study, an integrated artifact called the IT Capability Maturity (IT-CMF) framework has been researched and developed and had preliminary validation. The IT-CMF is an archetype of the levels and maturity stages an IT capability goes through as it defines, develops, controls, measures and improves its IT capability in support of value creation for the organization. The IT-CMF is thus a design pattern which CIOs can use as a generally reusable solution in the context of their own IT capability and business environment. The IT-CMF leverages the concept of dynamic capabilities providing a mechanism for not only developing capability but enabling reconfiguration to dynamically adapt to changing circumstances and strategy. The IT-CMF and its associated assessment instrument can act as an integrated improvement roadmap, assessment tool and improvement system for CIOs as they strive to improve IT capability in pursuit of improving value creation from IT.

Glossary:

CMM: Capability Maturity Model

CMMI: Capability Maturity Model Integrated

COBIT: Control Objectives for Information Technology

DSR: Design Science Research

EA: Enterprise Architecture

IS: Information Systems

IT: Information Technology

IT-CMF: Information Technology Capability Maturity Framework

ISO: International Standards Organization

ITIL: IT Infrastructure Library

SW-CMM: Software Capability Maturity Model

1 Chapter 1: IT Investment and CIO Challenges

1.1 Introduction

In increasingly competitive times, Information Technology (IT) continues to be a unique business resource that delivers increasingly better performance year after year. For more than thirty years, the raw processing power of computing driven by Moore's law (Moore, 1965)[1], effectively doubles every eighteen months whilst being delivered at less or equal cost. Despite this astonishing resource performance, many organizations struggle with being able to convert the improving efficiency of this business input into improved firm performance and value (Weill 1992; Brynjolfsson and Hitt, 1996) Ever since Solow's (1987) comment that he saw computers everywhere except in the productivity statistics, a debate has raged as to the value contribution of computers and information technology.

The mechanism of how information technology adds value has been discussed for almost 50 years starting with a seminal article by Leavitt and Whisler (1958) which argued that a new technology, called *Information Technology* was emerging.

There have been numerous studies addressing what has been called the IT productivity paradox (Brynjolfsson, 1993) which postulates that, despite enormous improvements in the underlying technology, the benefits of IT spending have not been found in the aggregate output statistics. This debate was further fuelled by Carr, (2005) who argued that IT is a commodity or utility which does not deliver competitive advantage and that perhaps organizations were spending too much on IT.

1.2 Why is IT Investment Important?

Despite the challenges in managing IT and measuring IT value, it appears to be very important to be able to manage IT in a more systematic fashion to optimize value contribution.

---

[1] Moore's Law was originally about the doubling of transistors on an integrated circuit every 18 to 24 months. It has become a metaphor for continued advances in computing performance which is a driving force for both technological and social change.

Driven for more than 30 years by the relentless march of Moore's law, IT has been deployed as a tool to cost reduce, automate and indeed transform many business functions. This has been manifested through cost reduction/avoidance, productivity improvement, growth and innovation as organizations have conceived, developed, acquired, deployed and used IT solutions to advance strategic objectives and the bottom line. IT spending has grown to be a significant percentage of business investments with the ratio of IT investments as a percentage of business investments peaking at 46% in the first quarter of 2001 (Strassman, 2002). In this context the justification of IT investments must be more carefully considered, with the irrational optimism of pre dot com crash IT investment subsequently being replaced by irrational pessimism driving a need for better economic metrics of IT performance.

Dale Jorgenson (2001) made the argument that there was convergence on a consensus that the remarkable behaviour in the prices of IT was the key to surges in economic growth. Equally a study by the University of Groningen (Van Ark et al, 2003) showed that GDP growth and labour productivity in the US in the period 1995-1999 outpaced that of the EU by a factor of 2 with larger spend on Information and Communications Technology (ICT) development and use of IT an important contributor to this. In somewhat of a contrast, Weill's (1992) study of business value in the Valve Manufacturing sector showed that there was no correlation between IT investment and superior performance; however, Weill (1992) noted that some targeted IT investment types aligned with a business objective delivered superior performance[2]. Organizations that can harness IT effectively and focus investment on the right processes and products that are core to their business strategy can likely gain competitive advantage.

Despite this valuable work there has been less focus on research at a firm level as to how sustained superior performance through IT can be delivered. The concept of IT potentially providing sustainable competitive advantage has been suggested (Ross et al, 1996) but how resources are managed to enable this is not well explained (Wade and Hulland, 2004). Sambamurthy and Zmud (2000) noted that there seems to be a growing gap between scholarly research and contemporary management practice for IT. They argue that accumulated research might be inadequate in shaping insights for contemporary practice.

[2] Weill (1992) found no significant association between total IT investment and any financial performance measures. However for example Weill found high transactional IT investment was significantly associated with both high ROA and high non production labour efficiency.

In their research commentary they make a call for research which can bridge this gap and this particular dissertation attempts to answer this call.

This dissertation introduces an integrating approach and framework for improving IT Capability and related management practices to support improved value delivery from IT. Specifically it develops and tests a theory of continuous improvement of value delivery from IT through driving IT capability improvement and develops a management and assessment system for same.

1.3 The IT Productivity Paradox

In response to the Productivity Paradox, studies which have used a production function approach (which involves estimating a relationship between firm outputs (revenue, value add) and inputs (capital, labour etc), have found positive and indeed above average returns on IT investments. One of the more significant of these studies is that of Brynjolfsson and Hitt (2002), who analyzed the effect of computerization on productivity and output growth using data from 527 large US firms over 1987—1994. They found that information technology makes a contribution to measured productivity and output growth in the short term (that is when examining year-over-year differences) that is consistent with returns to normal investments. However, Brynjolfsson and Hitt (2002) also found that the productivity and output contributions associated with computerization are up to five times greater over long periods (that is when examining five to seven year differences). These results are significant on two counts. The obvious significance is the positive impact of IT spending on longer-term productivity. However Earl (1990) found that the level of IT investment was not correlated with value indicating that something else is involved in converting IT investment into value. An important finding from Brynjolfsson and Hitt (2002) is that IT is significantly more productive when combined with organizational capital, for example a workforce which is both IT literate and is equipped with significant business knowledge and acumen. A corollary to the findings of Brynjolfsson and Hitt is that there are large and time-consuming inputs required for IT implementations, which are often omitted from return-on-investment (ROI) calculations. More recently Dedrick, Gurbaxani and Kraemer (2002) have published a comprehensive review of the empirical evidence of Information and Technology and economic performance payoff. Their study concludes that the IT productivity paradox as first formulated has been effectively refuted.

Their report concludes that at both a firm and country level, greater investment in IT is associated with greater productivity growth.

1.4 An alternate IT Productivity Paradox at the Firm Level

Investment in IT continues to grow, with IDC forecasting spending on IT to be at $1.48 trillion by 2010, with a compound annual growth rate of 6.3% (Lu et al, 2007). Both IDC and Gartner continue to report year on year increases on IT spending but it appears that there could be a complementary IT productivity paradox which exists at a firm to firm level. Having addressed hundreds of CIOs and asking them to recount their average and cumulative returns from the IT investments, their paucity of answers leads me to suspect an alternative IT productivity paradox beyond the firm level. This is that despite significant spending on IT at firm level, few IT organizations are in a position to state the return on their IT investments (Tallon, 2007).

With IT spending averaging between 2% and 5% of firm revenue one would imagine that CIOs would have ROI information at their finger tips. However this is clearly not the case. CIO Insight (Alter, 2003) reported in 2002 that 73% of CIOs don't calculate the Return on Investment (ROI) on their finished projects whilst 70% of companies find it difficult to calculate IT ROI. The survey was repeated yearly and despite some modest improvements in 2006, 62% percent of respondents still say their companies find it difficult to calculate the ROI for IT and 45% percent say their business value metrics do not accurately capture the value of IT investments (Alter, 2006). Similarly Ward (2006) identified that 70% of organizations believe they fail to identify and quantify the benefits from IT adequately and 73% said significant improvements were needed if their organizations were going to deliver satisfactory value from their IT investments. This is evidence that a structural problem or weakness exists in the IT profession and indeed industry in general around managing and measuring IT for value.

While most CIOs are tasked with using IT to help transform an organization, the reality is that most are consumed with managing complexity, trying to meet their budget and wrestling with ever increasing resource demand. Additionally when justifying new IT investments, inertia must be overcome; that is the cost of maintaining the existing IT application portfolio and infrastructure (Curley, 2004).

With this part of the IT budget or *operating tail*[3] consuming an increasing proportion of the IT budget some IT organizations are headed for what McKinsey Consulting call the *IT abyss* (Dempsey et al, 1997). This occurs when the firm is spending all its IT funding on maintaining its existing applications and infrastructure and not investing in any new solutions. This is a recipe to not only bankrupt the IT portfolio but also the broader firm if its future growth is tied to new IT solutions.

Additionally, not all IT organizations are able to convert their IT budget into IT value with the same efficiency (Weill, 1992). For a given level of budget, some organizations may be able to deliver significantly more coverage, better infrastructure and value (Markus and Soh, 1998).

1.4.1 IT Management Lag

The rapid change in IT performance driven by Moore's law has also produced a potential associated problem in that despite the rapid change in IT inputs, it appears that improvement in IT Management practices for controlling and harnessing this remarkable resource is happening at a much slower rate. An example of the challenges is reflected in the statement of perception of IT by Andreessen (2002, p1) as "*the most thankless, cumbersome function faced by Fortune 2000 companies where the work only gets noticed when things break, where it's viewed as a major source of expense, and workload has tripled in the past year*". Indeed IT function's inability to manage this resource effectively has meant that increasingly IT budgets are mostly consumed with spending on *keeping the lights on* with little headroom for investments in strategic IT that might create additional value in future. Van Bon (2006) notes that while IT management is one of the fastest growing fields across the business management spectrum, the speed of development of the domain means that public education programs are struggling to develop content and curricula that meet the demand from operating managers.

As the rate of change of technology continues to increase, many IT organizations are being asked to do more with less with many IT budgets staying flat or even declining. Gartner's 2007 CIO Agenda survey (McDonald, 2007) reported that despite CEO

[3] See Appendix B, Managing IT for Business Value, Curley (2004) for a case study of Delta Airlines and their use of the term "operating tail" to describe the TCO of hardware and software. Gartner and others estimate that for every $1 of Capital Expenditure (CapEX) spent approximately $5 are spent on Operational expenditure (OpEX)

priorities focused on business growth, CIO's immediate priorities remain internally focused on IT services, IT governance, improving the links between business and IT, and demonstrating the value of IT. This apparent dissonance between CEO and CIO priorities seems to stem from the difficulties CIOs have in managing the complexity, rate of change and growing demands on IT.

The survey also reported that the increased expectations of IT come at a time when IT budgets are relatively static or increasing only slightly. The survey found global IT budgets will increase by an average of three per cent in 2007, while a third of CIOs predict no budget change and 19 percent report a planned IT budget cut. Additionally the survey found that much of the IT budget (approx 63%) is used on just operating and maintaining complex infrastructure. Forrester Research highlighted that the top two management themes for IT departments in 2006 were improving IT efficiency and expanding IT value to the business (Betts, 2006). Despite these continued pressures there are few integrating frameworks which are value based to help CIOs manage differing pressures or priorities in support of value. Interestingly the adoption of management and improvement frameworks like the Capability Maturity Model Integration (CMMI) (Paulk, 1993) were ranked as the seventh highest priority. However, Ward (2006) noted high adoption rates of existing best practice frameworks indicating a propensity to use frameworks when they are available.

Additionally the annual Computer Economic survey (Scavo) in 2007 showed that whilst the median IT budget grew 5%, IT operational budgets as a percentage of corporate revenue dropped to 1.8% from 2% in 2006 indicating the IT budget is not growing as fast as corporate revenues. Whilst this might be manageable in the short term it is likely that CIOs require focused management efforts to continually increase the productivity of the IT function, supporting growing revenues with slower growing IT budgets.

1.5 New Challenges for CIOs

Today, IT organizations are being asked to deliver both substantial cost savings and increasing business value—a very difficult challenge, especially when coupled with rapidly increasingly IT workloads and business pressure for IT-enabled business innovation.

Figure 1.5-1 - CIO Challenges

Whilst on the one hand CFO's are squeezing CIOs to take cost out of IT (that is do more with less) CEOs are often asking CIO's to *show me the money* and demonstrate the value that IT is generating. Whilst this is already a challenge in itself, CIOs are also wrestling with managing increasing demand for IT services in firms which often translates into additional workload for the IT organization (Andreessen, 2001). Further challenges were introduced by legislation such as Sarbanes-Oxley which significantly increased the compliance workload on IT organizations. A representation of some of these challenges delineated by efficiency and effectiveness is shown in the figure above. Additionally with rising energy and oil prices, the cost of supplying power to computers is starting to exceed the capital cost and TCO cost of computers so CIOs are now facing a variety of efficiency challenges, how to take cost out of IT, how to do more with less, how to enable effective compliance and how to deliver an energy efficient enterprise infrastructure.

However, CIOs do not just have to deal with efficiency challenges; they are now facing effectiveness challenges also (Curley, 2005). CIOs increasingly have to deal with ever increasing security threats and are often measured on how effective they are at avoiding and recovering from information security attacks.

Increasingly CEO's are turning to CIOs as a source of inspiration and a delivery mechanism for innovation. In this context, I have been advocating that in the future, CIO may stand for Chief Innovation Officer.

There are often complaints about the IT organization's agility with legacy infrastructure and applications often inhibiting an IT organizations ability to deliver new services in an agile fashion (Bharadwaj, 2000). Perhaps an over-arching challenge that CIOs face is the one of *complexity*. Given the diversity of challenges that the CIO faces and the underlying fast clock-speed of the technology industry which underpins IT, it is clear that the environment that the CIO works in is very demanding. This set of often competing and conflicting challenges make the job of a CIO is indeed a very challenging one and the challenge of balancing and responding to these challenges are depicted in figure 1.5.1 above. As will be illustrated in Chapter 2, there is no CIO playbook or single integrating framework or unified theory to help the CIO operate successfully in such an environment.

1.5.1 New Measures for Success

While in the past IT organizations measured success primarily in terms of their services, for example, higher availability and service-level agreement compliance, today they are being driven to expand their success metrics to include those related to improving the bottom line, for example, increased revenue, improved time-to-market for products, increased market share, factory capital purchase avoidance, and measured improvements in employee productivity (Curley, 2004). As a result, IT organizations need to reduce their costs while simultaneously working with business to apply standard metrics and methods for forecasting and measuring realized IT business value. Such practices help with identifying previously unrecognized payoffs for IT spending, while actively measuring the ongoing value contribution of IT. A strategic partnership between IT managers and business executives is key to realizing business value.

Strategic alignment between IT and the business is a crucial factor in business value generation (Henderson and Ventrakaman, 1999).

Good strategic alignment implies a virtuous circle, that is, a positive bi-directional relationship between IT and business strategy. Increasingly business strategy depends upon robust IT Capability and IT, in turn, supports the business strategy. Alignment should be measured not only by the extent to which IT supports the business, but also by the extent to which business strategy capitalizes on IT capabilities. Tallon, Kraemer, and Gurbaxani (2000) produced two interesting findings: that close alignment between IT and business strategy is beneficial, increasing the payoff from IT investments, and, paradoxically, that increasing alignment beyond a certain point led to a decrease in payoffs from IT investments, primarily due to a loss in agility and flexibility. Indeed, IT innovations must be accompanied by innovation in business and management practices.

In a survey of 420 IT professionals reported by Cosgrove (2001), over 48% of those surveyed claimed that their largest IT initiatives were not directly linked with their own organization's business strategy. This strategic dissonance between business strategy and IT spending can seriously impact the financial performance of the business. Effective IT management and planning practices can help move IT and business strategy. A deeper level of alignment can be achieved by validating the IT organization's performance against the firm's values.

1.6 The Importance of IT Management Practices

Importantly in the context of this dissertation Dedrick, Gurbaxani et al (2002) identified that business practices around IT management have a significant impact on the value extracted from Information Technology Investments. Tallon, Kraemer and Gurbaxani (2000) in a study on executive perspectives on information technology found that firms that aligned IT with business strategy increased the payoff from IT investments. They also found that firms with higher level of IT investments gained greater payoff from alignment. These two results emphasize the important of business and IT alignment and lead to a conclusion that firms over-investing in IT compared to their peer-group can achieve higher returns from IT investments.

Mata, Fuerst and Barney (1995) concluded from a resource based theory analysis that Managerial IT skills was the only attribute of four attributes (capital, proprietary technology, technical IT skills and managerial IT skills) that can provide sustainable

competitive advantage. Bharadwaj (2000) found that firms with high IT capability tended to outperform a control sample of firms on a variety of financial performance measures. With this important evidence, it was surprising to find few best practice frameworks targeted at improving IT capability.

Resource-based theory argues that a subset of a firm's resources enable achievement of competitive parity while a further subset of these lead to sustainable competitive advantage. Barney et al (1991) argue that advantage can be sustained to the degree the firm is able to protect against resource imitation, loss or substitution. Peppard and Ward (2004) make the argument that we are entering a fourth era of information technology in organizations (data processing, management information systems, and strategic information systems being the first three). Their work proposes a *capability* perspective that specifically considers how organizations continuously derive and leverage value through IT. A core premise of their work is that technology itself has no inherent value and that IT alone is unlikely to be a sustainable source of competitive advantage. They argue that organizations need to understand, develop and nurture this capacity if they are to deliver value from IT on an ongoing basis.

In defining the IT capability Peppard and Ward (2004) define capability as that what the business can achieve through focused investment and deployment of competencies and resources. Further parsing this definition, IT capability can be defined as the strategic application of processes, resources and competencies in support of the organizations objectives (Kangas, 1999; Peppard, 2004). This definition can be further refined in terms of outcomes through leveraging the definition of Ross et al (1996) which defines IT capability as the ability to control IT costs, deliver systems when needed and effect business objectives through IT implementation. In this dissertation I use *what IT can do for the business* (Curley, 2004) as a spanning definition for IT capability.

Information Technology is defined using an extended definition from that of Weill (1990). Additionally, information technology is an overarching term used to define the integrated computer systems and solutions for providing information and automated solutions to support operations, management, analysis and decision making in an organization. The systems utilize computer hardware, software, middleware, network, storage, databases and of course the information that resides and flows through the systems.

Amongst others Dedrick et al (2002) have published an excellent summary of the empirical evidence linking IT investment and economic performance but this is not particularly useful for IT executives grappling with how they can increase value through IT in their own organization. Kohli & Devaraj's (2004) organizational process for realizing the business value of information technology investments is an example of academic research which is easily applicable.

1.7 *Theory of the IT Business*

Drucker (1994, P1) states "every organization, whether a business or not, needs a theory of the business" and "that a valid theory that is clear, consistent and focused is extraordinary powerful" (Drucker,1994, P1). Despite the significant amount of research work and a wide set of theories and IT best practice frameworks it appears there is not an obvious theory of the business in existence for IT organizations and CIOs. A key concern of managers is *both what to do* and *how to do it.* Many of the so called best practice frameworks in IT are focused on *doing things right* but there appears to be much less available in the realm of *choosing and doing the right thing.*

This appears to be analogous to a similar situation suggested in general management where Drucker (1994) described that there are many *how to do* tools available yet *what to do* is increasingly becoming the central challenge facing management. Again despite the proliferation of tools and frameworks like ITIL (OGC, 2001; OGC, 2008) and COBIT (ISACA, 2007) it appears there is a lack of an integrating framework which could act as guide and compass for CIOs in terms of *what to do* and then offer advice on the *how to do's* once *what to do* has been established. According to Drucker (1994) a theory of business has three parts

- assumptions and context about the environment of the organization
- assumptions about the mission and strategy of the organization
- assumptions about the core competencies needed to accomplish the organization's mission.

According to Teece (2002) success is achieved through owning and developing differentiating assets and capabilities and orchestrating them astutely. In an attempt to provide a framework that could act as a theory of the business for the CIO, linking capability improvement and value, closing the identified gap between theory and

practice (Sambamurthy and Zmud, 2000), the IT capability maturity framework (IT-CMF) has been researched and is presented in this dissertation.

1.8 Structure of the Dissertation

This chapter has set the scene for the research and dissertation and outlines why IT investment is important as well as outlining the difficult challenges facing CIOs. The lack of an all encompassing framework to help guide CIOs to better outcomes and the gap between theory and practice is also highlighted. Chapter 2 reviews important prior research from both an academic and industry best practice standpoint and introduces the IT capability and its context as a central construct for the research and dissertation. Chapter 3 defines the research problem, goal, and methodology as well as providing a chronology of the research. Chapter 4 describes the output of a case study at Intel IT which yielded a draft framework for the IT-CMF. Chapter 5 provides the theoretical derivation of the IT-CMF while chapter 6 describes the IT-CMF in detail. Chapter 5 also introduces the IT-CMF artifact schema which provides a diagram of the different artifacts produced during the research. Chapter 7 summarizes and explains how the IT-CMF can be used as a management and assessment system to help CIOs improve their IT capability and the value thus delivered. Appendix A details the IT-CMF assessment instrument while Appendix D gives an example of an IT-CMF assessment report. Appendix B shares classification taxonomy to enable further research and specification of the IT-CMF, whilst Appendix C gives a short overview of the critical processes underpinning the IT-CMF.

2 Chapter 2: IT Value and Capability

This chapter builds on the foundation from chapter 1 and introduces the concept of IT capability. IT capability and it's relation to value is used as a central construct to the research and this dissertation. This chapter summarizes key applicable prior research in areas such as resource based theory (Barney, 1991), dynamic capabilities (Teece et al, 1997), core competency (Prahalad and Hamel,1990), developing long term competitiveness through IT assets (Ross et al, 1998) and process theory for IT Business Value (Markus and Soh, 1998). A synthesis of the research in these areas helped inform and shape the IT Capability Maturity Framework which is detailed in chapters 5 and 6.

As introduced in chapter 1 creating value and measuring the value from IT enabled investments continues to be a topical and difficult problem to solve (Tallon 1999, Dedrick et al 2002, Curley 2004). Whilst most IT organizations are primarily evaluated based on performance metrics such as availability, cost and SLA compliance, there is increasing pressure to include a strong value component to this performance measurement. Indeed Strassman's (2002) comments about the CIO being done with mere technology and that their job was now to make money set the tone for an emerging change of posture for information technology management.

In chapter 1, it was noted that 73% of CIOs don't calculate ROI on their completed projects and 70% of companies find it difficult to calculate ROI (Alter, 2003). Repeated surveys (Alter, 2006) show that whilst there has been moderate improvement in IT evaluation, the profession continues to struggle with this issue.

Additionally, the famed Chaos report by the Standish group (Johnson, 1994) estimated that 31% of IT projects were cancelled before they were completed, 53% of those completed cost an average of 189% of the original estimate whilst on average only 42% of the initially proposed functionality is delivered. The Standish report also stated that less than 10% of IT projects were completed on time and on budget. Whilst there has been some improvement, Rubinstein (2007) reported that 35% of projects are categorized as successful based on the 2006 Standish report compared to an estimated 16.2% in the original Standish group report, this still indicates there is substantial room for improvement.

IDC reported that worldwide IT spending was expected to increase from $965m in 2004 to approximately $1.2 billion in 2008, a compound annual growth rate of 6% (Lu, 2004). Whilst worldwide IT spending is expected to continue to grow there is increasing pressure on CIOs to support business growth without big IT budget increases (Scavo, 2007). Computer Economics (Scavo, 2007) found that median IT budget growth was 5% in the US in 2007 compared to an average 4.1% growth in 2006. However they found that IT budget as a percentage of revenue dropped from 2% to 1.8% potentially indicating an improvement in overall IT productivity. Thus IT continues to be an important part of the worldwide economy and improving the productivity of IT is an important expectation of business management.

2.1 Existing Theory

The role of information systems in the creation and appropriation of economic value has a long tradition of research within which falls the literature on the business value of information technology (Piccoli and Ives, 2005). From the 1980's there has been significant research and debate on the subject of how IT investments lead to enhanced business value in such areas as improving organizational efficiency and effectiveness to outright business competitiveness (Dedrick et al, 2002). Previously the guiding theory of the firm used in these studies was the strategic positioning view or the industrial economics view (McFarlan, 1984; Porter and Miller 1985). More recently, there is an emerging body of research that utilizes the resource based view of the firm to examine the relationship between IT investments and effectiveness and competitiveness (Markus and Soh, 1995; Bharadwaj, 2000; Peppard and Ward, 2004; Wade and Hulland, 2004; Marshall et al, 2005).

In parallel information systems research also has a long history of drawing on theories from other fields (Wade and Hulland, 2004), and this research attempts to synthesize and advance some of more applicable research towards a dynamic capabilities and maturity model based approach to value creation from IT. Following a detailed literature review, the most promising research for this dissertation lies in process theories of business value, resource based theory and the theory of dynamic capabilities.

Of some importance also is task-technology fit (TTF) theory which holds that IT is more likely to have a positive impact on performance and be used if the capabilities of the IT match the tasks that the user or organization must perform (Zigurs et al, 1999). Indeed evolutionary theory (Darwin, 1859) also applies in that organisms evolve, under environmental pressure, such that they improve rather than evolve to some pre-established end-point. A key concept in this research is the proactive driving of evolution of an IT capability towards a higher maturity state, rather than reactive evolution which can lead to an IT capability and indeed its associated firm expiring due to competitive pressure.

2.1.1 Resource Based Theory

Resource based theory (RBT), which originated from the classical work of Penrose (1959) argues that firms possess resources, a subset of which enable them to achieve competitive parity and a further subset of these lead to sustainable competitive advantage. Penrose (1959) posited that firm growth is enabled by the best usage of available resources. RBT attributes superior performance to organizational capabilities (and to the resources which make up those capabilities). Bharadwaj (2000) found that firms with superior IT capabilities tended to outperform a control sample of firms on a variety of financial performance metrics. The resource-based view relies on two fundamental assertions, that of resource heterogeneity (capabilities and resources possessed by organizations may be different), and of resource immobility (the differences may be sustained over time) (Mata, Fuerst and Barney, 1995).

Under RBT, resources that are valuable and rare can lead to the creation of value. However, in IT many of the resources, (for example COTS – commercial off the shelf technology) are commonly available to most companies and it is how these resources are combined into capabilities that can lead to superior performance. Mata et al (1995) used resource based thinking to suggest that five key IS drivers led to sustained competitive advantage (access to capital, proprietary technology, technical IT skills, customer switching costs and managerial IT skills), yet they found empirical support only for managerial IT skills as a source of sustained competitive advantage. Marchand et al (2001) proposed an information orientation construct which was comprised of three entities, the management of information technology, the management of information and behaviours of users using IT.

Much of the resource based theory divides IT resources into two categories, IT assets and IT capabilities. Since IT assets such as infrastructure are the easiest resources to copy, they represent the most fragile source of competitive advantage (Wade and Hulland, 2000). However there is increasing evidence that competitive advantage often depends on a firm's superior deployment of capabilities (Christensen and Overdorf, 2000).

2.1.2 Dynamic Capabilities

Dynamic capabilities can be defined as the ability to integrate, build and reconfigure competencies to address rapidly changing environments (Teece et al, 1997). A key shortcoming of resource based theory in ignoring the environment within which resources exists, led to the development of dynamic capabilities thinking (Wade and Hulland, 2004). Dynamic capabilities thinking closes this gap by taking a dynamic approach where recognizing the changing environment, dynamic resources help a firm adjust its resource and capability mix to help maintain a firm's competitive advantage (Wade and Hulland, 2004). Dynamic capabilities theory posits that competitive advantage comes from owning and developing assets and then astutely orchestrating these assets to adapt to ongoing change (Teece et al 1997).

In the context of dynamic capabilities, a framework is needed which offers both an evolutionary improvement path for developing the strategic assets and processes of the IT organizations, whilst providing a mechanism for reconfiguring or altering IT investments in response to business strategy, business context and IT posture changes. In the environment of the IT organization, demand often exceeds available resources. A challenge exists of prioritizing business requests and allocating resources whilst developing the longer term capability of IT. Equally the challenge exists of how to be customer focused whilst making difficult decisions about which IT project investments to fund and which to reject.

Despite ongoing complaints about IT organization's lack of agility and inertia due to the legacy installations and budget required to maintain these (Curley, 2004); IT resources may take on many of the attributes of dynamic capabilities (Wade and Hulland, 2004). This paradox between the dynamic nature of information technology itself driven by Moore's law and the inertia in the IT organization and its budget may

be explained by the lack of a pragmatic theory and framework to help dynamically reallocate and reconfigure the IT budget and resources in response to a dynamically changing environment. It is in this context that the IT-CMF context diagram (figure 2.3.1) is introduced below, where business context and business strategy represents the key inputs that would drive dynamic reallocation of budget and resources in response to changes in the environment.

2.1.3 The Concept of Core Competency

The key notion of resource-based theory (Barney, 1991) is that an organization can create superior value and returns by developing and utilizing unique and often costly to replicate resource and process groupings to exploit business opportunities or to protect against business or other threats. When a firm can perform an activity well in a repeated fashion then this can be considered a competence. Competencies are the ability of the organization to develop, mobilize and use resources (Peppard, 2005) particularly leveraging processes. Core Competencies are what make an organization or indeed IT capability differentiating or unique in its competitiveness (Quinn and Hilmer, 1994). When a firm's self-knowledge of its own resources and processes is high (Prahalad and Hamel, 1990) then this allows further exploitation of specific competences. An organization that possesses an IT capability as a core competency can integrate information technology, business processes and governance processes to realize superior price-performance ratios and other measure of performance that exceed those of its competitors (Prahalad, 1993). Organizations that wish to compete using information technology should aim to establish the IT capability as a core competency.

A new lens which involves a set of critical processes which underpin the systematic development and execution of the IT capability in an organization is also introduced in this research. This draws upon the emerging field of process theory and business process management (Harmon, 2006). A key concept is that an architecture and infrastructure of related business processes exists in order to enable the IT capability execute stable and repeatable patterns of management activity in support of improved value creation and delivery. This leverages the concept of the self-knowledge identified as a requirement by Prahalad and Hamel (1990) for competency leveraging.

2.1.4 Process Theory of How IT creates Business Value

A body of research work in the area of process theory for IT business value has arisen due to the mixed empirical results on IT investment returns (Markus and Soh, 1998). An early significant contribution was Weill's (1992) introduction of the concept of *IT conversion effectiveness* to explain the failure of some IT investments to impact the bottom line of the firm. This led to more process theory work which attempted to trace the path taken by investments on the way to generating business value in the form of productivity increases and organizational performance increases.

Lucas (1993) proposed two conditions for improved conversion effectiveness, the first that IT is designed in a way that fits the firm's task effectively and, secondly, appropriate use of the effectively designed technology. Grabowski and Lee (1993) introduced the concept of strategic fit where they focus on the alignment between the application portfolio, firm strategic type and cost structure as being important for conversion effectiveness. Markus and Soh (1993) identify that IT investment can be wasted due to poor IT management and failure to select the right projects. They introduced the concept of IT assets as an intermediate outcome between IT investment and improved performance. IT assets are described as the result of a conversion process which is a necessary but not sufficient condition for realizing business value. Beath, Goodhue and Ross (1998) defined these assets more specifically and also introduced the concept of accompanying processes as being necessary for releasing value from the IT assets.

Sambamurthy and Zmud (1994) introduced the notion of four IT impacts as result of IT management roles and processes. These impacts were new/improved products and services, dynamic organizational structures, transformed business processes and enriched organizational intelligence. A conclusion from Sambamurthy and Zmud's model is a necessary and sufficient relationship between IT management competencies and IT impacts: i.e. the greater the IT management competencies, the greater the impact.

Markus and Soh (1998) synthesized this work into a sequenced process model consisting of a conversion process, a use process and a competitive process. Developing long-term competitiveness through IT assets and processes outlined by Ross et al (1998) is detailed further in the following section.

2.1.5 Developing Long-term Competitiveness through IT Assets

To generate sustainable competitive advantage through information technology, Ross, Beath and Goodhue (1998) argue that firms must build and leverage three assets namely, a strong IT staff, a reusable technology base and a partnership between IT and business management. By building an especially effective IT capability, firms can enhance competitiveness through IT. The capability is defined in terms of an ability to control IT costs, deliver systems when needed and effect business objectives through IT implementation. The results of their two years study of IT management practices suggest that the quality of the IT assets dictates the quality of IT planning, delivery and support processes. Although firms introduce some systems to reduce costs and can evaluate them in terms of their success in doing so, they want many IT initiatives to support a firm's strategic objectives.

According to Ross et al (1998), IT assets can be classified as people, technology and relationship assets as shown in the following diagram.

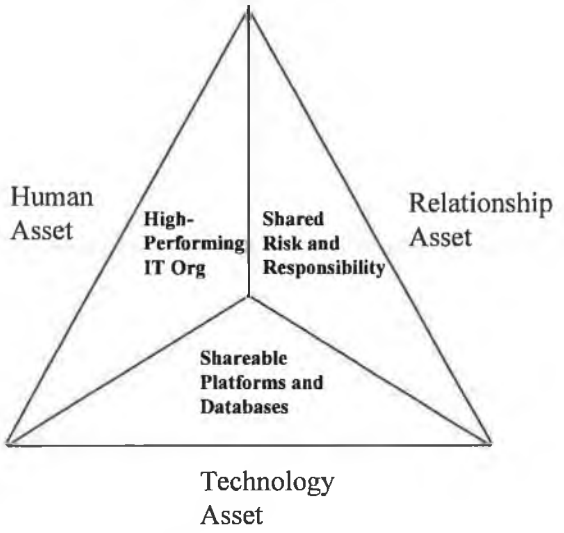


Figure 2.1-1 - IT Assets (Ross et al, 1998)

According to Ross et al (1998) the defining characteristic of a valuable human asset is an IT staff that consistently solves business problems and addresses business opportunities through information technology. Increasingly IT employees must effectively be bilingual speaking both IT and Business language[4]. The technology assets consist of an integrated IT architecture, a roadmap, sharable technical

[4] This concept of IT employees needing to be bilingual was introduced by Intel IT Chief Architect Gregg Wyant in internal meetings in 2007.

platforms and databases to implement the architecture. The relationship asset is maximized when IT and business unit management share the risk and responsibility for the effective application of IT in the firm. This includes business partnership ownership and accountability of IT projects and top management leadership in establishing IT priorities.

From Ross et al (1998), these three IT assets lead to business value through their impact on a firm's IT planning, delivery, and operations and support processes. When these processes are fast, cost-effective and strategically aligned, they result in competitively important IT-enabled business processes.

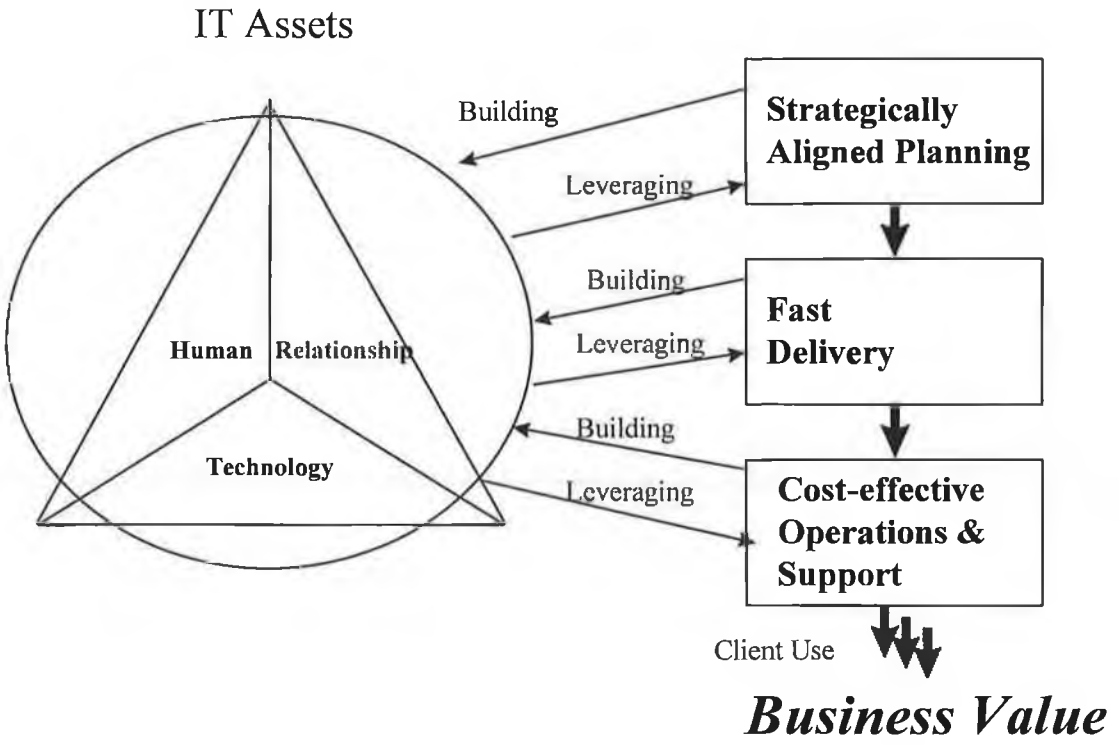


Figure 2.1-2 - IT Assets and Value Chain

The interplay between the three assets and the three IT processes determines what business value is produced and how well a firm is positioned to generate and sustain competitive advantage. Through a thorough understanding of a company's strategic context, managers can identify business and IT maxims that can help them determine the IT capabilities necessary to accomplish their business goals.

Before attempting to develop a theory and framework which might satisfy the requirements of providing both an evolutionary roadmap for strategic resource development and a dynamic model for astute orchestration of these resources and assets, I will define IT capability and value, followed by a review of the so called best practice models/frameworks that are used in the industry.

2.1.6 Using the Management Control System for Competitive Advantage

The recursive and reciprocal relationship between strategy and management control systems (MCS) is becoming a more important area for research (Pant and Yuthas, 2000). Traditionally the management control system has been defined as the process by which managers make sure resources are obtained and used effectively and efficiently in the accomplishment of an organizations goals and objectives (Anthony, 1965). There is an ongoing interaction between the management control system and the strategic planning system in an organization where strategic planning is defined as a process of deciding on key changes in the objectives of the organization, in the resources that are applied to attaining these objectives, and in the policies and procedures that are to govern the acquiring and deployment of these resources (Anthony, 1965). These two systems increasingly can mutually reinforce each other. With increasing digitization and process perspective an updated definition of a management control system can be stated as the formal, codified, information-based and other routines and procedures which are used to drive, change or sustain patterns in organizational activities (Simons, 1995).

Much of the literature claims there is a positive relationship between the improvement of MCS practices and an increase in firm performance and this concept is leveraged in this research. Thus a core assumption is that better and more sophisticated and integrated use of common MCS techniques such as planning, budgeting, performance measurement, product costing will lead to improved organizational performance.

The concept of closed loop management control has been one of the more important guiding concepts to the field of management (Salman and Younis, 2005) and the merits of closed loop control have been a key topic for management research literature in the past few decades (Salman and Younis, 2005). To manage a system

consisting of a set of resources one must be able to measure and control them. A control loop can be set up that first measures the performance of the output from a system, then applies policies and goals to decide what to do based on the observed output and then uses controls to change the resources, the level of resources or the allocation of resources being provided by the system. In doing so continuous adaption and control can be achieved to ensure the output from a system tracks as closely as possible to the desired objectives consistent with defined policies.
Salman and Younis (2005) state that feedback is a cardinal part of an effective, progressive and competitive management and organization. Management using a control loop is a core approach in achieving a dynamic capabilities perspective as detailed in chapter 5.

2.2 Context Building: The IT Capability

In building a context for this research, the concept of IT capability is used as the central construct. In general, a capability is understood as a distinctive attribute of a business that creates value for its customers. Capabilities directly affect the performance of an organization and differentiate it from others (Teece, Pisano, and Shuen, 1997). Capabilities are best measured by the value they generate for the organization (Kaner and Karni, 2004). In terms of IT capability, there are a variety of similar definitions described in the literature but few references to how to systematically develop and improve IT capability. There are also challenges in measuring the value of that capability (Sward, 2006).

2.2.1 Defining IT Capability

Before defining IT Capability in the context of this research and dissertation let's review a number of the existing definitions which refer to both the constituent components of IT capability and the outcomes delivered. In general capabilities can be defined as repeatable patterns of actions in the use of assets to create, produce and/or offer products or services to a market (Sanchez et al, 1996). According to Peppard (2004) IT capability is the strategic application of IT competencies and resources in support of an organization's objectives, whilst Kangas (1999) just refers to it as the strategic application of competencies. A similar definition is that IT capability is the combination of IT-based assets, resources and processes or routines that support business operations in value adding ways (Bharadwaj et al 1999, Sambamurthy and Zmud 2000).

From Peppard's (2004) research we can observe a three layer hierarchy in creating and managing a capability; resources and competencies leading to capability. However this definition seems to deemphasize the importance of processes; where a process is defined as a sequence of tasks which when properly performed produce a desired result (Humphrey, 1998). According to Christensen and Overdorf (2000) three factors affect make up a capability: resources, processes and values.

The combination of resources, processes and values/motivation can be considered composite factors that enable competencies. Values and Motivation are important since even if processes and resources are in place, without motivated employees the results desired (in pursuit of a particular set of goals) will likely not be delivered as well as they could be.

A pragmatic definition which I have extended from Agarwal (2004) is that IT capability is the ability to execute stable and repeatable patterns of IT management activities *in support of value creation*. Ross et al (1996) defines IT capability as the ability to control IT costs, deliver systems when needed and effect business objectives through IT implementation. A macro level definition of IT capability is simply *what IT can do for the business* (Curley, 2004). A core assumption is that as the IT capability's outcomes and business processes become more mature, more IT value is created.

2.2.2 Process View and Dynamic Capabilities

Aligned with this, Brown and Ross (1999) state that organizations are moving to more process-based structures and that this transition has implications for structures and processes of IT organizations, arguing the need for process based IT organizations to deliver higher performance. The emerging field of business process management begins with the concept that all processes are business assets and advocates achieving performance improvement through systematic design and management of a firm's business processes (Chang, 2006).

In an increasingly competitive world, success is often dependent on owning and developing difficult to replicate assets, and orchestrating them astutely. The latter capability is what Teece (2002) refers to as Dynamic Capabilities. This research aims to build a model for the IT capability and then develop a framework to help

orchestrate how the assets are used to increase value. Leveraging Teece's (2002) work on the theory of the firm, successful organizations are those that are not so much designed to minimize transaction costs (although they do this) but those where organizational capabilities capable of developing and reshaping clusters of assets in differentiating combinations to serve the needs of the organization.

The business firm (any by implication the IT capability) can be thought of as a repository for knowledge, the knowledge being embedded in business processes and routines (Teece, 2002), and increasingly digitized through IT. The notion of dynamic capabilities has two important aspects, the first the ability to sense the changes in the environment (be that changes in business strategy or the business context) and then an emphasis on the role of strategic management in developing, adapting, integrating, sizing and reconfiguring capabilities towards the changing environment (Teece and Pisano, 1994).

As described above research by Overdorf and Christensen (2000) suggests three factors that effect what an organization can and cannot do, namely IT resources, processes and values. IT Resources are the physical resources like people, infrastructure and the intangible resources like the relationship with the business and Intellectual Capital. Processes can be defined as patterns of interaction, coordination, decision making and communication used to transform resources into products and services of greater worth (Overdorf and Christensen, 2000). Values, as also defined by Overdorf and Christensen, extend beyond the traditional ethical connotation, are the standards by which employees set priorities in key decision making. . Christensen defines values broadly as the standards or guidelines by which employees set priorities to enable them to judge whether an action is appropriate or not. This theme is very closely related to IT Governance and as companies grow larger it is important to enable employees make independent decisions about priorities which are consistent with the business strategy and model of the firm. Governance (Weill et al, 2004) is the accountability and decision making framework in the firm leading to desirable behaviour in the use of IT in the firm.

2.2.3 The Maturation of the IT Capability

A core goal of management (and associated control theory) applied to a capability is to create conditions of sustainability, controllability, predictability, (Salman and

Younis, 2005) *and by extension value contribution.* When the IT Capability has achieved these conditions it should be in a position to contribute in an optimal fashion to value creation. In the formative stages of an IT capability much of what gets done is attributable to resources and in particular people (Christensen and Overdorf, 2000) – this is unless an out of the box application which already has digitized processes for managing the IT capability is available[5].

Over time as people repeat recurrent tasks, processes become defined (unless the organization has the foresight and knowledge to define up front what the processes are and the related inputs and outputs). As business strategy becomes better understood by the IT organization, the values of the firm become important and IT people make decisions based on what is important driven by company strategy or what is implicitly or explicitly defined by company strategy. Thus there is an evolution of the IT capability, starting from ad hoc use of resources to well defined processes and visible values as defined by IT Governance. Ultimately when resources, processes and values coalesce this could be defined as maturation of culture. (Christensen and Overdorf, 2000).

2.2.4 Strategic Alignment

IT capability exists in the context of two important business elements – business strategy and business operations (Henderson and Ventrakaman, 1999). Much has been documented about the importance of alignment between the business strategy and IT strategy. Tallon (1999) found that businesses with a higher focus on IT achieve a higher payoff, whilst he also found that IT Management practices contribute to IT payoffs. Business Value is realized through the interplay of complementary IT and Business Capabilities (Barua and Mukhopadhyay, 2000).

Tallon and Kraemer (2007) introduced the concept of the interplay between strategic alignment and IT flexibility. Their research identified four states of value harnessing;

- Worst Case: Low strategic alignment and IT flexibility
- IT Value Potential : Low strategic alignment and high IT flexibility
- Value at Risk: High strategic alignment and low IT flexibility
- Sustained IT value : High strategic alignment and IT flexibility

[5] Out of the box applications like HP Mercury's IT Governance center are emerging which aim to provide configurable digitized processes for key IT processes enabling fast starts for new capabilities or fast migration paths to higher maturity capabilities for existing IT organizations.

Thus the interplay of strategic alignment and the controllability and sustainability of the IT capability is important.

2.2.5 Business Context

Ross (2005) argues that IT executives should forget strategy and focus IT on the company operating model. Ross argues that to make IT proactive rather than reactive, firms should define an operating model. She defines operating model as the necessary level of business process integration and standardization for delivering goods and services to customers. Ross introduces four operating models:

- Diversification (low standardization and low integration)
- Unification (high standardization, high integration)
- Coordination (low standardization, high integration)
- Replication (high standardization, low integration)

each of which drive different requirements for the IT capability. For example, a unification operating model drives the need for cost efficient firm-wide shared services whilst diversification drives the need for highly agile solutions delivery based on a lower level of firm wide shared services. Ross's model is a key component of what I call Business context. Business context also includes prevailing economic conditions, industry structure and competitive dynamics amongst other factors.

The business context in which a business operates is naturally a key influence on business strategy and by extension, a modulator of the focus of IT capability. Environmental conditions such as market demand, regulatory, competitive issues and other factors will significantly impact the business strategy and how the organization creates value. This is aligned with Lawrence & Lorsch's (1967) contingency theory – i.e. the best way to organize a company (and by extension the associated IT capability) depends on the circumstances in which the company operates.

As an example in a Manufacturing company sometimes the company's focus might be *output at any cost* when the company has competitive products being sold into a

hot market, whilst on other occasions the focus could be *cost effective output* when market demand is limited or a price war is at play. Different business and environmental conditions will likely drive changes to business strategy which in turn would likely drive different portfolios of IT investments to be chosen and indeed potentially differing IT postures. IT posture (defined as the relative level of aggressiveness or assertiveness with which the firm leverages IT in support of its business objectives) is also proposed as a potential influencing variable for the value that can be delivered through IT (see more on this topic later in this chapter). Depending on the business environment and on the track record of results delivery from IT investments the IT posture may be bullish, bearish or neutral in a particular firm or company. In the context of this research the maturity of the IT capability is proposed as a primary modulator of IT enabled value.

The successful combination of business strategy, operations and IT capability leads to value. This reinforced by Strassman's statement that Information Management has only value in the context of business management (Strassman, 1995).

2.3 Understanding and Controlling the IT Capability

The core assumption of a firm or organization is that it is a coordinated set of activities that produce desired results (Samuel, 2002) enabling the creation of shareholder value. To accomplish that concerted activities are required to plan, coordinate, execute and control the use of resources to accomplish the desired goals and output. (Salman and Younis, 2005). In alignment with this definition we can further define the IT capability as a coordinated set of activities leveraging processes and resources that produce results in support of the firm's objective, within the constraints of funding made available (Tiernan and Peppard, 2005).

The figure below is the first IT-CMF artifact (A0) and is a context diagram which shows the relationship between IT capability and business strategy/operations. IT capability should be driven by and support business strategy and IT capability should also underpin firm's business operations. This model builds on Henderson and Ventrakaman's (1993) strategic alignment model and Peppard and Ward's (2004) IT/IS alignment model where IT capability comprises both IT strategy and IT infrastructure and operations in the diagram.

It also takes account of Tallon and Kramer's (1999) process model of alignment of business strategy and IT, and seeks to avoid both strategy shortfall and technology shortfall. Strategy shortfall occurs where the business fails to take advantage of the IT capability and technology shortfall occurs where IT does not deliver to meet the needs of the business strategy (Tallon and Kramer, 1999). The net output of this relationship and structure should be increased value although depending on a number of factors including business conditions and management maturity, value may well be destroyed as well as created.

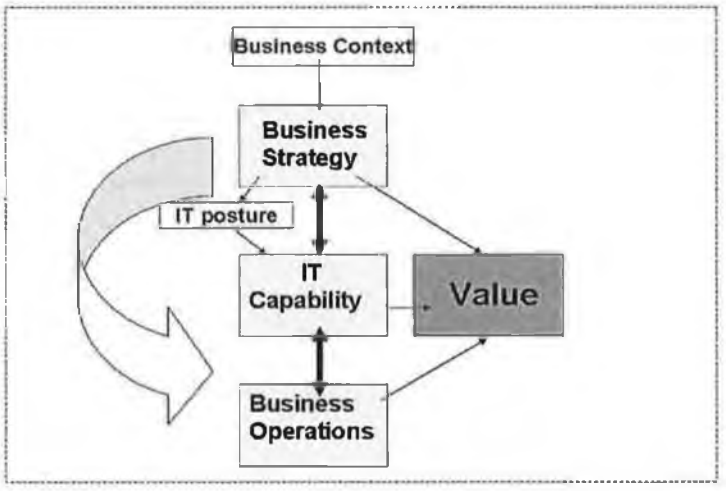


Figure 2.3-1 - IT Capability Context Diagram

This schema incorporates a dynamic capabilities view as business context and business strategy act as external stimuli to drive reconfiguration of the IT capability to create value. When strategy or context is changed or modified, management makes changes which are translated into budget increases or decreases as well as reallocation within the existing budget. These changes drive changes in the existing service portfolio as well as the workflow of new services being developed and ultimately if successful drive increased value to the organization through services that are in continuous alignment with the ongoing business context and strategy.

When the IT capability has achieved a state of sustainability, controllability and predictability it can react and proact in the face of dynamically changing conditions and strategy.

2.4 *Managing and Controlling the IT Capability*

In the context of a capability three elements, purpose, effectiveness and efficiency, are at the core of managing and controlling that capability (Berry et al, 2005). Efficiency is the relationship of outputs to a given set of inputs; effectiveness is a measure of the achievement of purpose. The establishment of purpose gives focus and direction to the patterns of activity, allocation of resources and use of competencies within a capability. It will be of no surprise if IT organizations are not perceived as delivering business value, if no specific purpose related to IT value generation has been defined and if no specific goals measures of efficiency and effectiveness have been defined or are in use.

Using the definition of cybernetic control posited by Tocher (1976) four necessary conditions must be in place in order to exercise control of a system or capability

- A defined purpose or objective exists
- An ability to measure process outputs in terms of the purpose or objective exists
- An ability to predict the effect of proposed control actions exists
- An ability exists to take action to reduce deviations from the purpose or objective.

Thus in attempting to maximize the value contribution of an IT capability, a clear purpose or mission needs to be stated. Often this is stated in terms of an IT mission statement and complemented by defined principles of how IT should be used as part of the IT Governance Process. In order to measure process outputs in the context of value, we need to define IT business value and IT posture.

2.4.1 Defining IT posture

In the context of the IT capability, IT posture is defined as a rationalized mental attitude towards the use of IT in the organization. This means the leadership and management in an organization have thought through their relative position with respect to the use of IT in the organizations. Posture can be measured across a number of dimensions with a first order dimension being that of how aggressively IT is adopted.

Moore (1991) in his book *Crossing the Chasm* identified five adoption states: Aggressive Innovator, Early Adopter, Early Majority Adopter, Later Majority Adopter and Laggard Adopter: in this research, I use these states as a proxy for IT posture. Depending on an organization's experience with IT and other factors such as economic climate, an organization may be bullish, neutral or bearish with respect to the adoption of IT. In some organizations with well developed governance, executives may have explicitly defined their IT posture perhaps aggressively using IT in order to attempt to achieve first mover competitive advantage. Other organizations may have a less aggressive approach to IT, seeking only to minimize IT spending and treating it like a necessary evil.

Tallon and Kraemer (1999) investigated the link between strategic intent for IT and IT business value. They found that firms with a higher focus on IT achieve higher payoffs. They also found that IT management practices contribute to IT value and that a firm's choice of IT management practices relates to strategic intent for IT.

2.5 Defining Value

The notion of value is an important one to grasp in the context of the IT organization with multiple definitions abounding. John Hill, CIO of Siemens Business Services says that "Value has to either translate into improved revenue or lower cost, Ultimate value has to be described in common-sense business terms" (Allen, 2006; P1). Thus IT value is really a contribution to the company's top and bottom line. We define IT Business Value as the contribution that IT makes to a company achieving its strategic objectives (Curley, 2004). This definition is also valid in the context of a non-profit or public sector organization where IT Business Value is the contribution IT makes to helping an organization achieve its strategic objectives.

2.5.1 Business Value Linkage

In their paper *quantifying the business value of Information technology*, Banker and Kauffman (1991) developed a conceptual framework and modeling approach which linked intermediate outputs to business value and which sought to help quantify the business value of IT. The key application of this framework is that it helps structure

an analysis of an IT investment so that the area's most positively impacted (tangible or intangible) are included in cost-benefit analysis.

Business Value linkage is used to represent the processes by which the direct outputs from information technology are transformed within a firm and its operating environment into enhanced revenues, reduced costs and new strategic opportunities to increase market share. The Business Value Linkage framework is in effect the classical *black box* approach to modeling. The inputs, outputs and the black box processes involved in the conversion are identified and in so doing the IT investment (input) can be linked to strategic or operational benefits for a firm. To provide a systematic framework for identifying the potential benefits of IT investment, Banker and Kauffman (1991) identified three broad categories of impacts, namely;

1. strategic and operational costs for existing operations
2. direct and potential revenue gains from existing and new products
3. market segment and market share improvements, due to changes in a firm's competitiveness or to effects that IT has in changing the basis of market competition.

Banker and Kauffman's three broad categories of IT value impact can be extended by focusing on two primary value adding mechanisms of IT (Curley, 2004)[6]

- Enabling and supporting business continuity
- Enabling and supporting business change and growth

2.5.2 Business Continuity and Business Change

Business continuity includes providing services to enable a business to operate and generate revenue today, whilst business change includes creating new business solutions and opportunities that enable future value. Significant contributions to future value are typically achieved through helping grow revenue, reduce costs, improve margin through better asset productivity and improving investor expectations of a company's ability to grow. In contrast, ensuring business continuity through lowering

[6] This notion stems from the portfolios observed to be under management by Deutsche Bank. Three portfolios were continuously managed Mandatory, Run the Bank and Grow the Bank. Mandatory referred to investments which were dictated by legal or similar requirements whilst the two other portfolios represented the investment to keep the bank running and growing respectively.

business risk and automating business processes and the like, enable current value generation to continue on a day to day basis.

Thus a broader set of value impacts can be defined as follows:

Figure 2.5-1 - Primary Contributors to Business Value

Shareholder value is primarily increased through growing revenue, improving operating margin (achieved through improved efficiencies), improving asset efficiency, managing risk and improving expectations which can be a key driver of total shareholder value as manifested by the P/E ratio for publicly quoted companies. Total Shareholder return is a function of 3 key factors: profit growth, free cash generation, and multiple expansion is a good overall measure of value generated. Investments in IT and IT capability should ultimately be targeted to influence at least one of the three key measures.

Pope et al (2003) in the Intel white paper *Defining the Value of e-Business* introduces seventeen standard measures (also known as Value dials) to help quantify the value of IT systems. This is an example of operationalizing of value within a particular firm and value dials become standardized measures of value which ensure consistency and validity across differing business cases in an organization. These measures are based on the premise that value is created by transforming business process which is enabled through improved or new IT systems. In further literature, both Curley (2004) and Sward (2006) have described the Intel Value dials approach which allows

the targeting and measurement of the impact of IT enabled investments on key business variables.

2.6 Why a New Framework?

From an IT practitioner viewpoint there is increasing interest in the utilization of more formal process methodologies. As IT increases maturity and pressures increase from the business for reliable performance and improved efficiency, effectiveness and value, CIOs are applying process methodologies to help stabilize IT and operations (Cameron, 2005). Cameron notes that the traditional home-grown process methodologies of IT organizations are being replaced by more standard approaches such as ITIL and Six Sigma (Motorola, 2008). Process improvement approaches are popular because of the belief that the quality of a system or organization is highly influenced by the quality of processes used within it.

Without any integrating framework and methodology focused on value to help, CIOs can quickly find themselves under pressure as they are aware that even if they deliver the next CRM or ERP solution exquisitely, it will only keep them or their company in the game. Additionally it seems there is a continuing structural problem in the IT profession and industry around managing the returns from IT investments. Evidence introduced in chapter 1 and subsequent research by the author shows that few CIOs can state the returns from their IT investments.

2.6.1 Existing Frameworks

A review of existing IT Management frameworks reveals that there is a plethora of frameworks for IT management already in existence. In the context of this research three key issues emerge following the review of these:

- comprehensiveness: few if any frameworks cover the full scope of an IT organization or capability
- validation: lack of theoretical and empirical validation
- value: lack of value focus

In order for a framework to help the CIO in an integrated fashion it should cover most if not all of the process footprint of the Enterprise IT organization. The notion of being value based is critical as this is ultimately what CIOs are increasingly being measured on. Finally it is important that frameworks have been validated to give confidence to practitioners that investing in adoption of the framework will indeed lead to value.

A table showing a brief summary of IT frameworks is shown below. Whilst this summary is not an exhaustive list of frameworks it is a good representative sample of those in popular use. Each of these frameworks could be discussed in great detail and there are many sources of information on each of these. Some of the frameworks are widely adopted and used and provide significant value. However none of the frameworks fully address the issue of comprehensiveness, validation and value focus.

NAME	SUMMARY	FOCUS AREA
AS 8015	Australian Standard for Corporate Governance of IT	IT Governance
CMMI Capability Maturity Model Integration	Capability Maturity Model® Integration (CMMI) is a process improvement approach based on statistical process control	Quality, Project Management, Software Development
CoBIT – Control Objectives for Information Technology, IT Governance Institute	A process model derived from an information security and risk management approach comprising of 34 processes	Risk Management, Information Security, Information Technology management
eSCM-SP: eSourcing Capability Model for Service Providers	Best Practice Framework for IT Services managing cost and risk	Sourcing
Earl Michael J and Feeny, David F. "Is your CIO adding Value"	CIO Leadership framework	Leadership, Value
Frenzel, Carroll 1996 "Management of Information Technology"	Strategic and Implementation considerations for IT Management	Management of Application Portfolios, Controlling Information Resources

NAME	SUMMARY	FOCUS AREA
Information Services Procurement Library (ISPL)	A systematic approach for tendering and supplying IT projects and services	Sourcing, Procurement
ITIL – IT Infrastructure Library, OGC Office of Government Commerce 2006	Framework for Best practice Guidance for IT Service Management	IT Service Management, Delivery and Support
Niessink, Frank 2004, IT Service CMM – IT Service Capability Maturity Model,	Framework for IT Service Management	IT Services
ISO 9000 Quality Management System	Standard which validates that correct processes are executed based on four key processes – management of resources, product quality, maintenance of quality records and continuous improvement	Quality, Resource Management, Continuous Improvement
ISO 270001 Information Security Management Systems	Model and Guidance for reducing a firms exposure to Information Security Risk	Risk Management
ISO 20000	Formal Standard for IT Service Management	IT Service Management
Kaplan and Norton – Balanced Scorecard	A performance management system which focuses on strategically aligned improvement	IT-Business Alignment, Performance Management
Kerzner, Harold 2004 "Advanced Project Management"	Integrated Best Practices and Project Management Maturity Model	Project Management
Luftman, 2004 "Managing the Information Technology Resource"	A list of 38 processes stratified by three layers strategic, tactical and operational	Resource Management
NASCIO EAMM	Enterprise Architecture Maturity Model	Enterprise Architecture
Six Sigma	A structured, disciplined approach to process improvement grounded in Statistical Process Control	Process Improvement

NAME	SUMMARY	FOCUS AREA
Spice/ISO 15504	Spice is a framework for assessment of processes and Spice stands for Software Process Improvement and Capability Evaluation	IT Service Management
Strassman, Paul 1995 " The Politics of Information Management"	Five interacting vectors (Governance, Business Plan Alignment, Process Improvement, Resource Optimization and Operational excellence) deliver and sustain information management superiority	Information Management Superiority
TQM Total Quality Management	Generic Improvement approach which leverages the Shewart/Deming Plan, Do, Check, Act framework to achieve competitive advantage	Quality, Continuous Improvement
Open Architecture Group, TOGAF	Enterprise Architecture Framework	Enterprise Architecture
Peppard J and Ward "IS Capability" – towards a fourth era of IS	Documents critical competencies of IS management	IS Management
PMBok, Project Management Body of Knowledge	Techniques for effective Project Management	IT Project Management
Prince2 –Projects in Controlled Environments	Project Management Methodology	Project Management
VALIT	Value Model for IT	Value
Zachman	Enterprise Architecture Reference Model	Enterprise Architecture

Figure 2.6-1 - Summary of Frameworks and Focus Areas

An analysis of the focus areas showed that while a wide range of focus areas were covered the most frequent were project management, quality management; resource management and IT service management as shown in the table below.

Focus Area	# of Occurrences
Project management	4
IT Service Management	4
Enterprise Architecture	4
Quality	3
Resource Management	3
Sourcing	2
Governance	2
Software	2
Risk Management	2
IT Management	2
Information Security	2
Process Improvement	2
Continuous Improvement	2
Procurement	1
IS Management	1
Value	1
Leadership	1
Alignment	1
Performance Management	1
Information Management	1

Figure 2.6-2 - Summary of Focus Areas

Of these frameworks the IT Information Technology Infrastructure Library (ITIL) is one of the more widely adopted (OGC, 2007). ITIL is a set of techniques and concepts for helping manage IT infrastructure, development and operations. Many of the concepts in ITIL originated from early IBM work on systems management concepts which were documented by the primary author Edward van Schaik in his 1985 book *A Management System for Information Systems*. Van Schaik (1985) drew upon one of the earliest systematic treatments of the topic of IT Management which was published by Richard Nolan in 1974. Microsoft Operating Framework (MOF) has gained significant traction in IT operations organizations and focuses on a subset of the ITIL libraries.

COBIT (ISACA, 2007) is another framework which has attracted significant press and has its roots in the information security and auditing domain. An extension of COBIT called VALIT (ISACA, 2008) extends the risk management and security focus into the domain of value management. CMMI (SEI, 2003) is used often for software development and project management practices in IT organizations. The IT Service CMM (Niessink, 2005) applies a CMM approach to the IT service Management aspect of IT and has gained some traction in the Netherlands and surrounding countries. Reviewing the overall list there is no single framework which covers the entire footprint which a CIO managing an enterprise IT function has to cope with. Additionally there is no framework which comprehensively addresses the economics and value focus as well. In the next section I will elaborate further highlighting areas of strength and weakness of the more popular good practices and relevant academic while also building a theoretical frame of reference for the research question.

2.6.2 Framework and Literature Analysis

An analysis of both academic and practitioner literature indicates that there is a plethora of IT frameworks, many of which are quality focussed. Indeed Van Schaik (2006) describes the framework landscape as a *forest of frameworks*. While some of these are very detailed, few if any cross the full spectrum of business process activity required to support a complex IT operation and few adopt a value lens for process and output. Additionally with a continued fast rate of business change and innovation the focus for enterprise IT has shifted from minimizing total cost of ownership and adding incremental solutions to providing a platform for business agility.

Rozemeijer et al (2007) note with the growing number of frameworks covering different domains of IT, the coherence between the domains has been somewhat neglected. Rozemeijer et al (2007) note that despite the individual domain expertise the overall picture which is needed to deliver end-to-end services across domains has received less attention in framework development. They also note that most frameworks focus on the relationship between processes *within* a certain domain, with just a few covering most domains and even if they do, they lack integration and are too high level to add value. Rozemeijer et al (2007) argue that effective IT service management can only be achieved when *both* the cohesion of processes within a domain and the inter-domain dependencies are understood. However even this is not

enough as IT service management is only a component of an overall IT capability required to deliver value to an organization. As an example in Enterprise IT many other processes are required beyond IT Service Management such as Innovation Management, IT Governance and Enterprise Architecture.

With the significant challenges facing CIOs many are turning to best practice frameworks and adoption rates continue to increase (Ward, 2006). In enterprise IT organizations there, appears to be a structural change in the organizational logic with a shift from organizing around functions and technical capabilities to organizing the IT structure around customers and processes (Agarwal and Sambamurthy, 2002; Rozemeijer et al, 2007). The Intel IT transformation (Curley, 2006) is an example of this where the first step was to organize around the customer, followed by successive efforts to identify processes and subsequently improve their maturity.

IT Infrastructure Library (OGC, 2007) is probably the most popular framework serving the area of IT service management. ITIL, whose development was driven initially by the Office of Government Commerce (OGC) in the UK, originally had a focus on infrastructure management and operations and from this domain it derives its name *IT Infrastructure Library*. A significant shift happened in the upgrading from ITIL V2 (2000) to ITIL V3 (2007) with a shift in focus from operational processes to focus on guidance on service management. With version 3 came a new official name, ITIL Service Management Practices which reflected an up levelling of scope. ITIL focuses on service strategy, service design, service transition, service operations and continual service improvement. It has a vibrant user community and is quite widely adopted. Despite its wide adoption and longevity of existence, ITIL is not value based, does not cover the full spectrum of IT process activity and has had limited empirical validation (Spafford, 2007). In ITIL Version 2 there was no significant reference to Value, whilst version 3 importantly has begun to integrate a value lens into the framework philosophy.

The Capability Maturity Model Integration (Chrissis et al, 2003) is the dominant so called best practice model used in the field of Software engineering and is increasingly used as a *good practice* in the field of project management. Maturity models are based on the hypothesis that control, effectiveness and predictability of an organizations processes improve as an organization moves up the different levels of maturity (Ahern et al, 2001). CMMI replaced the original Software CMM model (SE-CMM) which expired on 31 December 2007. SE-CMM was one of the first

maturity models developed and it can be described as a structured collection of elements that describe the maturity of software processes in an organization (Paulk et al, 2003). Like ITIL, CMMI is quite widely adopted but again its scope and adoption is limited to software engineering and project management areas and this again fails to meet the requirements of value based, integrated and validation discussed earlier in this chapter. From an enterprise IT standpoint a number of IT organizations have adopted CMMI as a practice in their solutions delivery and project management process areas, however this is again not sufficient as the processes required to run and manage enterprise IT capability are much broader than just these two processes.

COBIT (ISACA, 2007) developed by ISACA and the IT Governance Institute is another good practice framework which is increasingly used in the domain of IT governance. COBIT, or Control objectives for information technology has its roots in the auditor and information security domains and has recently evolved into the IT Governance domain. It is a comprehensive framework and is organized around four main processes; plan and organize, acquire and implement, deliver and support and monitor and evaluate. The primary goal of implementing COBIT is about achieving *control objectives* for IT, which reflect on its origins in the auditing area of information systems. The mission of the COBIT development initiative was to create an international set of generally accepted control objectives for use by business managers and auditors. The latest version of COBIT 4.1 (COBIT, 2007) included improved performance measurement guidance, improved control objectives and IT/Business goals and a significant focus on IT Governance. Whilst COBIT is a good process model containing 34 processes and 210 control objectives it appears that there is mismatch in the level of abstraction of some of the processes, for example PO1 *define a Strategic IT plan and direction* seems to be at a higher level of abstraction than processes such as *DS8 Manage Service Desks and Incidents, DS9 Manage the Configurations, DS10 Manage problems* which a framework like ITIL (2008) might integrate into a Service Management Process. Recently the work of ISACA has been extended with a separate framework VALIT (ISACA, 2008) which addresses the domain of Value of IT which COBIT did not fully adequately address.

The Project Management Maturity (PMMM) model developed by Kertzner (2004) is an excellent example of applying a maturity model approach to one important discipline of concern to the CIO, that is Project Management. The PMMM identifies high level states associated with improving Project management maturity and

includes a maturity assessment tool. As a standalone tool the PMMM is very useful but similar to other frameworks is expert at a process in one domain but does not extend into the other processes areas required to run enterprise IT.

ISO 20000 (ISO20000, 2008) is yet another standard focussed on IT service management. ISO 20000 evolved from BS15000, with the British Standards Institute being one of the first organizations to identify the need for a standard in this area. ISO 20000 contains a specification for IT service management and a code of practice for IT service management. Again this appears to be an example of deep domain expertise in the domain of IT service management but does not span into other domain areas of IT.

SPICE (2008) or ISO/IEC 15504 is another relevant standard in the field of IT service management. It is a framework for assessment of processes and SPICE stands for *Software Process Improvement and Capability Evaluation.* Similar to the S/W CMM, ISO 15504 originated in a development context, making it somewhat difficult to apply in a service management context. This standard continues to be developed with coverage extending to process areas such as engineering and acquisition.

The ISO/IEC 27000 (2005) series comprises a set of related standards for information security which is published by the International Organization for Standardization and the International Electro Technical Commission. This is a significant standard covering aspects of specification, assessment and code of conduct. However once again there is little linkage with other domains within enterprise IT.

Niessenk's (2005) IT Service CMM is another noteworthy contribution to the knowledge in the field of IT Service Management. The IT Service CMM has two main objectives, firstly to enable IT service providers to assess their capabilities for delivering IT services and secondly to provide IT service providers with steps and guidance for improvement of their service capability. Like other CMM models, the IT Service CMM measures the capability of processes on a five level ordinal scale with each level prescribing certain key processes that needs to be in place before organization can have maturity designated at that level. IT Service CMM categorizes the processes across three aspects management, enabling and delivery. Once again while this model displays significant depth and adds value in the domain of IT service

management, there is little coverage and guidance in other domains of IT management.

Luftman (2004) and Peppard and Ward (2004) offer descriptions of processes and competencies respectively which span well beyond the domain specific definitions of many of the good practice frameworks. While both of these provide an inventory of processes and competencies and the organizing logic associated with each of these offer much potential, they have yet to cross the chasm from text book and journal paper respectively into a best practice framework which practically adds value to the practitioner. In contrast to the good practice frameworks described above what they offer in breadth, they lack in depth of description of the processes and competencies. Not withstanding this both have proved very useful sources and calibration inputs in my research.

Outside the domain of IT Service Management there are many other frameworks which offer guidance and help to working IT executives. In different domains there are excellent good practice frameworks and excellent academic work and to illustrate the point I will discuss briefly one particular domain, that of enterprise architecture.

2.6.3 Enterprise Architecture Example

In the domain of enterprise architecture (EA) frameworks such as TOGAF (2007), Zachman (1987, 1992), NASCIO (2006) and Ross, Robertson, Weill (2006) all add significant knowledge and value to the IT practitioner.

The open group architecture framework (TOGAF, 2007) provides a framework for enterprise architecture which spans governance, design, planning and implementations of enterprise architecture, covering four different aspects of EA namely business, data, application and technology architectures. TOGAF (2007) defines architecture as the structure of components, their interrelationships and the principles and guidelines governing their design and evolution over time. The Zachmann (1987, 1992) framework for enterprise architecture aims to establish a common vocabulary and a framework for describing complex enterprise systems providing a blueprint for an organizations information infrastructure. The Zachman framework is also a classification scheme that logically relates different descriptive representations and aims to provide an analytic model for understanding how

different architecture elements fit together. The association of Government CIOs in the US NASCIO developed and released an enterprise architecture maturity model (NASCIO, 2003) which helps US public sector organizations improve their enterprise architecture practices and results. This is a very useful model also incorporating an assessment tool. Ross, Weill and Robertson (2006) deal with enterprise architecture as strategy and demonstrate the importance of enterprise architecture as a strategic tool for an enterprise. They argue that managers should construct a solid foundation for business execution through enterprise architecture that supports digitized business processes executing on an IT infrastructure which automates the company's core capabilities.

This brief summary of some of the frameworks and texts available supporting the domain of enterprise architecture shows a rich source of content but a lack comprehensive linkage or coherence to some of the other domains in Information Systems Management. For example there is no linkage to important processes such as supply/demand management, sourcing, people asset management or risk management. With the exception of Ross et al (2006) the existing enterprise architecture frameworks have not specifically been developed using a *value* lens.

2.6.4 Value Frameworks

Few *value* based frameworks if any are connected to the process or good practice models. For example, the report from the Working Council for Chief Financial Officers (CEB, 2003) on improving the yield of information technology shares good practices in the area of IT Business case discipline, enterprise-wide investment coordination and continuous portfolio management but does not extend linkage to the IT process landscape beyond this.

An analysis of a list of more than 40 exemplary IS research papers discussed in the Handbook of Information Systems Research (Whitman and Woszczynski, 2003) failed to yield a single papers which had the words *value* or *IT Business Value* in their titles, whilst value. A more detailed analysis of this list of papers failed to yield information on value as a significant or central theme. This ranked list of exemplary papers was created by IS scholars voting for the most influential papers in the IS field and these results could indicate both a paucity of quality research in this area and potentially also an indication that quality research in this area has not been prioritized

by researchers. On the other hand it could also mean that the IT Business Value area was not an influential research area at the time of polling. Indeed Bannister and Remenyi (1999) argue there is a surfeit of IT evaluation methodologies, but that managers too often have to fall back on instinct in IT investment decision making. Additionally Veith et al (2007) conclude following a review of IT value based management methods conclude there is no existing method suitable for assessing the business value created by IT assets.

2.6.5 The Challenge Remains

Despite the existence of all the good practice frameworks and research papers, many CIOs struggle with trying to optimize the value delivered from a given IT spend in a company. Weill (1992) reports that different organizations will realize different levels of value from the same level of spend. An important reason why CIOs and organizations can fail to realize sustainable value from their IT investments is that there is a lack of an integrative framework and model to help CIO manage the complexities and tradeoffs required to continuously evolve the IT capability in an organization while delivering ongoing value. Indeed there are few systematic guidelines to help firms measure IT value (Mooney et al, 1995). Without an overarching framework CIOs have to go it alone and often re-invent the wheel, trying to integrate different management frameworks and models in real-time as they navigate the very difficult challenges they face. In fact sometimes the existing best practice frameworks may be in conflict with each other.

All this supporting material and evidence leads to an argument and logic which says that there is no single integrated framework which can meet the multiple demands of the CIO struggling to improve IT capability whilst managing different challenges. The evidence supports the need to develop a coherent *design pattern* manifested as an integrated value based process framework which CIOs can use to improve their IT capabilities in pursuit of value creation.

2.7 Applying a Maturity Framework Lens

Humphrey (1998) introduced a breakthrough approach to software quality management and improvement by applying a capability maturity model (CMM)

approach to software improvement. A CMM can be defined as a formal archetype of the levels through which an organization evolves as it executes and improves its processes in a particular area of focus (SEI, 2003; Paulk, 1993; Kaner and Karni 2004). Typically the levels outline an evolutionary improvement path from embryonic to mature processes and the CMM provides a roadmap to help choose process improvement strategies that lead to a targeted maturity state.

Maturity based approaches to process improvement evolved from the field of quality management where Crosby (1979) described the behaviour by an organization at five levels of maturity. Crosby's (1979) quality maturity model was grounded in an evolutionary approach. His selection of five levels was not grounded in any particular theory but from management intuition. Since the introduction of the Software-CMM (Paulk et al, 1993) there have been a number of applications of the CMM approach to different fields for example the People CMM (Miller et al, 1995) an approach to improve the People Capability in an organization and the IT Service CMM (Niessink, 2005).

Amongst others, Ward and Peppard (2002), and Sambamurthy and Zmud (2000) have noted the fragmented approach to process improvement in the IT area and noted the need for more integration in approaches. Indeed, Ward and Peppard (2002) comment that a synthesis of the various efforts would add value and enables organization to achieve competitive advantage.

An important addition to the value proposition of a capability maturity framework is to introduce an evolutionary path of *outcomes* in parallel with process maturity (Curley, 2005). Using a process improvement approach without using a roadmap of desired outcomes is analogous to improving the efficiency and performance of car, without providing a map and targeted destination. This approach was informed by Nolan's (1973) introduction of an IT stages of growth model. The model described evolution from the early cautious use of information technology (*initiation*), followed by *contagion* where computers were enthusiastically embraced in different areas, followed by a reining in phase (*control*) which was a reaction to unbridled and unmanaged expenditure on computers.

This control phase was followed by a phase of *integration* where attempts were made to integrate islands of automation or computerization. A next phase called *data administration* identified a shift to managing an organizations data rather than its

information technology. Finally the last phase *maturity* represented the phase where IT had matured and was recognized as a peer function of Human Resources, Finance and other functions and where data based applications were delivering competitive advantage (Nolan and Gibson, 1973; Nolan, 1979). Despite its popularity Nolan's stage model has been criticized for a number of problems including the fact that its principal tenets have not been independently validated (King and Kraemer, 1984).

The software process maturity framework approach has since evolved to become the core of CMMI (Chrissis et al, 2003). CMMI applies the principles of statistical control and measurement to drive software process improvement and describes five levels of maturity; Initial, Repeatable, Defined, Managed and Optimizing.

Curley (2004) introduces the concept of applying such a capability maturity approach to IT management for value. A similar approach was followed by Renken (2004)[7]. Many CIOs struggle with identifying the outcome maturity states that they should target their IT capability improvement actions on and this is an equally weighted consideration in the development of this research. This dual approach ensures CIOs can focus on both *doing the right things – outcome maturity* and *doing things right – process maturity.*

The goal of this research is to research and develop a Capability Maturity Framework which comprehends both Outcome and Process maturity and builds on and synthesizes elements from existing research. This research work presents a *framework* which can act as an executive IT management tool and provide a wireframe for the potential development of a full CMM. The framework coupled with a linked assessment tool can act both as a map and a set of integrated improvement strategies to help improve the value contribution from IT.

[7] During the third cycle of the design science research iterative approach I became aware of the work of Renken which is somewhat similar but less extensive in terms of the research used to create his IT Capability maturity framework. His work also does not explore the dynamic capabilities dimension which is used in my framework.

3 Chapter 3: Research Approach

3.1 Research Goal

The generalized research question can be posed as follows;

What evolutionary maturity framework can CIOs follow to improve their IT capabilities in an integrated fashion in support of increasing value creation?

The primary goal of the research is to develop artifacts and improved theory leading to an assessment and management system to help organizations systematically improve the value they get through IT by improving IT Management capability. This goal of creating a generally reusable solution could make a significant contribution to the field of information systems management. These artifacts and theory are manifested as a framework called the IT Capability Maturity Framework (IT-CMF) which is a formal archetype of the levels and stages through which an organization traverses and evolves as it defines, implements, measures, controls and improves its IT capability in support of value creation for the organization[8]. This framework should meet the three criteria identified in chapter 2 in terms of comprehensiveness, validation and value based. A related secondary goal is to identify a list of critical processes which underpin the IT Capability in an organization. By theory is meant a systematic body of knowledge that explains and helps predict the nature of capability improvement and value improvement through IT.

3.1.1 Research Positioning

Using an Area-Field-Aspect lens the research can be positioned as follows

AREA	FIELD	ASPECT
Information Systems	Business Value of Information Technology and IT Capability	Artifacts and theory for continuously improving the value of IT through systematically improving the IT capability.

Figure 3.1-1 - Research Area-Field-Aspect

[8] This definition is adopted from that of Kaner and Kami who developed a CMM for Knowledge Based Decision Making.

The broad area of research is conducted in the field of information systems research with a specific focus on the business value of IT and maturity of IT capability/management practices. The problem definition was the lack of a unifying framework to help mature IT management capability & practices in support of improving IT business value. CIOs who seek to improve their IT capability and associated value delivery find a myriad of content available to help but no systematic and integrated approach to help drive improvement systematically. The field of Information Systems Research has had a long history of drawing on other disciplines for theory and approaches (Wade and Hulland, 2004). This dissertation continues that tradition leveraging fields such as economics, software engineering, management and control theory. The discipline of economics, defined as the study of the allocation of scarce resources is an important body of knowledge which can be leveraged in the study of how an IT capability can produce improved value. In most firms, the IT capability exists in the context of constrained funding (Tiernan and Peppard, 2005) with many CFOs using a ratio of IT expenditure to revenue or cost of goods sold as a guideline for setting IT expenditure levels. Applying an economic or value lens can help ensure that this constrained resource is used to maximum effect.

IT Business Value research has typically been done at five levels (Bakos 1987, Melville, Gurbaxani, Kraemer, 2004):

1. the economy as a whole
2. the industry within an economy
3. the firm within an industry
4. a workgroup or division within a firm
5. the individual or information system.

Whilst a significant amount of work has been done in this field, much of the focus has been evidence based, supporting or refuting the claim that IT creates business value. Much work has been done at the economy level (Jorgenson, 2001; Dedrick et al, 2002) and good examples exist at industry level (Weill, 1992; Markus and Soh, 1993). From a practitioner standpoint there is sparse useful content available at the firm level (Brynjolfsson and Hitt, 2003 reported firm level computing productivity evidence). There are however examples of research at workgroup/division (Kohli and Deveraj, 2004) and individual systems (Peppard and Ward, 2004) which are useful to practitioners. This research is focused at level 3, the firm level where a significant gap in useful artifacts and theory exists.

3.2 Research Approach

The approach followed in this research used is a design science research approach (Hevner et al, 2004; Vaishnavi and Kuechler, 2007). Design Science Research (DSR) "creates and evaluates IT artifacts intended to solve organizational problems" (Hevner et al, 2004, P77). This research approach is an iterative step-by-step process by which artifacts and theory are generated and verified, with both an inductive and a deductive process being used. The research process followed the general design cycle (GDC) adapted for design science research (Vaishnavi and Kuechler, 2007) and included the following phases:

- Awareness of the problem
- Suggestion
- Development
- Evaluation
- Conclusion.

3.3 Design Science Research

In recent years there have been several philosophical debates on ways to conduct IS research (for example interpretivism versus positivism) with the main focus of such debates being on the epistemologies of research (for example Klein and Myers, 1999). Two important paradigms which characterize research in Information Systems are behavioural science and design science. While behavioural science has dominated the 20th century IS research, design science research is becoming more mainstream. A fundamental goal of design science in Information Systems Research is utility – that is that the artifact is useful in addressing a real world problem or challenge.

The design and specification of an artifact and the assessment of its utility, in comparison to other existing or competing artifacts, is an integral component of design-science research (Hevner et al, 2004). Furthermore Hevner et al (2004) distinguish between the core goals of the behavioural-science paradigm compared to a design science paradigm. They argue that the goal of the behavioural science paradigm is to find *what is true* whilst the design-science approach's goal is to find *what is effective*. Hevner et al (2004) also posit that utility relies on truth but that the

discovery of truth may actually lag the application of utility. This may particularly be true in the field of IS where the speed of change means that often theoretical research lags real world practitioners' needs (Sambamurthy and Zmud, 2002).

Typically the design process of an artifact is a sequence of activities that produces the design artifact. The evaluation of the artifact then provides feedback information and a better understanding of the problem and the design process to help improve the quality of the artifact. This build and evaluate loop is typically iterated a number of times before the final design of the artifact is completed (Markus et al, 2002). The goal is not only to add to the knowledge base but also to provide an artifact that is applicable to a real world challenge (Hevner et al, 2004). It is important also to note that the developed artifact should continue to be developed post the research, taking into account changes in the ongoing environment and responding to new insights.

3.4 Design Science Research Evolution

Design science research is an emerging way of conducting research that is gaining momentum in a number of different fields. Van Aken (1994) is sometimes credited with the introduction of this new research paradigm. A core objective of DSR is to develop generic knowledge which can be used to design solutions to specific problems in particular domains.

The main motivation of DSR is to solve problems and a core driver is the utilization problem (Susman & Evered, 1978). The distinguishing feature of the typical output of a DSR activity is that it is prescriptive or normative and that it often takes the form of a solution concept, which is a general prescription which can be used by a practitioner to help develop a solution to a specific problem in a particular domain.
Walls et al (2002) define information systems design theory as prescriptive theory which integrates both descriptive and normative theories into design paths to help produce more effective information systems.
Disciplines based on design are more focussed on synthesis than analysis and involve the construction of artifacts and subsequent evaluation of the artifact post construction (Vaishnavi and Kuechler, 2007). An important characteristic of DSR is that the research is justified by pragmatic validity (Vaishnavi and Kuechler, 2007). Validity refers to the best available approximation to the truth or utility of a given proposition, model or inference (Trochim, 2006). Worren et al (2002) introduced the concept of pragmatic validity and its introduction stems from the idea that some

social science researchers argue that real-life environments are needed in order to produce useful research artifacts, as compared to testing actions in a laboratory setting which does not accurately reflect the complexity of a multi-variable real world environment (Brown, 1992; Husen 1999). Brown (1992) and Hodkinson (2004) assert that artifacts are validated by the adoption rate of practitioners active in the relevant field.

3.4.1 General Design Cycle

Increasingly there are common process steps of creativity, problem selection and development, literature search, validation and evaluation used in the DSR process. (Vaishnavi and Kuechler, 2007). Vaishnavi and Kuechler (2007) describe an aggregate general design cycle for design science research which consists of five phases namely, awareness of a problem, suggestion, development, evaluation and conclusion with a closed loop between each phase that is indefinitely iterative. Peffers et al (2006) describe a similar research approach consisting of the following phases: problem identification and motivation, objectives for a solution, design and development, demonstration, evaluation and communication. The following table attempts to map chapters in the dissertation to the various design research phases of Vaishnavi and Kuechler (2007) , however as is often the case it not possible to provide a fully perfect mapping as the boundaries between different phases are often grey.

Design Science Research Phases	Chapter
Problem Awareness	Chapters 1 and 2 provide the information to support that there is a generally reoccurring problem for CIOs trying to manage enterprise IT for value in the face of competing forces. Chapter 2 also discusses the paucity of generally reusable solutions available in the literature or in practice.
Suggestion	Elements of the literature review in Chapter 2 inform the suggestion phase but the primary suggestion which initiated the suggestion phase was the output from the Chapter 4 case study
Development	Chapter 3 describes the iterative development process for the IT-CMF. Chapter 5 and 6 documents the instantiation of the constructs, models and methods in the IT-CMF
Evaluation	Chapter 3 also describes the evaluation process, with chapter 5 attempting to explain the artifacts from existing literature
Conclusion	Chapter 7 summarizes and also describes how the IT-CMF has been used at Intel to help improve IT capability and value contribution. Future research directions and research limitations are also discussed.

Table 3-1 - Mapping of Chapters to Research Process

Design science research can be considered as a type of Mode 2 knowledge creation (Gibbons et al, 1994) where knowledge is co-created in an area which is interdisciplinary, problem focussed and context sensitive. This is typically knowledge generated by practitioners dealing with real problems in a real context as distinct

from knowledge which is generated from traditional research (called mode 1) which is academic and based within a particular discipline (Gibbons et al, 1994). In developments in other social science fields such as management research the relevance problem has been highlighted (Van Aken 2005, Galavan et al, 2008). Van Aken (2005) proposed increasing the use of mode 2 knowledge production in management research to increase the relevance and utility of the research. Additionally Van Aken (2005) advocated a focus on output which is field tested and grounded. The epistemology of DSR differs from that of the positivist and interpretive research perspectives in that iterative circumscription reveals meaning as artifacts are developed, evaluated and used (Vaishnavi and Kuechler, 2007).

3.4.2 Takeda Design Cycle and Theory Building

The Takeda (1990) design cycle underpins the general design cycle research approach. The figure below explains the reasoning in the design cycle as outlined by Takeda (1990).

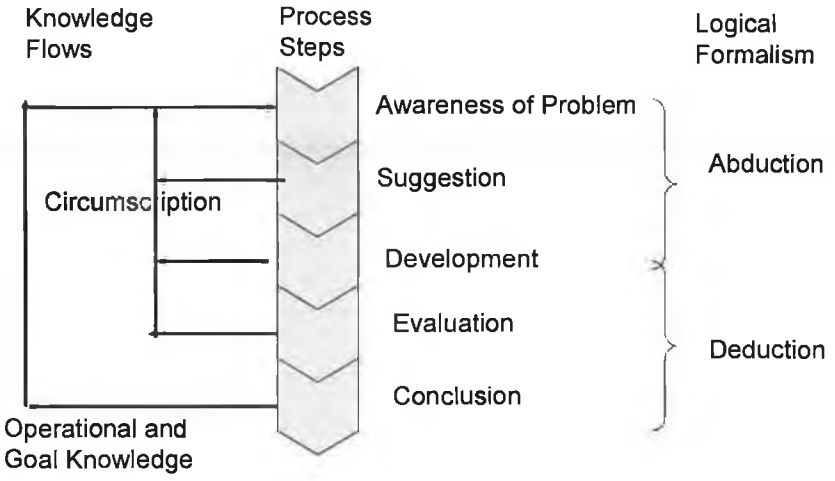


Figure 3.4-1 - Reasoning in the Design Cycle (Takeda, 1990)

In the Takeda (1990) design cycle, design begins with awareness of a problem and in this context design research is sometimes called improvement research emphasizing the solution development nature of the research activity (Vaishnavi et al, 2004). The next step is to develop suggestions for the solution through abductively drawing from the existing theory and knowledge base (Pierce, 1931). These suggestions are then synthesised into a draft of the solution artifact and this is categorized as development in the Takeda (1990) design cycle. The next phase is

the evaluation phase which is deductive. The suggestion, development and evaluation phases are cycled through a number of times as depicted by the arrow flows marked circumscription until as a satisfactory artifact is produced. This process yields both new knowledge and an artifact which is useful to practitioners.

This part of the research process also leveraged an alternating inductive and deductive theory building approach, advocated for management theory development by Carlile and Christensen (2005). Carlile and Christensen identify that that the building of theory occurs in two major phases – the descriptive phase and the normative phase. They also argue that the theory building process iterates through these two phases again and again and define theory as a body of understanding that researchers build cumulatively as they work through each phase. This alternating process is shown in the figure below.

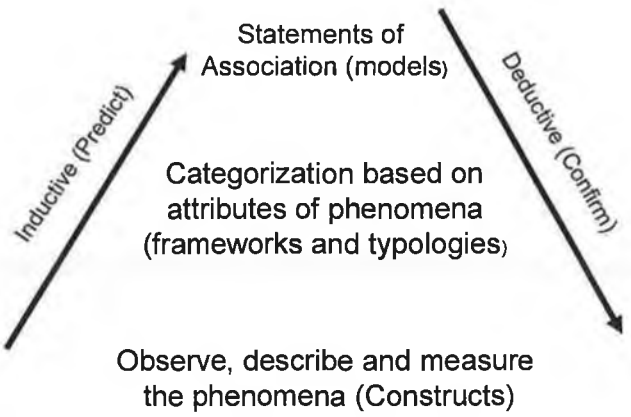


Figure 3.4-2 - Alternating Inductive and Deductive Cycles

This alternating inductive and deductive theory building approach manifested itself as a four stage parallel process which was recursively cycled through to learn, test and improve the theory quickly. The manifestation of the design science research process is shown in the figure below, with a four stage research cycle.

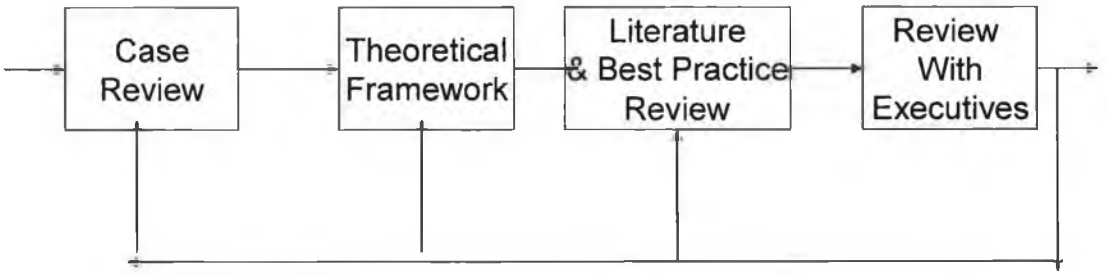


Figure 3.4-3 - Recursive Research Process

As described in the early stages of this research, a case study approach was followed where the exploration and analysis of related observations at Intel IT led to the development of an initial theoretical framework[9]. This framework was enhanced with suggestions from literature, best practices frameworks and executive dialog. Subsequently, the enhanced framework would be reviewed with executives for validation. Based on learnings the cycle would be repeated until a validated framework was generated.

The descriptive phase of theory building was an integral part of this phase of the research. This phase involved there key stages:

- Observation including careful observation, documentation and measurement of phenomena observed
- Classification to classify the phenomena by categories
- Defining Relationships where the association between category defining attributes and the outcomes are observed and explored.

An extensive review of the existing academic and practitioner research helped continuously improve and help validate the theoretical framework. This parallel exploration of both academic literature and best practice frameworks and methods produced a rich collection of knowledge to be leveraged to improve the framework. The framework was then shared with executives in a workshop format for validation and capturing of improvements. Findings and observations at each phase were fed back to ensure continuous improvement of the framework.

[9] The case based approach was based on a transformation of Intel IT for which the researcher was responsible for driving. This transformation started in1999 when the Intel IT organization was held in low self-esteem by its internal business partners, had few documented and organized business processes and had no measures of value in place.

3.5 Design Science Outputs

In DSR the primary output of the research activity are artifacts. In DSR artifacts are innovations which define the ideas, technology, practices, products and services through which the conception, analysis, design, codification and use of IS can be accomplished to deliver value (Hevner, 2004). March and Smith (1995) proposed four general outputs for design research, constructs, models, methods and instantiations. Rossi and Sein (2003) and Purao (2002) added a fifth output to this list which is better theories and these output types are shown in the figure below.

OUTPUT	DESCRIPTION
Constructs	The conceptual vocabulary of a domain
Models	A set of propositions or statements expressing relationships between constructs
Methods	A set of steps used to perform a task – how to knowledge
Instantiations	The operationalization of constructs, models and methods
Better Theories	Artifact construction as analogous to experimental natural science

Figure 3.5-1 - Design Research Outputs

Constructs as defined by March and Smith (1995) are the conceptual vocabulary of a problem/solution domain and can include a conceptual schema and a universe of discourse. A model is a set of propositions or statements expressing relationships among constructs (March and Smith, 1995). According to March and Smith (1995) models are proposals for how things are and they note that they differ in DSR from natural science theories (NST) in that in DSR the focus is on utility, whilst in NST the focus is on the truth. In this context theory helps explain the relationships between constructs.

Parsing DSR outputs further, methods can be simply defined as sets of steps (for example a guideline or more formally an algorithm) used to perform a task (Vaishnavi and Kuechler, 2007) or to deliver an outcome. More precisely Vaishnavi and Kuechler (2007) define methods as goal or objective directed plans for manipulating constructs so that a solution is implemented. A crucial output of DSR is an *instantiation* that operationalizes constructs, models and methods (March and Smith,

1995). Noting the iterative nature of DSR, an instantiation or several instantiations sometimes precede a complete articulation of the conceptual vocabulary and the theories that it operationalizes. An instantiation is manifestation of an artifact in a particular environment. One of the best examples of the fact that instantiations can precede a full development of a conceptual vocabulary and theory is that of flight. There were numerous models of airplanes which were built and flew before a holistic understanding of the theory of flight was developed. Vaishnavi and Kuechler (2007) make the point that it is unlikely that such an understanding would have happened without the presence of working artifacts.

The last and possibly most important output of a DSR activity is theory. Theory is an explanation for some phenomenon that is based on observation, experimentation and reasoning (NASA, 2007). Theory is also a set of propositions which summarize, organize, and explain information about a phenomenon and provide a framework for the generation of new ideas and tests on the topic or phenomenon (Keppel et al, 1992). Vaishnavi and Kuechler (2007) argue that DSR contributes to better theory as the construction of an artifact can be viewed as an experimental proof of method or an experimental exploration of method or both. Additionally they make the point that the construction and examination of the artifact can expose relationships between its elements.

3.6 Design Patterns

A *design pattern* is a construct which exists in software engineering (Gamma et al, 1994) and which I have leveraged as a vehicle in my design science research approach. A design pattern is a general reusable solution to a commonly occurring problem (Vaishnavi and Kuechler, 2007) and it is often manifested as a description or template for how to solve a problem that can be used in many different situations. Vaishnavi and Kuechler (2007) specifically define patterns as a solution to a problem in a recurring context and as a general technique for approaching a class of problems that are abstractly similar. Appleton (2000; P3) defines a pattern as "a named nugget of instructive information that captures the essential structure and insight of a successful family of proven solutions to a recurring problem that arises within a certain context and system of forces".

Also Vaishnavi and Kuechler (2007) describe patterns as similar to, but shorter and more structured than the case studies using in business school classes which communicate similarly complex and subtle information. A more concise definition of a pattern is provided by Appleton (2000; P3) as "a pattern is a named nugget of insight that conveys the essence of a proven solution to a recurring problem within a certain context amidst competing concerns".

Leveraging how design patterns are used in Software engineering (Appleton, 2000) the goal of patterns in Enterprise IT should be to create a body of knowledge to help IT executives solve recurring problems or seize recurring opportunities encountered in IT management. Design patterns create a shared language and vocabulary for communicating insight and experience about recurring problems and their solutions (Appleton, 2000). Codifying the linked solutions and capturing their relationships enables the capture of a useful and re-applicable body of knowledge (Appleton, 2000).

A core objective of my research is to create, iterate and define a general design pattern that CIOs can use to systematically improve IT capability and value in the context of their own IT organization and the business objectives/challenges they own and face, within the boundaries of their ongoing business context.

Patterns were introduced as a design concept by Alexander (1977) and the Gamma et al (2002) book on design patterns as applied to object oriented programming began to popularize the use of patterns in Computer Science. Another application of design patterns in the field of information systems was the work of Fowler (2002) in the domain of enterprise application architecture.

In the context of my research the primary design pattern that I propose to create is an IT Capability Maturity Framework (IT-CMF). IT Capability can be defined as the capacity of an IT organization to complete specified repeatable actions to deliver outcomes in a defined range of complexity, context and purpose (adapted from ECSA, 2003). The spanning definition I use for IT capability is simply *what IT can do for the business* (Curley, 2004).

My spanning definition of framework in the context of a design pattern is that a *framework* is an extensible structure for describing a set of concepts, methods, technologies and other changes necessary for managing and delivering a value

driven IT capability, based on an integrated set of enterprise IT processes (adapted from CERN (2006)). Frameworks can be thought about as a conceptual model used to help understand, tackle and solve difficult issues, often with competing forces. Additionally frameworks provide a mechanism that guide users through a proper order of steps, applications and data via a common interface (CERN, 2006). In the next chapter I will map the specific artifacts developed in my research to the design science research outputs taxonomy defined by March and Smith (1995).

3.7 Case Study Research

The behavioral science paradigm seeks to find *what is true* while the design science paradigm seems to find *what is effective and useful* (Hevner et al, 2004). In my research I take a different view to the positivist position which suggests that empiricism is the core of the research activity, with an attempt to identify and describe natural laws through observation and experimentation. My research philosophy is that of post-positivist recognizing that there is no observation which is infallible and that all theory is revisable (Trochim, 2006). I believe that the nature of knowledge involves multiple realities and indeed I believe theory *should* be continually revised as new knowledge and observations become available. My research philosophy was significantly informed by my role as the organizing chair of the IFIP 6.2 (Fitzgerald and Wynn, 2004) conference on IT Innovation where I observed the academic contributions which were clearly very significant, were of little immediate utility to the attending practitioners (with a few exceptions) who were struggling with being on the leading edge of a nascent discipline. Teeravarunyou and Teixeira (2002) argue that because of their ill-defined structure the nature of design problems is in conflict with scientific inquiry. Owen (2002) argues that design as a multidisciplinary discipline suffers significantly from philosophical ambiguity. Teeravarunyou and Teixeira (2002) argue that development of a philosophy underpinning the design discipline is nascent and that "since design is a young discipline, the number of philosophers in this field is tiny" (Teeravarunyou and Teixeira, 2002; P6).

March (1984) makes the point that from a philosophy standpoint natural science relies mostly on deductive inference whilst social science mostly uses inductive inference. Teeravarunyou and Teixeira (2002; P1) argue that abduction (or production as they call it) is the "only logical operation which introduces any new

ideas". Further Teeravarunyou and Teixeira (2002, P1) state "production creates; deduction predicts; induction evaluates."

From a practitioner point of view, I as a researcher am more interested in *knowing that* rather than *knowing how* and believe that utility is of more value than truth. As a researcher (and indeed practitioner) I am for example much more interested in how to *ride a bicycle* rather than understanding how a person is able to achieve a state of balance that enables a bicycle to be ridden (Polanyi, 1958). From an epistemology standpoint the Intel IT case study provided an opportunity to seek to understand what happened in the IT transformation, rather than necessarily understanding how this happened.

The literature review provided evidence that there was no integrated design pattern or generically reusable solution which could be applied to systematically improving IT capability in pursuit of value. Inductive reasoning starts with specific observations and measures, from which we can begin to detect patterns, from which we can formulate some tentative hypotheses, from which we can explore and ultimately develop some theories (Trochim, 2006). Given my role as a central actor in the Intel IT transformation (Curley, 2006) and the successful outcome of the Intel IT transformation I felt that this would be a significant source of information and observation from which I could potentially infer or detect a nascent design pattern. A case study of the Intel IT transformation would allow for detailed exploration of a design pattern for the complex environment and challenges a CIO has to deal with.

Yin (1994) pointed out that the body of literature on case study research is primitive and limited compared to that of experimental research. The requirements and rigidness of experimental research make case studies the only viable alternative in some cases (Tellis, 1997), although this was not necessarily the case in addressing my research question. The paucity of relevant comprehensive value based frameworks which I encountered at the beginning of my learning journey coupled with my central role in a very successful IT capability and value based transformation (Curley, 2006), suggested that a case study based approach could yield a robust initial framework or pattern which could then act as an input to a more comprehensive design science research approach. Indeed the availability of a rich case with a successful outcome, coupled with my ability to access this information meant a case study was an attractive starting point for my research process.

Acknowledging that my role as a central actor would bring some subjective bias to the case study, I felt that the access to information and knowledge about many of the nuances and political activities in an organization would provide a very rich repository of information to which an objective external case study researcher would not normally have access to. Case Studies are unparalleled in research methods in their "ability to study a research question in an environment of rich contextual environments" (Schell, 1992, P2). Yin (1984) advises that the case study approach is appropriate when there is a contemporary phenomenon rather than a historical phenomenon being studied and where there is little control over behavioural events. Additionally a case study produces a lot more information than what might be produced through a more traditional statistical analysis (CSU, 2008). Advocates argue that case studies are needed to deal with innovation, creativity and context, where more traditional research approaches which deal well with homogenous and routine behaviour might struggle (CSU, 2008).

Case Study methodology is often criticized in that its dependence on a single case makes it difficult to provide a generalized conclusion, however the integration of a case study approach with a design science approach which validates or replicates through pattern matching can increase robustness and confidence in the theory developed. Case Study methods involve an in-depth longitudinal exploration and review of a single scenario or event within a particular context. Yin (1994) suggests that single case studies are appropriate if:

(a) the case is revelatory
(b) it is a critical case for testing a well developed theory
(c) it is an extreme or unique case.

The general research question as described at the beginning of this chapter is to attempt to develop a generally reusable solution in the form of an evolutionary maturity framework which CIOs could use to improve their IT capabilities in an integrated fashion in support of increasing value creation from IT. Given that the Intel IT organization had implemented a fast transformation I decided this extreme case coupled with the potential revelatory nature of the case (notwithstanding any personal biases I might bring as a central actor in the case) would be a ripe source for performing exploratory research to gain insight and makes initial suggestions for the design science research cycle that would follow. With respect to the ontology, the key objective of the case study phase was to see if I could generate a draft *design*

pattern from the Intel IT case which could then be used as the initial solution suggestion in the design science research cycle.

Evers and Echo (2008) point out that is possible to generalize from single case studies where there is a pattern of inference (also known as abduction) used to draw conclusions from a single case study. Thus thereafter I proposed to use a design science research approach (including abduction as a sub-process) to better access knowledge of working executives and to iteratively improve the design pattern through an ongoing synthesis process. Ultimately the goal was to deliver an integrated model and theory, manifested as a design pattern which was grounded and of considerable use to working practitioners. In this particular scenario the Intel IT case is revelatory because of the author's own central role as an actor in the case which leads to the possibility of revealing information and facts that even a very diligent external researcher would not have access to for different reasons such as context awareness or length of time exposed to the case. The case is somewhat extreme in that the Intel IT organization was very poorly perceived at the initiation of the period in which the case was studied and yet within the space of two years of a transformation plan being developed, the Intel IT organization had won the Intel Quality Award, the highest level of achievement and recognition in the company.

Front ending of the research process with a case based approach was done because of the fragmented and un-integrated landscape of theories applied to Information Systems Management for Value which the author encountered and because of its value and usefulness in creating an initial suggestion for a design science research process. Building theory from a case involves using a particular case to create a theoretical construct from case based evidence (Eisenhardt, 1989).

The core idea of using a case approach is to use the case to develop theory inductively (Eisenhardt and Graebner, 2007). Such theory is emergent in that it is situated in rich observed data and developed by recognizing patterns of relationships and underlying logical arguments within a case. The theory building process typically follows a recursive cycle through case data, emerging theory and extant literature. An important reason why case based research is useful is that it creates a useful bridge from rich qualitative evidence to mainstream deductive research (Eisenhardt and Graebner, 2007).

A crucial validation of case based research is that the focus on developing constructs, measures and testable theoretical hypotheses makes inductive case research consistent with a mainstream deductive research approach. The case study described in chapter 4 yielded an early draft of the IT-CMF which was subsequently iterated through the design science research process.

3.8 Detailed Research Approach

The recursive research process depicted in the earlier figure above was conducted in four iterative phases, key elements of which are documented in the following table.

PHASE	ACTION
Phase 0	Case Study: Intel IT Transformation
Phase 1a	Develop IT-CMF rev 1 and rev 1 Assessment Instrument
Phase 1b	Share, review and update Draft IT-CMF
Phase 2a	Develop IT-CMF rev 2 and rev 2 Assessment Instrument
Phase 2b	Share, review and update Draft IT-CMF
Phase 3a	Develop IT-CMF V1 and V1 Assessment Instrument
Phase 3b	Share, review IT-CMF V1 and score Assessment instrument V1
Phase 4	Finalize artifacts

Table 3-2 - Phases of Research

A detailed schedule of the events and workshops mapping to these phases are shown in table 1 below. The table documents the event, location, duration, attendees, time period and the outcome.

WORKSHOP /EVENT	**PLACE**	**TIME**	**ATTENDEES**	**DATE**	**OUTCOME**
AIM IT Business Value Workshop	Leixlip, Intel	2.5 hours	IT Directors (40)	Summer 2004	Validation of problem with IT value management and lack of an integrating framework

Intel IT review	Various	Various	Various Intel Executives and Manager	2004	Review of Draft IT-CMF
Ecosystem and CIO Workshop	Leixlip, Intel	4 hours	IT executives (50)	Nov. 2004	Overview of IT-CMF shares Ecosystem companies (Deloitte, Mercury, Seaquation, Enzo Consulting) shared how their products mapped to different levels of the IT-CMF and how their products could improve maturity
Focused Workshop	Leixlip, Ireland	4 hours	IT and ecosystem executives	Nov. 2004	Detailed dialog on the IT-CMF and maturity states. Mapping of attendee best practices to framework.
1 on 1 Analyst dialog	London	90 minutes each	European Analysts (4)	July 2004	Detailed dialog and confirmation of value and sequencing of maturity states.
CIO Roundtable	Atlanta, Georgia	2 hours	20 Atlanta based CIOs including UPS CIO, Coca-Cola CTO	January 2005	Detailed dialog and confirmation of value and sequencing of maturity states.
GSU Academic Review	Atlanta, Georgia	4 hours	Prof. Lars Mathiassen, Prof Eph McLean, Prof Arun Rai	January 2005	Detailed dialog and confirmation of value and sequencing of maturity states. Validation of Proposal to apply control loop approach to four macro processes linking budget, capability and value through the control of the Managing IT like a Business macro-process

Nokia Workshop	Dublin	1 day	Nokia CIO staff subset	Feb. 2005	Review of IT-CMF and preliminary assessment
PRC MITBV class	Beijing	2 days	15 Chinese CIOs	June 2005	Validation of framework and draft assessment instrument
Analyst Workshop	MIT, Cambridge	1 day	14 IT Industry analysts	July 2005	Validation of Framework
Intel IT review	Various	Various	IT executives and Manager	Q4 2005	Validate Framework and Assessment tool
DNV	Leixlip	1 day	DNV ICT Governance Board (8)	Nov. 2005	Validate Assessment Instrument – all questions >=4 in importance
MITBV	NUIM	1 day	(20) executives including BP, Nokia executives	Nov. 2005	Validation of framework and draft assessment
IT-CMF overview	Edinburgh, Scotland	2 hour presentation and dialog	Scottish IT and Business Executives	Feb 2007	Further validation and improvement
MITBV class	Sydney, Melbourne, Australia	3 * 1 day classes	Australian IT & Business Executives (30)	Sept. 2006	Further validation and improvement
MITBV class	Sao Paolo, Brazil	6 hour class	Latin American IT Executives (15)	January 2007	Further validation and improvement

Table 3-3 - Research Phases and corresponding workshops and interviews

Additionally I made presentations on the IT-CMF at more than twenty executive events and conferences around the globe, using an interactive style to elicit feedback and confirmation of the usefulness and applicability of the artifacts.

3.9 Executive Dialog Process

A standard executive dialog process was used for many of the roundtable and executive events. The dialog began with the question of testing whether executives perceived there was a problem in industry and the IT profession with respect to maturing IT capability in pursuit of improved value. Invariably the following two questions were asked

- What is the average return from your IT investments?
- What is the cumulative return from your IT investments?

With one notable exception,[10] no executive (across all the events, roundtables and training classes) was able to answer both of these questions indicating that a pervasive problem existed in the industry with respect to measuring the performance of IT investments.

Following this I typically shared a brief history of the SEI SW-CMM and validated whether such an approach would be useful in the IT profession and industry and probed whether such a model applicable to enterprise IT already existed. Consistently the executives affirmed such an approach and also that such an approach would be very useful. They also consistently answered that they were not aware of any existing comprehensive applicable framework already in existence. Many noted, as I posited, that CMMI was a useful framework applicable to elements of the IT management domain, such as Project Management and Solutions Delivery, but that there was no single integrated framework which addressed the most important areas of enterprise IT.

Subsequently in the workshop a high level diagram of the IT-CMF would be shared followed by a description of the four macro processes and the evolutionary maturity states. In each dialog I would share key characteristics of each state and elucidate with examples. Interactive dialog with executives led to refined characteristics which defined each level and also new examples of IT organizations[11] operating at different

[10] Michael Baume, former CIO at AIB answered that the average return from IT investments at AIB was the banks overall return on equity since IT was intrinsically integrated as part of the business and that most business investments had elements of IT investments.

[11] For example ING were identified as an organization likely operating at Level 5 of MP1 Managing IT like a business due to their consistent and effective use of advanced Investment analysis processes.

levels. Detailed reviews were also held with a number of academic experts in this field. In particular a review of the framework with four leading academics at Georgia State University in January 2005 was particularly helpful.

3.10 Mapping the Levels

The positioning of particular characteristics in terms of processes and outcomes at particular levels in each maturity curve was carefully considered. As a particular outcome, process or practice was encountered in either field work or academic literature, I would attempt to position it in the continuum of existing characteristics that I had previously collected, grouped and ordered. Often a case of natural ordering occurred where it was obvious that particular characteristics needed to be in place before higher level characteristics could be achieved, For example, comprehensive cost identification needs to be in place before a proper business case can be developed and it was observed in the field that many organizations focused on establishing a total cost of ownership process before attempting to build a robust business case process. Adopting a five level maturity model approach such as S/W CMM (Paulk, 1993) provided an instrument which allowed for sufficient differentiation of characteristics to show a logical increase of maturity of characteristics across a particular macro-process. Once a maturity curve was complete it was reviewed with practitioners to review the logical accumulation of maturity and to test for and fill identified gaps. Where it was difficult to logically position a set of or a particular characteristic secondary criteria such as the type of outcome (efficiency, effectiveness, transformation) or type of process (below industry average, industry average, leading or world-class practice or process) were used to position a particular characteristic.

In the extended roundtables, workshops and classes, executives were encouraged to share best practices and position these practices at a particular level in the model. For example AIB proffered a benefits register practice which logged and banked the benefits delivered in an online register which tracked the cumulative value of IT investments.

3.11 Maturity Assessment Instrument

Additionally, in an initial workshop, executives were asked whether an assessment instrument would be useful to assess their own organization's maturity against the framework. Invariably the response was a strong yes validating the value in creating such an instrument.

As a vehicle for collecting and validating key maturity characteristics and with the intention of ultimately using the assessment as a component of the artifact, a maturity assessment instrument was developed and an iterative process was begun to systematically improve the maturity assessment instrument. This was built and informed using both literature review, review of vendor products in this area and dialog with executives. The first version resulted in an instrument with eight questions per macro-process. This instrument was extended and used in a workshop with the Nokia CIO team and used as part of an integrated workshop with Chinese executives in Beijing in June 2005. Following this, during and following a period as a visiting scholar at MIT Sloan School of Business, the survey was substantially updated following a detailed literature review and discussion with various researchers as well as meetings held with industry analysts. An important step in validating the instrument was to add an importance criterion so that executives could rate in their opinion whether the assessment criteria were actually important. As the assessment criteria were developed a draft list of processes which the criteria were aligned to was maintained. Whilst generation of a list of processes associated with the framework was not a specific goal of the PhD research, the list of processes with a short description is included in an Appendix to serve as raw material for further research.

Detailed review and scoring of the assessment instrument and the IT-CMF maturity levels were held with Intel IT executives and senior engineers in Q4 05 with a number of colleagues completing the assessment to assess Intel IT maturity and rank the importance of the assessment criteria. The figure below shows the iterative process used to improve and test the assessment instrument. Following the internal test of the early assessment instrument at Intel, the assessment instrument was used as part of a one day workshop at National University of Ireland, Maynooth (NUIM) in November 2005. Executives from companies such as BP and Nokia completed the revision 2 assessment. Criteria which were consistently ranked number 1 or 2 in importance on a five-point scale were removed from the criteria list or merged with

others. Following a day long workshop with the ICT Governance board of Das Norske Veritas (4 IT executives, 4 Business executives) and their completion of the instrument, all assessment criteria were deemed important following completion of an assessment and this version of the assessment instrument was stabilized as version 1 and used for further validation.

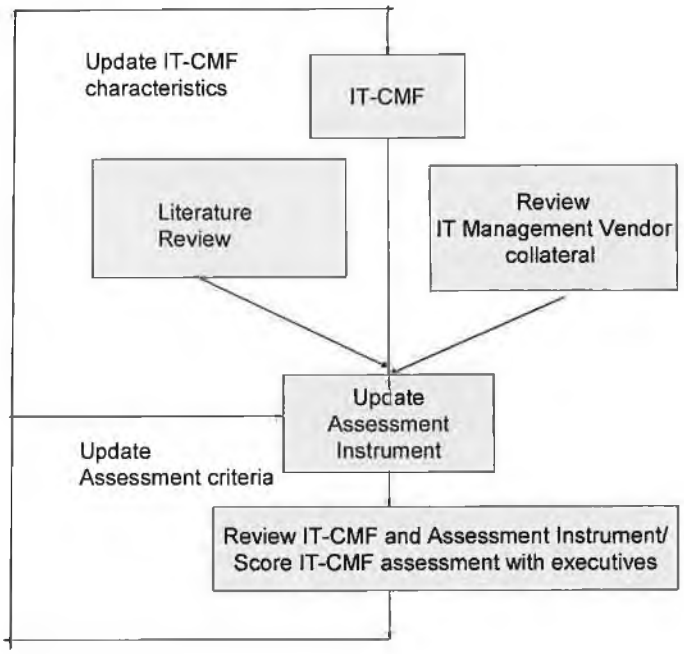


Figure 3.11-1 - Linked Framework and Assessment Development

Two separate series of workshops/interviews were held with IT Industry analysts. In the first year of the research the formative IT-CMF was discussed 1:1 with key European analysts from IDC, Butler Research group, Meta and Gartner in London (July 2004). A second one day workshop was held at the MIT faculty club with fourteen analysts from the leading US based analyst firms (Gartner, IDC, Forrester, Aberdeen, Summit and AMR) in Summer 2005. Detailed overviews were shared on the overall framework and one hour descriptions of each macro-process and the associated evolutionary maturity curve. The city of Westminster (London) shared a case study on how some practices from the framework has helped in their use of information technology for increased value whilst the software company Mercury shared how their products offerings mapped to the framework and helped drive improved outcomes and value.

Reference by the analysts and vendors to my Business Value framework indicates both usefulness and industry applicability of the IT-CMF[12]. Additionally a number of meetings and workshops were held with key vendors selling tools in the domain of improving IT management.

3.12 Assessment Instrument

The survey instrument was primarily developed and used as an instrument during the inductive phase of the research as a vehicle to help identify and validate outcomes and practices associated with different levels of maturity of each macro-process. In the design science phase of the research, the main purpose of the survey instrument was to assess the importance and relevance of particular outcomes and processes in IT. A second purpose was to enable the assessment of the maturity of processes and outcomes. A third purpose was to enable the future exploration of the relationship between IT capability maturity, IT posture and value. In version 1 of the survey sixteen questions assessing the maturity of both outcomes and process were asked for each of the four identified macro-processes (described in detail in subsequent chapters). These survey questions were mapped to specific critical processes in each macro-process but were primarily used in this research and dissertation to assess the overall maturity of each critical process. A short excerpt of the assessment survey is shown below.

In order to create a baseline for improvement and a desired future state, executives were surveyed on IT capability maturity and value performance for two different years. The full survey instrument is contained in Appendix A.

[12] Extract from Butler Group Analysts research report 2007: "For those organizations unsure how to proceed, "Managing IT for Business Value Capability Maturity Framework" provides a valuable basis for ascertaining current competence and future direction. Butler Group recommends that organisations look to put in place remedial action to attain Level three as an urgent necessity, bringing definition to the measuring process. The organisation should have plans to reach Levels four and five over the medium term, evolving IT to an optimised state where the IT department is seen as a value centre, works within a sustainable economic model, and provides core competency".

Managing the IT Capability			
Scoring Schema: **1 = Ad Hoc, 2 = Basic,** **3 = Intermediate, 4 = Advanced** **5 = Optimizing**	**Importance** **1-5** **1= Not Imp.** **5=Very Imp.**	**2002 Maturity Level**	**2006 Maturity Level**
IT has the necessary capability assessment tools and processes in place to give a holistic view of IT capability			
IT delivers a steady stream of solutions which provide competitive advantage to the firm.			
IT is perceived as a differentiating core competency for your firm or organization			
A flexible modular technical, application and data architecture which enables business agility is in place			
A high level of enterprise data quality and integrity exists and IT enables Information Superiority over competitors (for example better customer data and market intelligence)			
Industry Best Practice models (e.g. CMM-I) are an integrated part of developing IT solutions and software development capability			

Table 3-4 - Sample of Capability Maturity Assessment

The IT Value Performance instrument, outlined in the table below, considered four important goals for IT value contribution and surveyed both the importance of the *outcome of IT usage* on these goals (scale from 1 (not important) to 5 (very important)) and the *influence of the use of IT* in the organization (scale from 1 (not successful) to 5 (very successful) on these goals).

GOAL	IMPORTANCE OF THE OUTCOME OF IT USAGE ON THE GOALS	INFLUENCE OF THE USE OF IT IN ACHIEVING THESE GOALS
Cost Effective Use of IT		
Effective Use of IT for Business growth		
Effective Use of IT for Asset Utilization		
Effective Use of IT for Business Flexibility		

Table 3-5 - IT Value Performance Assessment Instrument

To enable a preliminary assessment of the relative IT posture of an IT organization survey respondents were asked to rate their IT posture using the phases of high technology adoption as identified by Moore (1991). These phases corresponded to innovator, early adopter, early majority adopter, late majority adopter and finally laggard.

3.13 Future Hypotheses

As well as the validation of the IT-CMF artifact that occurred during the design science research phase, I was keen to seek to provide some initial hypotheses that could be used in the future for potential empirical validation of link between capability maturity and value. The following hypotheses are suggested:

1. H1: There is a positive association between mean IT capability maturity and IT value performance.
2. H2: There is a positive association between mean maturity of each macro-process and IT Value Performance.
3. H3: There is a positive association between IT posture and IT value performance.

The empirical testing of these hypotheses was beyond the scope of my PhD work but is a logical next step for follow-up research.

4 Chapter 4: Case Study: The IT Transformation at Intel

In 1999, I became Director of IT Strategy and Technology for Intel and was given an assignment to develop a strategic and business plan to transform the IT organization. This model provided a conceptual model to help shape a strategy and plan for IT transformation at Intel. Subsequently my analysis of the transition and evolutionary journey provided the initial draft IT Capability Maturity Framework presented in this dissertation.

4.1 Background: Transforming Intel IT; the IT@Intel Business Plan 2000

Enabling business transformation through IT is an increasing priority for CIOs. Often, however, the IT function must transform itself first, before it can become a true catalyst and enabler of overall business transformation. A constant struggle for most CIOs is defining how IT can add value to the business. Most IT organizations are trying to build capabilities that cut costs, increase revenues, and support business innovation. But, because they are saddled with legacy systems, processes, and depreciation, many of them are viewed as business liabilities rather than strategic assets. Despite the emergence of IT governance, enterprise architecture, service management and a variety of other approaches to enhancing the value of IT, many IT organizations have not been able to transform their roles in the organization. Such was the situation of IT at Intel in the late nineteen nineties.

In the late nineties an Intel employee communications magazine ran an April fool's Day edition with a lead story whose headline read, *Intel IT wins an Intel Achievement Award*. Such an achievement was so far from the realm of possibility that it was a big joke in the company. This event was one of the catalysts for a six-year transformation of IT, from a mediocre organization to one considered a strategic business partner by 80% of Intel's executive team.

This transformational journey began with a new CIO, Louis Burns. Burns came to the job with a passion for operational discipline and customer orientation. His goal was to stabilize IT and initiate change, such as organize IT around the customer, rather than around IT functions.

Burns created a vision for Intel IT to enable Intel, and he focused on developing leadership skills within IT. By summer 1999, he had accomplished foundational improvement work, which included re-organizing Intel IT around the customer and centralizing infrastructure spending. He then returned to lead Intel's chipset business and was succeeded as Intel's CIO by Doug Busch, an Intel IT director with a strong technology background.

4.2 Building a Foundation for Success

Doug Busch came to the position with a long standing belief that IT wasn't delivering the competitive value that it could provide. Busch began his tenure as CIO by aiming to build on the foundation for success established by Burns. He created a new mission and vision for IT that aligned with Intel's 2000 corporate objectives. His transformation vision was that Intel IT would be recognized as a key contributor to Intel's success, both inside and outside of Intel. His new IT mission was to fuel Intel's success with outstanding strategic leadership and IT services.

To drive the transformation, he launched an initiative in 1999 to build a business plan to transform IT. As the incoming Director of IT Strategy and Technology, I was asked to lead and assemble a small team of IT managers and employees to build this plan. We were given a key boundary condition: take an objective approach to running Intel IT like a business by building the business plan at arm's length from Intel[13]. At this point the IT organization's scope included: infrastructure, shared services for enterprise applications and a number of vertical functions, including office computing, manufacturing computing, engineering computing and such.

As leader of the transformation team I set an aggressive agenda for driving the transformation. I went looking for an overarching framework to help structure and guide the transformation but to my disappointment could not find an overarching framework in either the literature or best practices frameworks to directly help.

[13] We deliberately targeted running IT "like" a business, rather than "as" a business. This was to ensure that we maximized the business value to Intel and not the profit of the IT organization, avoiding any agency costs through mis-alignment of objectives. I define IT business value as the contribution that IT makes to an organization achieving its strategic objectives.

However one paper on developing long term competitiveness through IT assets by Ross, Beath and Goodhue (1998) provided a basis for helping develop a mental model for thinking about developing a strategic transformation plan.

4.3 The Business Plan

A first step on the transformation journey was to become customer centric and this was advanced through organizing around the customer and establishing a customer engagement team. In parallel new product lines which more closely matched what the customers needed were developed. With some good progress in this area the next major step was to develop a business plan which would enable the transformation of the IT organization.

This business plan detailed what service and products Intel IT would provide, enabling accurate cost and value quantification and the establishment of a new operating model to enable Intel IT to run like a business. The goal of the business plan was to enable IT to run like a market driven business to maximize the business value provided to IT by Intel. This would involve achieving end-to-end accountability for customer satisfaction for each of our services and products by reorienting our focus from an internal IT perspective to a customer-driven perspective. Additionally the aspiration was to also improve responsiveness and reduce time to market.

The new IT Business plan was shared with more than 100 IT senior leaders in Folsom, CA in January 2000. The CIO Doug Busch kicked off the business summit by sharing new vision, mission and strategic objectives that were aligned with the new Intel strategic objectives. The Strategic Objectives were

1) Aggressively influence and execute Intel corporate strategies
2) Deliver outstanding, customer-oriented IT services
3) Radically improve Intel business agility and productivity
4) Build and run a world-class IT capability

4.3.1 Establishing the Framework for the Business Plan

At the business summit I presented the business plan and strategy to help achieve these objectives. The strategy behind the IT plan was focused on a number of key themes:

- Focus on the business value of IT rather than total cost of ownership
- Transform IT @ Intel into a market-driven service organization with vertical service and product lines that had full end-to-end accountability for customer-oriented product/service definition, delivery and pricing.
- Develop a new finance model that would enable costing of each IT service/product and the quantification of the business value of the service/product delivered. The end goal was to create a sustainable economic model for IT which optimized the business value of IT to Intel
- Create a business operating model to enable IT to prioritize the IT Investments that needed to be made and the institutionalization of a common repeatable process for allocating resources (people, money, etc) against these priorities and measuring the value of the investments.

A key milestone of success was that Intel IT would win an Intel Quality award which was the most prestigious organizational award at Intel. Just less than two years after the introduction of the business plan, Intel IT was announced as a winner of the Intel Quality award. This did not mean that the transformation was over but as well as being a significant milestone on the journey also created confidence and momentum that Intel IT could truly transform itself. The business plan continued to be executed and many of the key goals were achieved.

Having been the driver of the business plan and a key player in setting the goals I was in a unique position to understand and talk on an ongoing basis with many people involved in the transformation. A key insight for me was to apply the concept of a maturity model to map the evolutionary journey as Intel IT matured. I present the first findings in the following pages.

4.4 Learnings from the Intel Case: IT-CMF Revision 0

Intel IT's six-year transformation worked under four strategies, with specific goals for each:

- Manage the IT budget, where the goal was to create a sustainable economic model through careful cost management
- Manage the IT assets and value chain, where the goal was to develop IT as a corporate core competency
- Manage IT for business value, where the goal was to optimize the business value of IT
- Manage IT like a business, where the goal was to run IT like a market-driven service organization, running IT as efficiently and effectively as possible in support of Intel's goals.

Based on my observations of our transformation, as well as additional research, I developed a framework that captures these strategies and the maturity levels in such IT transformations.

The initial version of the IT Capability Maturity Framework mapped the IT transformation to five levels of maturity for four IT strategies that support long-term enterprise competitiveness. In increasing its maturity, the Intel IT organization evolved from having unmanaged, reactionary processes to following disciplined, high-performing processes and better outcomes. In the sections below I share figures which represented early understandings of the capability maturity curves associated with each strategy.

4.5 Strategy 1: Managing the IT Budget

Managing the IT budget is crucial for an IT organization to gain credibility from its business partners. Westerman et al (2006) report that IT cost cutting is an ever present mandate for CIOs. In managing the budget, IT management aims to meet business requirements as well as free up resources for innovation and growth.

A Gartner report in 2004 stated that 81% of typical IT budgets were used to keep the lights on, leaving only 19% available to fund new innovations and business transformation[14].

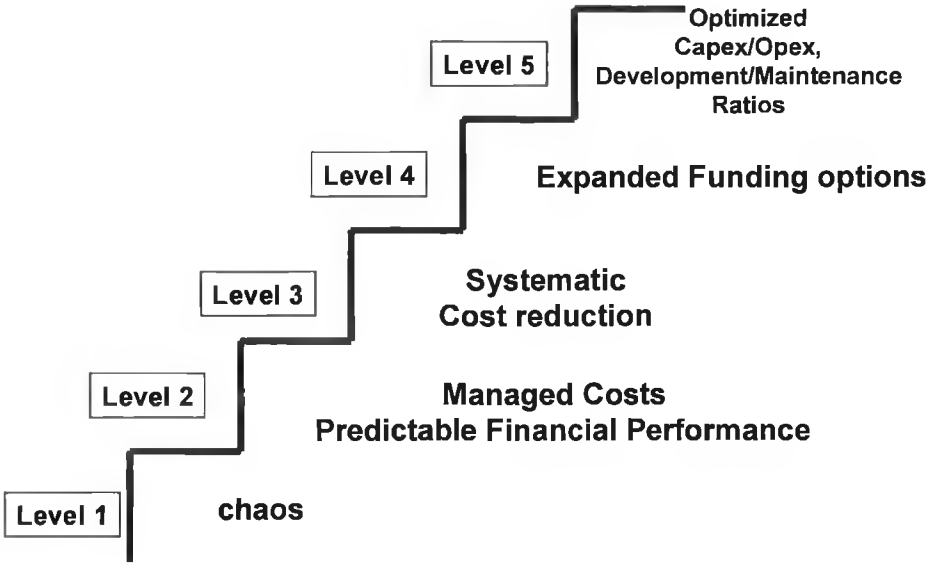


Figure 4.5-1 - Early Managing the IT Budget CMF

Taking cost out of the IT budget relies on such practices as automating components of IT service and support, adjusting service levels as needed, and renegotiating supplier contracts, as needed. It can also rely on nurturing disruptive[15] technologies, that is, technologies that can deliver new or equivalent services at lower costs. Examples of disruptive technologies include virtualization of servers and Voice over IP.

The goal of managing the IT budget is to reach a sustainable economic model. The draft maturity curve developed from the case study is shown in the figure above and is described in the next section.

[14] "IT Spending, How Do You Stack Up?", Gartner, January 2004

[15] For an excellent overview of disruptive technology, see Christensen, Clay, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail,* Harvard Business School Press, 1997.

4.5.1 CMF Outline: Managing the IT Budget

At Level 1, IT spending is ad hoc, with few budget controls.

At Level 2, the IT budget is defined and performance-against-budget is monitored until it is predictable. At Intel, CIO Doug Busch set the visible goal of IT being within +/- 2% of its annual budget.
That announcement alone improved performance because employees knew performance against planned budget was being measured.

At Level 3, we introduced systematic cost-reduction techniques with the goal of reducing both aggregate and unit IT costs. Intel IT introduced two, among many, techniques to cut costs. One example was to introduce Linux as a disruptive technology in engineering computing. Another was to redesign the business processes of the PC support group.

At Level 4, we expanded our funding options to leverage the existing IT budget and introduce budgeting flexibility. We were able to complement IT funding with co-funding from the business or other sources such as government agencies for advanced research.

At Level 5, the IT organization achieves a sustainable economic model, which means that IT an meet the ongoing growth demands of its enterprise with a stable or declining IT budget. This was an ongoing goal for Intel which required ongoing management commitment and attention.

Understanding and managing the IT budget can provide significant leverage, enabling costs to be reduced and savings to be reinvested in new IT investments or elsewhere to help the company bottom line.

4.6 Strategy 2: Managing the IT Assets and Value Chain

IT assets and the IT value chain, together, comprise IT capability. At Intel we loosely defined IT capability as *what the IT function can do for the business.* (Curley, 2004). IT capability includes the knowledge, skills, tools, process abilities, and motivation

present and available in the IT organization to support or perform enterprise business activities.

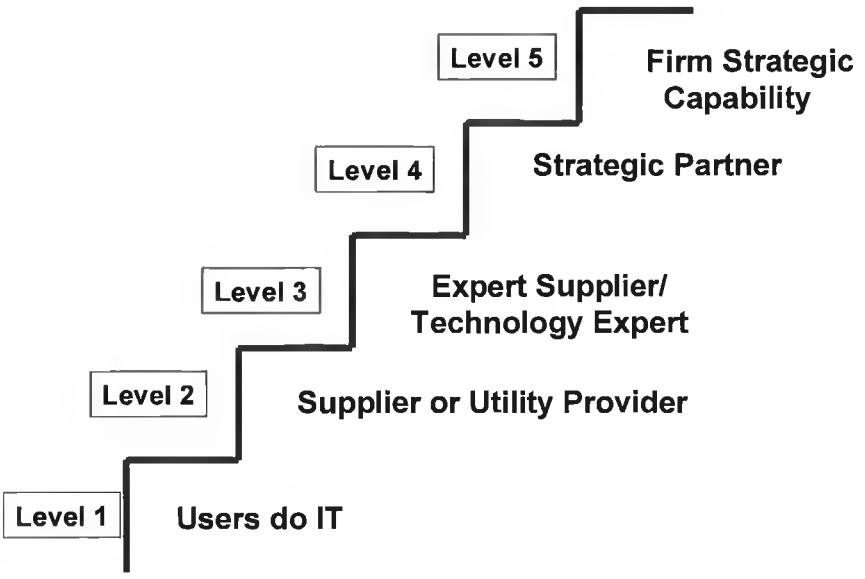


Figure 4.6-1 - Early Managing the IT Capability CMF

Managing IT assets and the IT value chain involves systematically managing four aspects of IT: (1) IT's assets, (2) the value chain that creates business value from IT, (3) the core competencies that deliver IT business value, and (4) the complete workflow through the entire IT value chain.

The premise of managing IT capability is that sustainable competitive advantage (Ross, 1996) from IT comes not from delivering individual stove-piped solutions but from delivering new strategic applications – and doing this faster and better than competitors. When IT capability matures, it is well understood by enterprise executives, it becomes a differentiator for the enterprise, and it is woven into the overall enterprise business strategy (Ross, 1996).

The key basis of the maturity states identified here came from an IT customer satisfaction survey which itself was adopted from a practice that Intel used with external customers. This practice called *vendor of choice* was conducted twice annually by Intel with external customers to see if Intel was indeed their vendor of choice.

4.6.1 CMF Outline Managing the IT Capability

In a Level 1 company, there is no formal IT presence. Users themselves typically purchase and try to maintain computer systems for their own use.

At Level 2, the IT function is viewed similar to an external supplier or utility provider. It offers little or no strategic input to the business.

At Level 3, the IT organization has established a track record of providing quality services, it has delivered some new solutions, and it has gained the reputation as an organization of technology experts. To reach this level, Intel IT began measuring customer satisfaction, and taking actions to improve three key assets: IT infrastructure, IT people, and IT-business relationships.

At Level 4, the IT organization has earned the reputation as a strategic business partner to the enterprise at large. At Intel, CIO Doug Busch earned this reputation, in part, by managing key IT assets: for example the desktop PCs. He replaced them with notebook computers which actually changed how Intel worked. At Level 4, IT leaders are frequently or permanently invited to the business table to discuss and help set strategic direction. This has been the case at Intel.

At level 5, IT capability is perceived as one of a select few strategic and differentiating capabilities of the company. It can provide both operational and information superiority over the competition. This state has not yet been achieved by Intel IT.

4.7 Strategy 3: Managing IT for Business Value

Research shows that CIOs consistently have difficulty measuring and managing the value contribution from IT (Alter, 2003). Managing IT for business value focuses investment decisions on expected benefits and verifying that these benefits are actually delivered. This approach corresponds to the *Begin with the end in mind* mantra of Covey (1989).

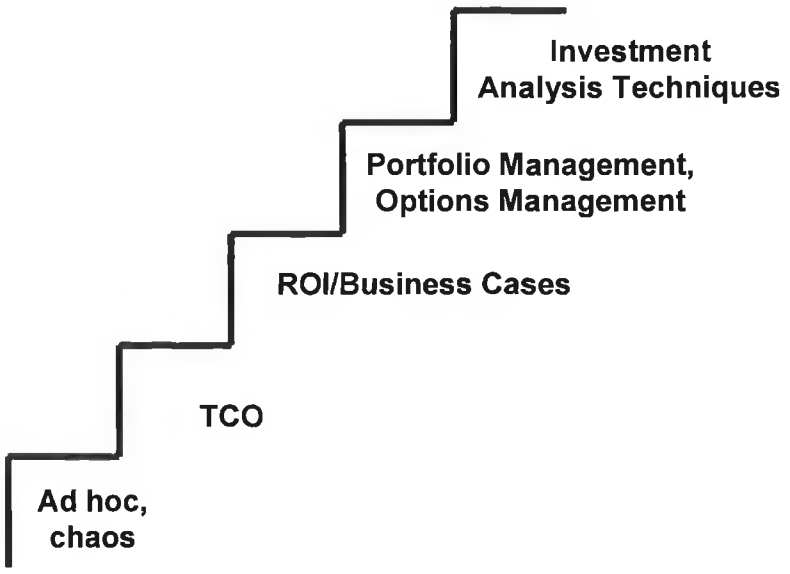


Figure 4.7-1 - Early Managing IT like a Business CMF

In taking such a benefits realization approach, IT management adopts core business practices, including return-on-investment measures, firm-wide coordination of investments, business case discipline, and continuous portfolio management and reprioritization. Managing IT for business value helps IT move from total cost of ownership (TCO) analysis to optimizing the value of IT investments – the Level 5 goal of this strategy. This progression is shown in the figure above.

4.7.1 CMF outline: Managing IT for Business Value

At Level 1, there are no defined or repeatable processes for managing IT's business value.

At level 2, IT organizations focus on TCO by identifying, controlling, and managing the total direct and indirect costs of provisioning and supporting IT solutions to the business. Intel IT made significant progress in reducing its TCO of desktops and notebooks and was able to use this data to make the business case to shift its ratio of desktops to notebooks from 80:20 to 20:80.

At Level 3, IT organizations focus on the business value that solutions deliver. Generating business value is achieved when the focus on cost shifts to a return on investment (ROI). At Intel, this shift to Level 3 was spurred by a goal set by CIO Doug Busch that IT should deliver $100m in new value without increasing its spending. A core practice in achieving this was the establishment of a business

value program office which helped to create and track the value of business cases associated with new IT investments.

Level 4 companies use techniques such as portfolio management to better optimize their portfolio of IT investments against agreed-upon criteria. Other advanced practices, such as options management and assigning accountability for both forecasted benefits and actual benefits realization, are commonplace at Level 4. Intel IT shifted from evaluating individual investments to grouping IT investments into like categories, so they could be compared and the return of a portfolio actively managed.

At Level 5, IT organizations demonstrate optimal return from IT investments through their use of sophisticated investment analysis techniques. Intel IT had yet to achieve this state at the time of writing.

4.8 Strategy 4: Managing IT like a Business

Managing IT like a business means taking a business-like approach to running the IT organization. This strategy involves applying solid professional business practices to the IT function. Some examples are: managing customers professionally using account managers, using chargeback and service level agreements to manage demand, and institutionalizing governance principles.

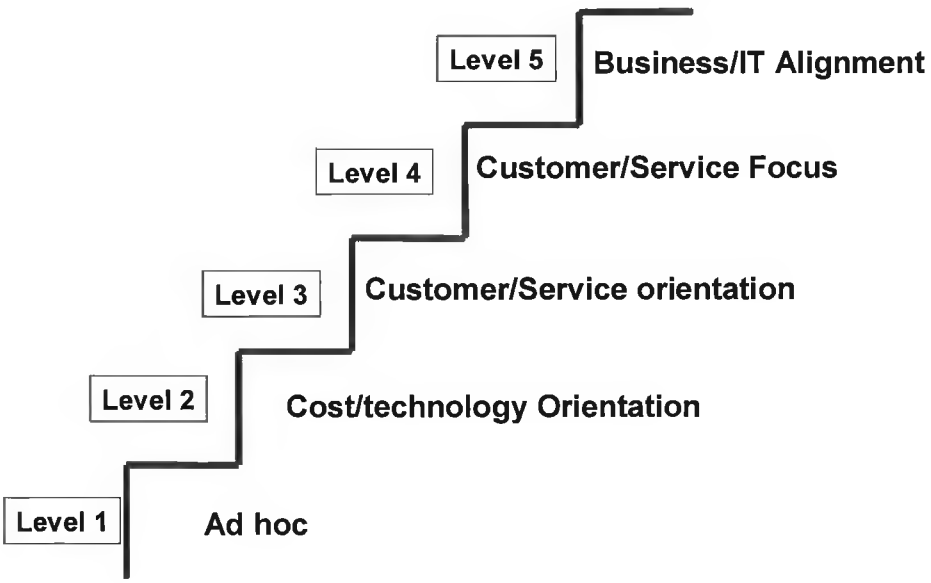


Figure 4.8-1 - Early Managing IT like a Business CMF

Managing IT like a business also involves implementing a number of critical processes to ensure that IT delivers output commensurate with the enterprise's goals. In addition, maturing this strategy can help the IT organization move from being perceived as a cost centre to being seen as a value centre, with a high level of IT-business alignment. This progression is shown in the figure above.

4.8.1 CMF Outline Managing IT like a Business

At Level 1, the IT organization is completely focused on technology, and has few or no asset or cost management systems in place.

At Level 2, the IT organization is seen as a cost centre. It has basic IT asset management and cost management practices in place. Intel IT created MOAT (The Mother of All Templates) that gave a comprehensive view of all IT product and service costs – to help reduce costs and manage current demand.

At Level 3, the IT organization is viewed as a service centre. IT staff think less about which information technologies to provide and more about delivering services that meet current needs and generate value from current investments and infrastructure. Intel moved from a gross chargeback approach to chargeback based on consumption, thereby giving division general managers visibility and control over the IT services they used.

At Level 4, IT is viewed as an investment centre. It has implemented ERP for IT to support efficient and effective IT operations and the IT budget is driven more by business strategy than by external benchmarks or targets defined by the CFO. Intel IT reorganized itself into service organizations with full accountability for defining, pricing, and delivering services to their specific Intel businesses they supported. It also formed an innovation organization to look to the future.

At Level 5, the IT function is operating as an entrepreneurial value centre, actually leading the business in the creation of new products, services or even business models through innovative use of technology. Intel IT publishes an annual report, as businesses do, and Intel's sales and marketing organization draws the IT@Intel program and IT Innovation centres to influence prospective Intel customers and help catalyze innovative solutions.

This nascent framework provided the raw material to the next phase of the research process which was a recursive inductive theory building process, which was part of the overall design science research process.

5 Chapter 5: Describing the IT-CMF and Theory

The next two chapters define and describe the IT-CMF. This chapter begins with an overview of the artifacts generated during the research. The chapter then introduces the IT capability maturity framework (IT-CMF) and provides the theoretical underpinning of the IT-CMF. The first version of the IT-CMF was developed using a case based theory building approach followed by a design science research approach leveraging academic research, industry best practice frameworks and practitioner experience. The theoretical underpinning of the IT-CMF leverages prior work such as process theory for IT Business Value, resource based theory and dynamic capabilities theory.

5.1 Describing the IT-CMF artifact schema

In the following figure a schema is shown for the IT-CMF set of artifacts generated during this research. As mentioned previously the goal of the IT-CMF is to create conditions of sustainability, controllability, predictability and continuous value improvement through;

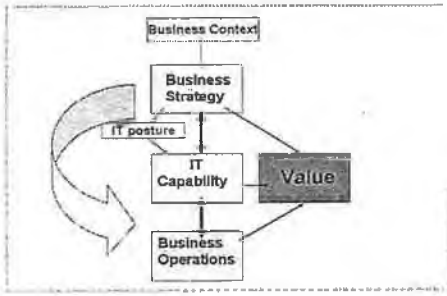
- systematic proactive evolution of IT capability
- dynamic reprioritization and reconfiguration of capabilities in response to the changing business strategy and context.

The artifacts produced by the design research process have been categorized using the nascent design output taxonomy (March and Smith, 1995; Rossi and Sein, 2003; and Purao, 2002) described in chapter 3 and are intended to be used as practical tools by IT executives in achieving the goals outlined above. The table below is not intended as a precise mapping but as a starting point for categorizing the artifacts generated during the research activity.

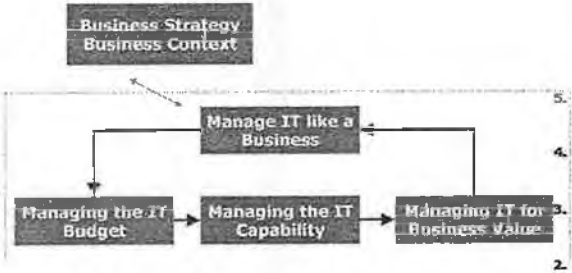
OUTPUT	DESCRIPTION
Constructs	A0: The IT Capability Context Diagram
Models	A1: The IT-CMF control loop A2: The IT-CMF integrated maturity states A3: The IT-CMF individual maturity states per macro-process A6: The IT-CMF critical process listing A7: Individual CP CMF
Methods	A5: Macro-process PMOs A9: Critical-process PMOs
Instantiations	A4: Macro-Process Key Characteristics A8: Critical-Process Key Characteristics A10: IT-CMF Assessment Instrument
Better Theories	IT-CMF theory

Figure 5.1-1 - Mapping of Artifacts to DSR outputs

These artifacts are graphically shown in the next figure whilst the next two chapters reference and describe the artifacts in particular giving examples of artifacts A1 to A5.



A0: IT-CMF context



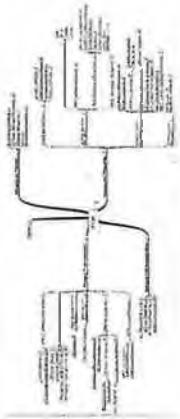
A1: Closed Loop CMF

Maturity Levels	Major Strategies			
	Managing the IT Budget	Managing the IT Capability	Managing IT for Business Value	Managing IT like a Business
Optimizing	Sustainable Economic Model	Corporate Core Competency	Optimized Value	Value Centre
Advanced	Expanded Funding Options	Strategic Business Partner	Options and Portfolio Management	Investment Centre
Intermediate	Systemic Cost Reduction	Technology Expert	ROI & Business Case	Service Centre
Basic	Predictable Performance	Technology Supplier	TCO	Cost Centre
Initial		← Beginning →		

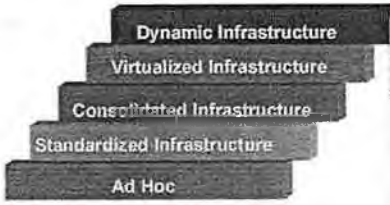
Source: Martin Curley, Intel / National University of Ireland

A2: Integrated IT-CMF

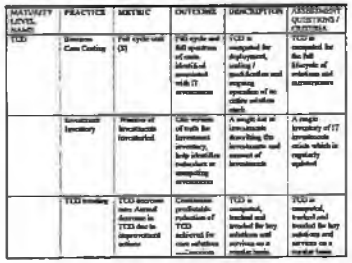
A3: Individual MP CMF



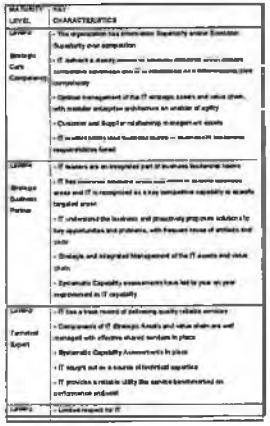
A6: IT-CMF Mind map



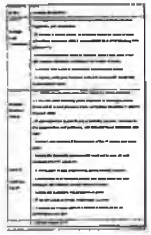
A7: Individual CP CMF



A5: MP PMOs

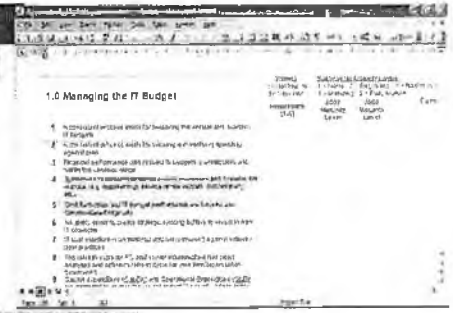


A4: MP Key Characteristics



A8: CP Key Characteristics

A9: CP PMOs



A10: IT Capability maturity assessment instrument

Figure 5.2-1 - IT-CMF Artifact Schema

5.3 Business Value Process Theory

In early business value process theory research Markus and Soh, (1993) proposed a model in which IT expenditure was influenced by IT management to create IT assets which then were used to improve firm performance. This model consists of two connected process models, the first explaining how IT investment becomes IT assets and the second how IT assets yield improved organizational performance. This model leverages the concept of conversion effectiveness introduced by Weill (1992). The Markus and Soh (1993) model as depicted in the literature is shown as an open loop model in the figure below.

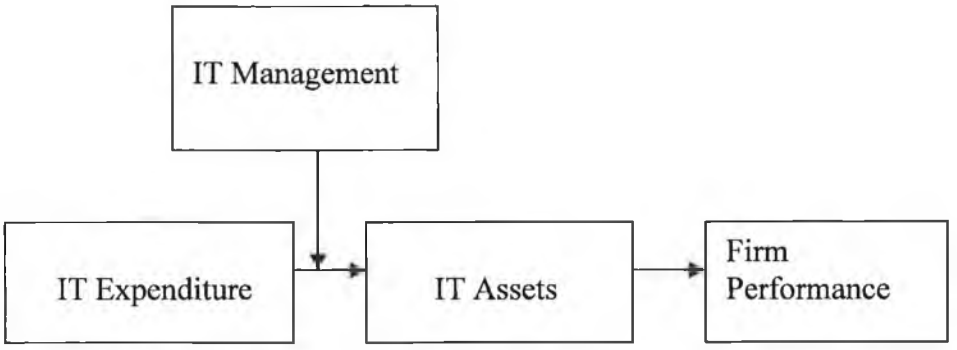


Figure 5.3-1 - Markus and Soh Process Model (1993)

Markus and Soh (1998) subsequently developed their research through synthesis of a number of different process models shown below, which led to a sequenced three process theory model. The principal process models they referenced are shown in the table below.

SOURCE	KEY MODEL POINT
Lucas (1993)	Appropriate use of Information Technology
Grabowski and Lee (1993)	Strategic Fit between firm type, cost structure and IT application Portfolio
Beath, Goodhue and Ross (1998)	Delivering long term competitive advantage for key assets
Sambamurthy and Zmud (1994)	IT impacts are intermediate outputs from IT Management roles and processes which in turn enable value
Tallon and Kraemer (1999) Marshall (2004)	IT Strategic Alignment: IT Management practices as determinants, IT Business Value as consequences

Table 5-1 - Process Theory Key Points

The three processes they identified were

- The IT Conversion Process
- The IT Use Process
- The Competitive Process

The logic of the sequence of processes is as follows. Organizations consume IT budgets to create or acquire IT assets. Good IT assets if combined with appropriate use, yields positive IT impacts. IT impacts lead to improved organizational performance. Marshall et al (2005) proposed a preceding process to those defined by Markus and Soh which was a strategic alignment process. This is comprehended in the overall model in the context diagram where a bi-directional relationship exists between Business Strategy and IT Strategy. This also leverages Tallon and Kraemer's (1999) process-oriented assessment of the alignment of information systems and business strategy,

In the context of this research the context diagram of the IT capability corresponds to the third competitive process where Business Operations and IT capability, directed by a business strategy in a particular business context leads to value creation.

In the new model the conversion and use process are extended to introduce a feedback loop, indeed multiple feedback loops which connect the output of this model, performance (or value) back to the input, so that the input can be continuously modulated to achieved the desired output (value/performance). The act of management frequently uses feedback loops so that inputs are modified with a component from the output to ensure the desired output is achieved. Marshall et al (2005) suggested the concept of closing the loop between organizational performance and business strategic thinking. By modifying investment spend levels or shifting funds to a better performing IT investment portfolio, more value can be created.

5.4 *Theory for Continuous Improvement of IT enabled Value in a firm*

Leveraging the Markus and Soh (1993) and related work an improved theory of how the IT capability in a firm can be managed to help improve the value delivered through IT is introduced. The theory posits that in an operational organization there are four important and interconnected macro processes and associated improvement strategies which are important for the creation of value. Peppard and Ward (2004) identify that a critical part of IT capability is to have the right business and management processes to be able to supply, deliver and exploit IT systems and solutions and three processes envelop the IT capability process to deliver this critical function. The four processes are shown in the figure below, whilst key references are listed in the following Table.

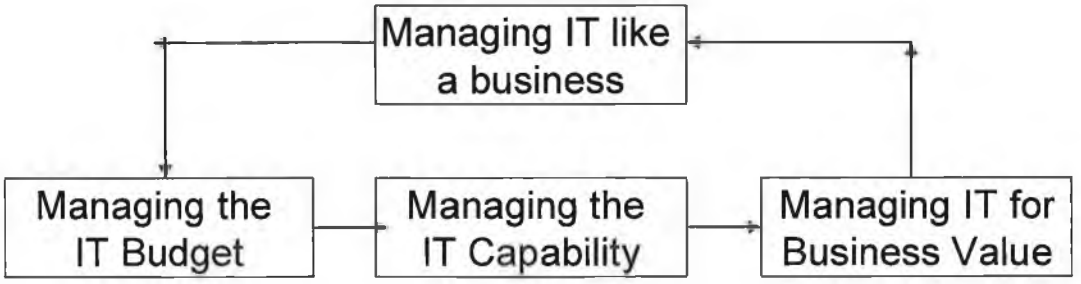


Figure 5.4-1 - Four Macro Processes of the IT-CMF

In this dissertation this diagram is artifact A1 of the IT-CMF and shows a closed loop management system for the IT capability. The four macro-processes identified map to the three processes identified by Markus and Soh in their IT Value Process Theory Synthesis (Markus and Soh, 1998), namely the IT conversion process, the IT use process and the competitive process and the alignment process identified by Marshall et al (2005).

In the integrated IT-CMF we synthesize two well tested concepts, a production process[16] model and a Deming/Shewart cycle[17] (Walton, 1990), to create an integrating framework. In this integrated approach we view the IT capability in a firm as a production process, with four interconnected macro-processes. The IT Budget is the input to the production process, the IT assets and value chain are the production engine and IT value is the output. Managing IT like a business is the management, control and feedback mechanism for ongoing adjustments to the input and the IT capability to optimize the output value (providing the ability to take action to reduce deviations from purpose/objective).

5.4.1 Four Macro Processes

This theory posits there is firstly a *managing IT like a business process* which serves to set strategy and enable concurrent control of the IT capability and modify the IT spend or the portfolio allocation of this spend to help ensure IT helps the firm to deliver to it's objectives on an ongoing basis. This macro-process focuses on critical processes such as IT Governance (Weill, 2004), Supply/Demand Management (Earl and Sampler, 1999) and builds on Ventrakaman's seminal work (1998). Ventrakaman introduced a new approach juxtaposing risk propensity (Minimize risk vs. Maximize Opportunity) versus purpose (IT efficiency or Business Capability) of the IT organization and defined four different types of business models for IT, cost centre, service centre, investment centre and profit centre.

In reality elements of all four business models may exist in an IT organization or just one. A core premise of the approach advocated in this dissertation is to operate IT *like* a business rather than *as* a business with the term *value* centre substituted instead of *profit* centre. This is because significant agency costs (Gurbaxani, 1990)

[16] In microeconomics, production is simply the conversion of inputs into outputs. A given production process is efficient if a particular quantity of goods cannot be produced with any less inputs.

[17] Deming in the 1950's recommended that business processes operate in a continuous feedback loop. This process became commonly known as the PDCA cycle (P=Plan, D=Do, C=Check. A=Act).

can be incurred and a sub-optimization can occur where IT seeks to maximize its own profit rather that the overall value contribution of IT to the firm.

Secondly there is a process for Managing the IT budget which is a critical input to the IT value creation process. The IT budget process controls both the absolute level of budget applied to the IT capability and the allocation to particular portfolios. Budget management is a well recognized component of a management control system.

The IT capability is the production engine of the framework and essentially reflects what IT can do for the firm (Curley, 2004). Capability (Peppard, 2004) refers to the strategic application of competencies leveraging underpinning resources such as technical assets and people. IT capability has been substituted instead of IT assets in the Markus and Soh model to reflect Ross, Beath and Goodhue (1998) theory that while IT assets are important they also need to be complimented with an associated value chain to enable sustainable competitive advantage. Agarwal and Sambamurthy (2002) identify three primary processes of the IT value chain as Innovation, Solutions Delivery and Services Provisioning. The IT Capability consisting of the IT assets and the associated value chain is energized and made productive by applying a budget to it.

MACRO PROCESS	MACRO PROCESS	DESCRIPTION	REFERENCES
MP1	Managing IT like a business	The process of Managing the Budget, Capability, Value process to help optimize value	Weill (2004), Ventrakaman (1997), Earl (1998), Gurbaxani (1990)
MP2	Managing the IT Budget	The process of managing the IT spend and budget	Markus and Soh (1993) Curley (2004)
MP3	Managing the IT Capability	The process of managing the IT assets and associated value chain	Ross, Beath, Goodhue (1996), Weill (1992), Agarwal and Sambamurthy (2002) Peppard (2004)
MP4	Managing IT for Business Value	The process of designing and measuring to help ensure that value is designed in and released through outstanding usage of IT enabled investments.	Curley (2004), Kohli and Deveraj (2004), Sward (2006)

Table 5-2 - Key References per Macro-Process

The Ross et al model of IT capability (1996) is extended with two important extensions. A fourth asset class, Intellectual Capital is added to their existing three asset classes (technical infrastructure, people and relationship assets). The Intellectual Capital assets comprises of the application/solution suite and the data, information and contained in the firms databases, processes and workflows (Curley, 2004).

In addition Eckert (2002) posits that software solutions can only fulfil their promise through the expertise of people who use them; arguing that latent ROI is wasted ROI and that raising the proficiency of users nearly always results in a higher return on investment. Complimentary research from Donald Marchand (2004) posits that IT value does not come from excellent service delivery alone but from the combination of excellent service delivery and *outstanding usage*. Additionally Lucas (1993) proposed that two conditions are necessary for improved performance from IT, firstly the fact that IT is designed so that it fits the firm's task effectively. Secondly he proposes that appropriate use of an effectively designed technology is also a necessary condition for improved organizational performance.

Thus a fourth value chain process has been added to the Ross model, reflecting the *IT use process* highlighted by Markus and Soh (1998) in their Process Theory Synthesis paper. Approaches such as user centred design (Sward, 2006) can help design in value which can be released through easy and outstanding usage.

The *Managing IT for Business Value* process is the instantiation of the third competitive process identified by Markus and Soh (1998) where value is created through using IT impacts to create competitive differentiation. This is where value is assessed and realized. As discussed in chapter 2 in terms of firm performance IT creates value through two fundamental mechanisms – business continuity and business change. Business continuity ensures that the firm can continue to obtain value from its products and services through such actions as process automation, product or service development, services provisioning etc. Business change delivers value when some change in the business model, process or product/services is enabled or driven through IT. Business Change reflects on value created through the IT impacts defined by Sambamurthy and Zmud (1994). These include new/improved products and services, transformed business processes, enriched organizational intelligence and dynamic organizational structures.

An expanded version of the integrated model is depicted in the figure below.

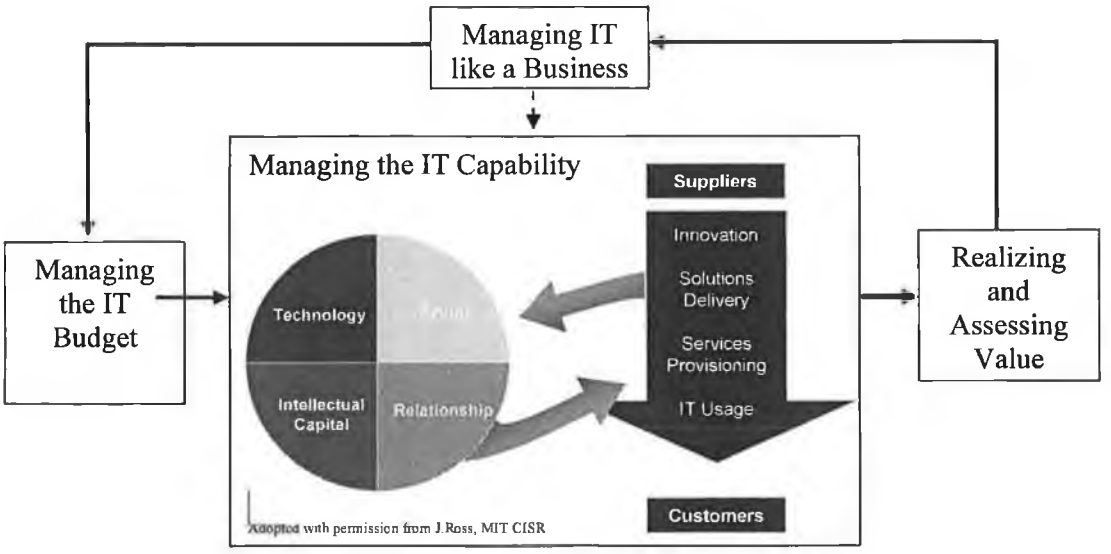


Figure 5.4-2 - Integrated Model for continuously improving IT Value

In this expanded diagram the assets and value chain which make up the IT capability are depicted and as described above these consist of four assets and four value chain processes which are extended from Ross et al (1996).

5.5 Improving IT Capability Output and Productivity

In general most organizations want to increase output and indeed this is true of a firms IT capability. In the face of increasing competitive pressure firms will want to achieve more output from their IT capability. Dedrick et al (2003) define two mechanisms for increasing the productivity of the IT organization – capital deepening and improving multi-factor productivity. Extending and disaggregating suggests the following approaches for improving IT capability productivity and output;

- Using a different portfolio mix of inputs, weighting investment toward higher performing kinds of IT investments

- Aligning and sequencing investments better so that they better support the goals of the organization

- Improving the quality of the inputs to the IT capability (for example buying computer hardware from a different vendor resulting in potentially improved performance with lower acquisition and total cost of ownership costs)

- Capital deepening: the productivity of IT employees and organization may increase when more capital is provided. Capital could include hardware, software, data centres or other related assets acquired through increased investment.

- Multifactor productivity (MFP): advances in improving the conversion effectiveness of the IT capability through improving the maturity of composite business processes can increase the level of output without an additional increase in input

Jurison (1996) identified that IT benefits primary depend not on the size of the investment but on management effectiveness in converting the investment into business results. He also states that organizations differ vastly in their conversion effectiveness. Improving the IT capability to allow improved conversion effectiveness is a key theme of this dissertation.

A key theme then is to improve the maturity of the IT capability by improving process maturity and outcomes to improve conversion efficiency and then modulating and changing the portfolio allocations for different kinds of investments based strategic business alignment and on historical returns to optimize the overall value delivered from the IT capability.

5.6 Dynamic Capabilities and Continuous Improvement of Value delivery from the IT capability

In this section I discuss the macro-process sequencing for continuous improvement of IT value delivery using a dynamic capabilities lens. An example of an unmanaged, unaligned situation is shown in the following figure. Here effectively the IT capability operates in open loop with no connection between output and input. There is also no

alignment amongst investments or even a concept of portfolio management. Some investments may not only be not complementary but also competing.

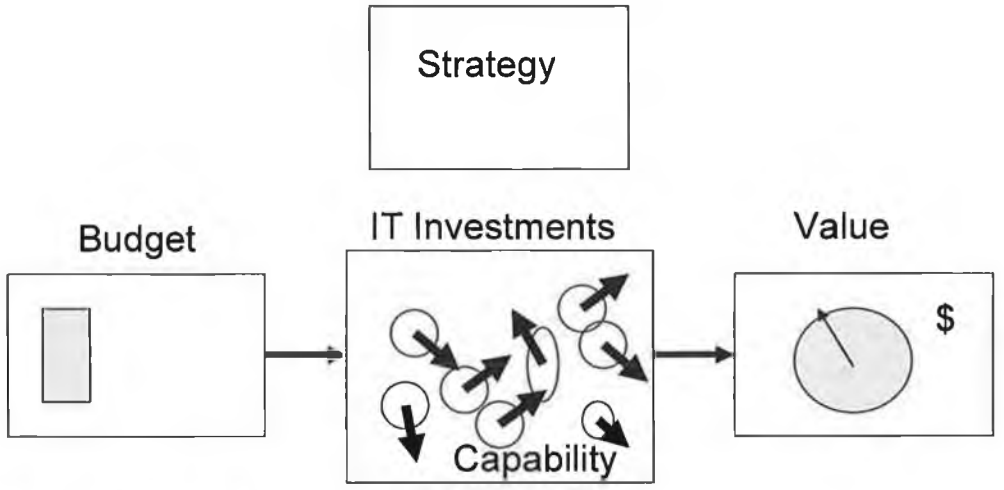


Figure 5.6-1 - Unaligned, Unmanaged IT Investments

In terms of the continuous improvement of value delivery the sequence of primary events is as follows.

1. In MP1 the IT leadership/governance and IT strategy processes set the direction for the overall IT capability. This direction setting should be highly aligned to the business strategy and influenced by prevailing business conditions.

2. In MP2 the strategic direction is translated into an IT budget which will create two kinds of value, value from maintaining existing systems and future value from new solutions.

3. The IT Capability (MP3) is the production and manufacturing engine of the IT capability and two primary activities are performed here (a) existing products and services are maintained and provisioned and (b) new solutions are envisioned, developed and existing services are supported, based on the budget applied.

4. In MP4 value realization and assessment happens with IT delivery translating into value. Here the ongoing performance of IT investments should be regularly tracked.

5. The performance of these IT investments should then be fed back into MP1 perhaps resulting in a change in strategic direction based on information on financial return information of investments. IT strategy reassessment will also be considered in the light of changing business strategy and business conditions.

6. Subsequently the cycle starts again with a new budget being determined in MP2 based on the output of MP1.

This continuous operation of the control loop at an appropriate frequency is intended to lead to continuous alignment and improvement of the value contribution of the IT capability given a constrained budget. The application of a dynamic capabilities approach where the loop is closed regularly aims to move IT Value creation from a relatively unmanaged and unaligned state to a scenario depicted in the following figure where all IT investments are aligned with strategy and value is continuously improved through active portfolio management, weighting investment more heavily towards the better performing investments.

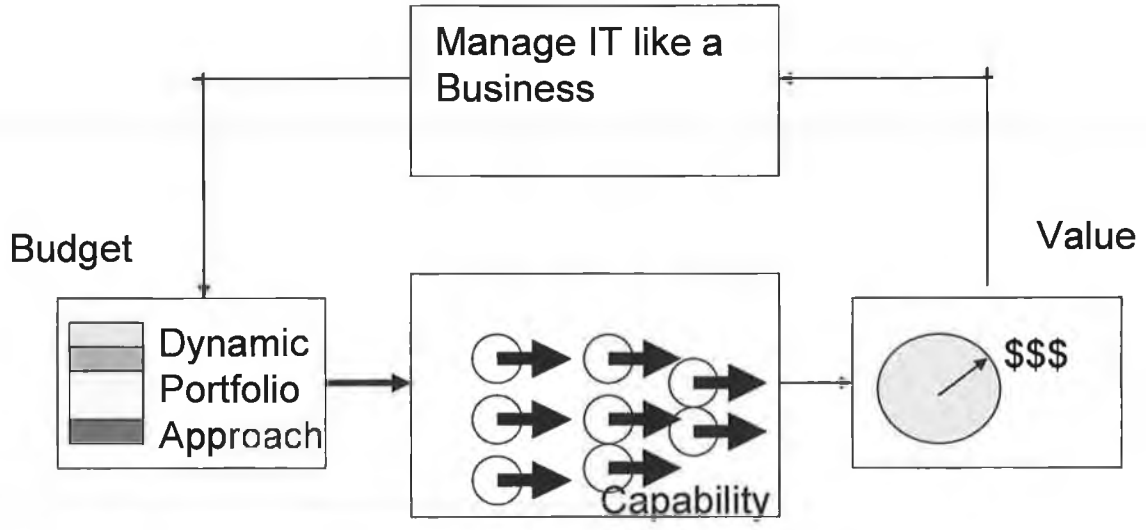


Figure 5.6-2 - Aligned and Managed IT Investment

Superior returns from IT compared to other classes of assets or responses to new business opportunities or challenges may lead to an increase of the IT budget. Alternatively improving productivity or efficiency of IT may lead to a reduction in the overall IT budget as more can be done with less. The IT posture of the firm may be a modulator in this kind of decision making. A proforma version of the results which might be expected is shown in the figure below.

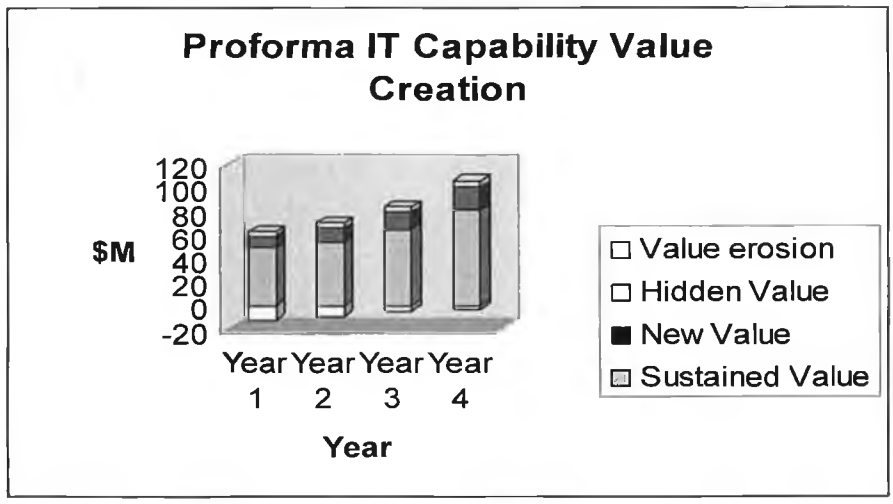


Figure 5.6-3 - Proforma IT Capability Value Creation

In year one there is a baseline value ascribed or measured. New investments will yield future value whilst the process of measuring returns from IT investments may actually uncover value that is hidden.

In year 2 then the new sustained value baseline becomes the composite of year 1 sustained value plus new value realized[18] and any hidden value identified, less any value erosion that might have occurred due to application degradation or perhaps a significant outage. In year 2 because of increasing conversion efficiency due to improvement in process and outcome maturity, combined with better portfolio management and allocations aligned to business strategy, it is expected that the value contribution will increase. Similarly each further year with continued improvement in conversion efficiency due to improved process maturity and outcomes, as well as more aligned and better value contributions, it is expected that the value contribution from IT will continue to increase. We can write this value equation as follows:

$$Value\_S(n) = Value\_S(n-1) + Value\_N(n) + Value\_H(n) + Value\_E(n)$$

- Value_S(n) is Sustained Value in year n
- Value_N(n) is new Value created in Year n
- Value_H(n) is hidden value discovered in Year n
- Value_E(n) is Value Eroded in Year n

[18] Doug Busch, Intel CIO first suggested this way of looking at new value combined with existing value to create a new value baseline.

Value erosion may occur due to a number of factors including competitive dynamics and increasing Total Cost of Ownership (TCO). Value for all elements of a portfolio should be tracked on an ongoing basis to determine to enhance, modify or end-of-life an investment/solution if value goes negative or less than the required return.

In parallel a similar equation can be written for the IT budget[19]:

Budget(n) = Budget(n-1) + Budget_U(n) – Budget_CS(n-1) + Budget_NI (n-1) + Budget_NI (n)

- Where Budget(n) is the new overall budget in year n
- Budget_U(n) is uncontrollable budget increases such as wage inflation, merger and acquisition activity or investment driven by perhaps compliance legislation
- Budget_CS(n-1) is the cost savings achieved in the last year which will reduce this years baseline budget
- Budget_NI(n-1) is the impact on this years budget of new investments made last year
- Budget_NI(n) are the new investments proposed for this year

The overall goal is to deliver increasing IT value with a sustainable economic model for IT. This could be potentially realized by driving significant cost savings and instituting a win-win investment mindset where only new investments are selected which lead to increased business value *and* improved IT efficiency as measured by reduced IT unit costs and/or reduced IT aggregate costs. A proforma scenario for this is shown in the figure below with increasing cost savings enabling more investment which enables further cost savings.

[19] This equation is created and adopted leveraging an IT budgeting practice at Harrah's called Dynamic Baseline IT Budget. This information was shared in a briefing by Corporate Executive Board to its members.

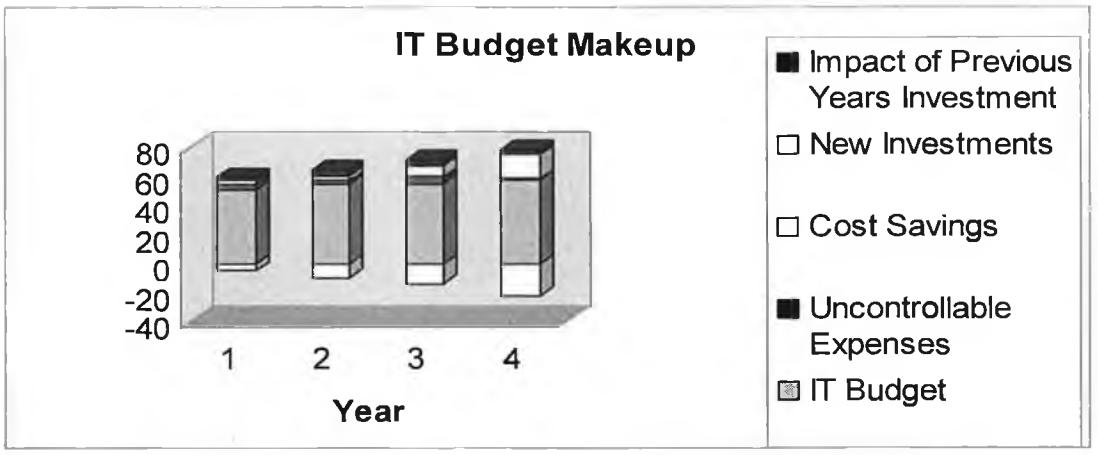


Figure 5.6-4 – Proforma IT Budget Breakdown

Equally active management of portfolio allocations based on value contributions can lead to higher returns from IT. In the following diagram a proforma portfolio allocation is illustrated which would reflect the potential changing in portfolio allocations which might occur as IT conversion efficiency improves and value performance from the previous years portfolio allocations is fed back into next years allocation process. The portfolios identified in the example chart below correspond to the core entity and processes identified in the IT capability model, namely research and innovation, solutions delivery, services provisioning, IT usage, IT assets with an added additional category for IT improvement investment spending.

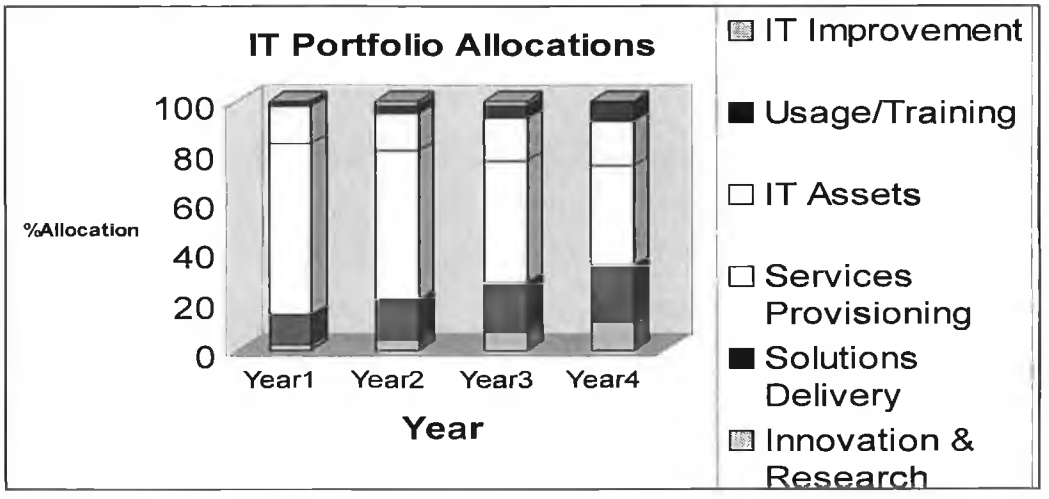


Figure 5.6-5 - Example Portfolio Allocation Changes

In this example the higher returning portfolios receive a higher budget allocation in a subsequent year, whilst lower performing portfolios receive a lower allocation in a subsequent year.

Typically budget allocations for any portfolio will not tend to zero as likely a minimum budget allocation needs to applied to each portfolio, irrespective of the return of the individual portfolio.

We can also write the IT budget equation as the sum of the portfolio allocations

$Budget(n) = B\_I\&R + B\_SD + B\_SP + B\_IU + B\_A + B\_II$

Where

- B_I&R is the portfolio allocated to Innovation and Research
- B_SD is the portfolio allocation to Solutions Delivery
- B_SP is the portfolio allocation to Services Provisioning
- B_IU is the portfolio allocation to IT Usage and Training
- B_A is the portfolio allocation to IT assets
- B_II is the portfolio allocation to IT Improvement efforts

Ultimately the goal is to reach a balanced portfolio which optimizes the return to the business within the constraints of IT funding (Tiernan and Peppard, 2005). On a cyclical basis the portfolio allocations can be changed to increase budget allocation to higher performing portfolios and decrease budget allocation to lower performing portfolios. Also as maturity around budget and value management increase, one may be in the position to contrast and compare the returns from IT investments to other types of investments in the firm which may lead to a subsequent increase in IT budget.

5.7 Applying a Capability Maturity Lens

Applying a capability maturity model lens (Humphrey, 1989; Curley, 2004) provides a very useful framework to help provide roadmaps and direction for IT capability improvement efforts. The first capability maturity model was created by the software

engineering institute at Carnegie Mellon University to help improve software engineering capability (Paulk, 1993).

Thus a five stage maturity model was used as an organizing and structuring framework for mapping the IT improvement efforts across the four identified macro processes. However it became clear that focussing on process maturity was not enough and that it was necessary to document and manage to maturity *outcomes* in parallel. Defining a roadmap of maturity outcomes creates a runway for improvement efforts and in stretching to achieve new maturity outcomes, processes began to emerge to ensure systematic, predictable achievement of these outcomes. In the remainder of this chapter the key maturity states are identified for each level of the four macro-processes. These maturity states were identified using an inductive theory building process where processes and outcomes were observed, categorized subsequently associations formed between them.

5.8 Introducing an IT Capability Maturity Framework (IT CMF)

Building on the process model introduced earlier, a maturity path for each process is introduced which is described as an IT Capability Maturity framework (IT CMF). Using this approach CIOs can manage four inter-related macro-processes and adopt four associated improvement strategies and maturity curves corresponding to the four macro-processes to help deliver more value from IT. The capability maturity framework is illustrated in the figure below and consists of defined maturity states for the five levels of each of the four macro-processes

1. MP1 Managing IT like a Business
2. MP2 Managing the IT Budget
3. MP3 Managing the IT Capability
4. MP4 Managing IT for Business Value

	Maturity Levels	Major Strategies			
		Managing the IT Budget	Managing the IT Capability	Managing IT for Business Value	Managing IT like a Business
5.	Optimizing	Sustainable Economic Model	Corporate Core Competency	Optimized Value	Value Centre
4.	Advanced	Expanded Funding Options	Strategic Business Partner	Options and Portfolio Management	Investment Centre
3.	Intermediate	Systemic Cost Reduction	Technology Expert	ROI & Business Case	Service Centre
2.	Basic	Predictable Performance	Technology Supplier	TCO	Cost Centre
1.	Initial		← Beginning →		

Source: Martin Curley, Intel / National University of Ireland

Figure 5.8-1 - The IT Capability Maturity Framework

This diagram referred to as the integrated IT-CMF diagram, is artifact A2 generated during the research. Each of the names of each of the unique maturity states have been carefully chosen to reflect the dominant characteristic present at each level, for each macro process. Note that at level 1 the initial level, the dominant characteristic across each level is that it is beginning.

5.8.1 Applying the IT-CMF

Using the IT-CMF as a guide, CIOs can help their IT organizations move from being perceived like a utility or technology supplier to become a core competency of the firm. They can help the organization move from a scenario where the IT budget is apparently out of control to where there is a sustainable economic model for the IT budget where increasing demand for IT is met, while avoiding a runaway budget. They can help the organization move from being barely able to compute the total cost of ownership (TCO) of their infrastructure to being able to deliver and demonstrate optimized value from their IT investments. The framework can help the IT organization move from being perceived as a cost centre to that of a value centre with a high level of IT and business alignment. Ultimately the goal of management (Salman et al, 2005) is to create conditions of sustainability, controllability and predictability of the IT capability in support of continuous value creation and use of the framework can support this goal.

5.9 Describing the Capability Maturity Framework

In chapter 6 each of the four macro-processes outlined above are described in detail beginning with the outline maturity curve associated with each macro-process. A staged representation of a capability maturity model is used to provide an executive perspective but it deviates from the traditional CMM models in that each step in the IT CMF represents an increased level of sophistication of the processes/practices used and the output delivered, rather than just the degree of control and institutionalization across a particular key process area. It is assumed in the IT-CMF that each critical process is in control and institutionalized before an organization can be viewed as having reached maturity at a particular level. In the maturity curves for each macro-process it is assumed that there are a number of critical processes (CPs –see Appendix C) which underpin each macro-process and as these critical processes are collectively matured that the impact and value delivered through each macro-process is improved. Typically it is advised that CIOs make improvements in parallel across each of the four macro-processes.

5.9.1 Five Maturity Levels

Each maturity curve has five maturity levels (unmanaged, basic, intermediate, advanced, and optimized). These are defined briefly in the following table.

LEVEL	BRIEF DESCRIPTION
Optimized	At level 5 the critical process is optimized both within the process area and in the context of other related critical processes and delivers optimal output.
Advanced	At level 4 there is an advanced level of process sophistication and functionality to deliver an advanced level of functionality and process output
Intermediate	At level 3 there is an intermediate level of process sophistication to deliver an intermediate level of functionality
Basic	At level 2 there is basic process functionality to deliver a basic service or function
Unmanaged	At level 1 there is no formal process and critical processes are executed in an ad-hoc manner

Figure 5.9-1 - Level Definitions

Here follows a description of criteria used to help determine the appropriate positioning of a process, practice or outcome at a particular level, with the levels being described in more detail below.

5.9.2 Structuring of Levels

As referred to in chapter 3, in the IT-CMF there is a natural ordering and a cumulative approach where more mature states build on lower maturity states. To help position a practice, metric or outcome at a particular level the following table is presented which includes five dimensions of maturity reflecting the outcome impact, the outcome competitive positioning, process maturity (based on CMMI maturity measure) and practice evolution status.

Practice Evolution Status	**Process Maturity**	**Outcome Competitive Positioning**	**Outcome Impact**	**Level of Digitization**
State of the Art - Breakthrough Practice	Optimizing	World-Leading	Optimization	Approaching full Digitization
Emerging Practice	Managed	Differentiating	Transformation	Significant levels of Digitization
Industry Average	Defined	Competitive	Improved effectiveness	Digitization Strategy exists
Behind Industry Average	Repeatable	Basic	Improved efficiency	Elements digitized
State of the Ark	Beginning	Ad-Hoc	Little impact	Ad-hoc

Figure 5.9-2 - Reference table of criteria

Any given IT practice, outcome or metric can be evaluated against these criteria to help determine its level position in the framework. Practice evolution status indicates whether this is a well known and used practice or whether it is just emerging with some early adopters or whether it is state of the art likely enabling some outcome breakthrough. The process maturity assessment uses the standard CMM levels of maturity (Humphrey, 1988) with the following definitions:

- Beginning – If the process is not stable or under control , no structured progress
- Repeatable – The organization has achieved a stable process with elements of statistical process control used to achieve repeatability of outcomes
- Defined – The organization has defined the process to ensure consistent implementation and to provide a basis for a better understanding of the process.
- Managed – The organization has initiated comprehensive process measurements, leading to possibilities of significant quality improvements
- Optimized - Here the organization has a strong platform for individual and collective process improvement.

The type of outcome impact further helps with positioning of content in the framework. For example an outcome or process which leads to improved IT efficiency would be at level 2, whilst an outcome or processes which lead to improved IT effectiveness would be at level 3. The level of digitization of a process is also used as a criterion for levelling. Aggregating the different levels that a particular process or outcome ranks at and then finding the average, will yield an estimate as to the positioning of a particular process or outcome in the framework.

5.9.3 Level Definitions

At level 1 processes are likely non existent and if they are in place are undocumented. Outcomes at level 1 are likely inferior to outcomes from peer organizations and far from predictable, likely requiring significant human glue and effort to deliver and sustain. Regarding outcome maturity, a level 1 outcome typically is ad-hoc and unpredictable. A basic outcome or level of functionality means just that, an outcome which meets the bare minimum of requirements.

At level 2 some elementary processes are in place and documented and may even produce repeatable results. At level 2 there is likely to be risk associated with desired outcomes with possible over-runs on new IT investments, unmanaged costs on sustaining services and unexpected outages in services.

At level 3 a standard set of organizations processes are in use and well defined leading to predictable outcomes and costs. At level 3 outcomes place the

organization in a competitive position with respect to peer organizations. A competitive outcome or level of functionality means the outcome is a mainstream outcome which provides a competitive advantage or at least maintains parity with peers. At level 3 consistency becomes a core attribute of the organization and digitization of process is occurring.

At level 4 more sophisticated outcomes are achieved often placing the organization in a differentiated position with respect to the outcomes it delivers. Differentiation means delivering outcomes which are clearly differentiating compared to outcomes in peer organizations. A high degree of rigour exists around process management and execution and processes are often quantitatively controlled where appropriate. At level 4 a high level of process digitization exists.

At level 5 outcomes are reaching optimum states, putting the organization in a clear leadership position. Quantitative process improvement goals are dynamically adjusted to take into account changing business strategy and context. Also at level 5 processes are approaching a complete level of digitization and the leading outcomes achieved are just achieved by a handful of world-class organizations.

5.10 Classification schema for the IT-CMF

In order to specify the IT-CMF a classification schema has been proposed in appendix C. Recursive logic has been used to help ensure extensibility and consistency in the framework classification schema

6 Chapter 6: Defining and Describing the IT-CMF

As defined the IT-CMF is an archetype of the levels and stages through which an organization traverses and evolves as it defines, implements, measures, controls and improves its IT capability in support of value creation for the organization. Having reviewed the theoretical derivation and dynamic capabilities aspect of the IT-CMF, in this chapter we will define the levels and key characteristics associated with the four macro processes identified in the IT-CMF. The primary focus of each macro process is show in the following table.

MACRO-PROCESS	PRIMARY FOCUS
MP1: Managing IT like a Business	Leadership, Governance, Alignment and Management Processes
MP2: Managing the IT Budget	Budget Management and Performance, sustaining and making new investments for the IT Capability
MP3: Managing the IT Capability	Traditional IT factory functions including solutions delivery, services provisioning
MP4: Managing IT for Business Value	Value and benefits delivery

Table 6-1 - Macro-Processes and Focus Areas

6.1 MP1 Managing IT like a Business

Firstly *Managing IT like a business* advocates taking a business-like approach to managing IT business value. This involves using solid professional business practices and applying them to the IT function; for example, managing customers professionally using account managers, using chargeback methods to manage IT resource demand and institutionalizing governance principles similar to those used by firms. This approach involves a number of critical processes to help ensure that the IT capability delivers an aligned value output commensurate with the level of IT budget used as input, in the context of what the firm or organization is trying to achieve through IT. Importantly MP1 is where strategic direction, leadership and Governance for IT are defined. Additionally, Earl and Sampler (1998) argue that the management of IT is about two core issues, the supply side which covers research,

solutions delivery, services provisioning and the demand side which is the identification of opportunities to exploit emerging technologies and prioritization of business and solution requirements. Managing IT to create ongoing supply/demand equilibrium is thus also a key objective of this macro-process. The five maturity states identified with MP1 are shown in the following figure, which is an example of artifact A3 generated during the research.

Figure 6.1-1 - MP1 Maturity States

As mentioned previously it not advocated running the IT organization *as* a business as this can lead to sub-optimization where the goal of IT making profit inappropriately supersedes the goal of the overall firm to make profit. The basis of this logic is agency theory applied to IT management (Gurbaxani, 1990) where the goals of the firm and the IT organization may have dissonance. Attempting to run IT as a business can also create significant difficulties where IT management lacks the business acumen and systems to operate IT successfully as a business.[20] This is not to say that IT can not be successfully run as a business but the vast majority of IT organizations reviewed in the research were not trying to operate as a business[21].

[20] A public presentation by a Shell IT manager in 2003 identified that Shell had had a very troublesome experience in attempting to run its IT as a business externally to Shell. In a subsequent interview with the new Shell CIO Mike Rose, he identified that he and Shell were successfully able to bring Shell IT back into the Shell group and operate much more successfully

[21] In the course of this research a number of IT organizations were Identified as successfully operating as a true profit centre. Axa-Tech the IT provider to AXA group is a separate legal entity which conducts business as a P&L successfully servicing AXA group's ongoing needs. Additionally Delta Technology, the IT provider to Delta Airlines

Key characteristics for process and outcome maturity for the Managing IT like a business macro-process are listed in the table below for each maturity level. This table of key characteristics is an example of artifact type A4 generated during the research.

MATURITY LEVEL	KEY CHARACTERISTICS
Level-5 Value Centre	• IT perceived as a Value centre with a track record of sustained value delivery • IT & Business highly aligned and Supply/Demand equilibrium exists • IT performance continuously improved through balanced scorecard techniques • IT demonstrates strong entrepreneurial behavior and is a business driver • The firm leverages IT skills and resources externally in support of its strategic objectives.
Level-4 Investment Centre	• IT is strategic and focused on creating future value and new business capabilities • Emphasis is on maximizing opportunities from IT resources • IT has implemented ERP for IT to enable efficient and effective operations • Both IT Service excellence and usage excellence are routinely demonstrated • Flexible funding mechanisms and Dynamic Resource Allocation exist

and Gedas, the IT provider to Volkswagen, operate as a profit centre, selling IT services to other organizations as well as Volkswagen.

LEVEL-3 Service Centre	• IT focuses on releasing and realizing value from current investments • IT focuses on services which drive current business strategies and on automating and redesigning current business processes • Strengthening Customer and Service Orientation with Service Delivery and Management practices actively implemented • Cost Accounting and Chargeback Mechanisms in place • IT processes actively managed with some automation in place
Level-2 Cost Centre	• Key focus is stabilizing costs and Improving IT efficiency • Basic Asset and Cost Management systems in place • Focus is to deliver IT services and products at lowest cost levels relative to external benchmark • Technology/Product focus • Basic IT processes documented
Level-1 Unmanaged	• Ad hoc • No defined IT processes

Table 6-2 - MP1 Key Characteristics

In the Managing IT like a business macro-process five maturity states are called out mapping to levels 2 to 5. Level 1 is by definition ad-hoc. Level 2 is a cost centre where there is an operational focus that drives operational efficiency whilst also minimizing risk (Venkatraman, 1997). Historically many firms have operated IT as a cost centre and typically here business strategy is seen as independent of IT, with IT just providing a base infrastructure. Level 3 is a service centre where the aim is to create an IT-enabled capability which supports current organizational strategies, with a continued focus on risk minimization (Venkatraman, 1997). Transitioning from level 2 to level 3 typically entails shifting focus from delivering capability at lowest possible cost to delivering capability to deliver competitive advantage within the context of the current business strategy. Typically there may be a lag between when a particular requirement for a new IT enabled business capability is identified and when IT is able

to deliver this capability. At Level 4, IT is characterized as an investment centre which has a more strategic focus and where the aim is to create new IT-based business capabilities (Venkatraman, 1997). Level 5 is a value centre where IT displays entrepreneurial leadership creating new business opportunities and growth through advanced use of IT. This can also include a profit centre focus where IT delivers IT services to the external marketplace for incremental revenue (Venkatraman, 1997) or where the IT organization functions as a separate legal entity providing services back to a host organization. It should be noted that any particular IT capability may have elements of the capability which span the states described in level 2 to 5. For example at Intel, some parts of IT act as a cost centre while the IT Innovation group acts as a value centre.

In the next sections we will look at each level in more detail.

6.1.1 MP1 – Level 1

At level 1, the IT organization is completely focused on technology, and has few or no asset or cost management systems in place. Systems are provisioned on an ad-hoc basis, or perhaps even at high velocity, but there is no asset management or cost control or tracking and it feels like the provisioning process is out of control.

6.1.2 MP1 – Level 2

At level 2, the IT organization is very much perceived as a cost centre with the IT organization adopting basic IT asset management and cost management practices. However, at level 2 the IT organization is still very much focused on the technology and is often in a technology push mode.

6.1.3 MP1 – Level 3

As the IT organization matures to level 3, it begins to become customer and service oriented. In other words, the organization is thinking less about what information technology can be provided and more about providing what the customer actually needs. It is also starting to adopt an orientation toward service, recognizing that IT is primarily providing services, not just products. This is an important shift in the mental model used for the IT capability, requiring different costing approaches to be comprehended, instead of using conventional product costing metrics. At this stage, the organization is beginning to implement service delivery and management processes, surveying customers to get feedback on IT's performance and value proposition and also querying for current and future needs of the business. An important differentiator of level 3 from level 2 is the change of key performance

measures used to allocate resources and measure success. At level 2 general unit cost indices and benchmarks may drive resource allocation while a service centre mentality will use business objectives to allocate resources and measure success (Venkatraman, 1997).

6.1.4 MP1 – Level 4

As an organization makes the transition from level 3 to 4, concepts of IT chargeback and flexible funding mechanisms are taking root. This means that the business has more control over the IT budget, and that the budget is being driven more by business strategy than by external benchmarks or targets defined arbitrarily by the CIO. Chargeback is being used to manage supply and demand, appropriately allocate and use IT resources and better communicate the cost and value contribution of IT (Ross, Vitale and Beath, 1997). At level 4, the IT organization has created an internal market economy in which IT prices/costs are consistently used to allocate scarce resources (Ross, Vitale and Beath, 1997). At level 4, IT organizations can learn from and apply transfer pricing approaches (Eccles, 1987) which exist for firm products/services to IT chargeback. Level 4 IT organizations have a measurable customer and service focus. They have implemented proactive customer relationship management systems, possibly including customer segmentation. At this level, the IT organization also has key service support and delivery processes in place. At level 4 IT is markedly more strategic, likely possessing an IT R&D focus to proactively help identify technologies which might enable new business opportunities or proactively help solve emerging or future business challenges. A key focus is to maximize business opportunities from IT resources helping deliver the full value of IT[22]. A key shift in the posture from level 3 to level 4 is to more from focus of rectification of past weakness in operational efficiency to creation of new business capabilities (Venkatraman, 1997).

6.1.5 MP1 – Level 5

At level 5, the IT organization is perceived as a value centre publishing regular value statements showing the pipeline of future value promised and the actual value delivered in the appropriate calendar period. The IT organization has a track record of sustained value delivery and IT and the Business are highly aligned with coupled strategic planning and operational processes. Also an excursion management process exists to manage sudden changes in the business environment and

[22] Having retrenched significantly in 2006 and 2007 to align with a business efficiency goal, Intel IT CIO set a goal of delivering the full value of IT.

business strategy. At level 5 IT can demonstrate strong entrepreneurial behaviour and moves from following the business to leading the business. At level 5 consistently apply leading business practices to the management of the IT capability. At Level 5, systematic processes are in place to help ensure ongoing achievement of supply/demand equilibrium. Although equilibrium may be perturbed by environmental changes or business strategy changes, equilibrium or near equilibrium is achieved through processes which sense and respond to this or through recommendations from a capacity forecasting process. At level 5, there is active performance management of IT using advanced techniques such as balanced scorecard approaches (Kaplan and Norton, 1996). A culture of entrepreneurship and innovation exists with increasingly predictable and successful results. At level 5, the firm is also using its IT resources and skills externally and in non-traditional ways in support of its strategic objectives[23]. At level 5, the IT organization has attained a business orientation and has aligned business objectives to complement its comprehensive service and customer-focused practices with leading business practices such as publishing annual performance reports[24]. At this level of maturity, continuous innovation of business processes is the norm. As mentioned at level 5, the IT organization is perceived as a value centre and whilst this can embody using either cost centre or profit centre for various segments of its offerings, it will usually entail having a sophisticated cost management system. At level 5, the IT organization can compete with the best-in-class outsourcing vendors across a broad set of performance measures and the business may test this by asking the internal IT capability to tender for the organizations IT business in competition with external vendors. At level 5, the IT organization has created an internal market economy in which both predicted value and IT prices/costs are consistently used to allocate the scarce resources.

6.1.6 MP1 - Example Metrics

The following table shares some suggested metrics which could be used to measure performance at each level of the macro process Managing IT like a Business. This is not an exhaustive list but is provided as an illustration of types of appropriate metrics. Listed below are example metrics for each level of MP1.

---

[23] As an example at Intel, the IT Innovation organization drove the establishment and development of www.skoool.com, an advanced elearning content system to stimulate demand creation for PCs and to make a philanthropic contribution to national education systems.

[24] Intel IT publishes an annual performance report, similar to the way companies publish annual reports. This report describes performance in the prior year, the strategy, objectives and risks looking forward. This practice has also been used by IT organizations such BP and Northrup Grumman.

MATURITY LEVEL	MANAGING IT LIKE A BUSINESS – EXAMPLE METRICS
Value Centre	• Annual Value Contribution trend • Percentage of IT projects with Senior executive sponsor • Resource and Asset Utilization • Multi-layer Balanced Scorecard Index • Ratio of IT initiated investments versus business initiated investments • Ratio of IT resources/investments committed externally to internally committed
Investment Centre	• Percentage annual growth in IT budget • Ratio of New IT investment to sustaining and maintenance investments • Percentage of IT processes automated • Service and Usability Service Levels Agreements and Indices • Percentage of flexible to fixed and contract to permanent employee measures • Reallocation frequency of resources
Service Centre	• Percentage of Resources and Investments aligned to current business priorities • Vendor of Choice Survey • Annual Customer satisfaction measures • Standard accounting metrics • Percentage of IT processes automated
Cost Centre	• Unit Costs and trends • Asset Utilization • Percent of Assets Tracked • Key Service and IT unit costs versus Industry benchmark • Percentage of IT processes documented
Ad-hoc	No metrics

Table 6-3 - Example Metrics MP1

6.2 MP2 Managing the IT Budget

Managing the IT Budget is crucial as turbulent economic times persist and pressures on IT budgets continue. In fact the current set of business conditions may be the forcing function which drives a step function increase in adoption of better IT Business value practices industry-wide. In increasingly turbulent business environments, many IT organizations are only able to fuel new innovation and solutions through aggressive cost reduction of existing operations and services. The Managing IT Budget maturity curve describes a systematic approach and set of practices and tools which can be used to manage the IT budget and associated costs. These practices include cost reduction approaches such as service level adjustment, supplier negotiation as well as nurturing so called disruptive technologies which can deliver new or equivalent services often at much lower cost that existing products or services.

Figure 6.2-1 - MP2 Maturity States

How do you decide how much budget to allocate to IT, what is optimum level of investment? How should the budget be allocated against all the competing areas of investments – these are some of the key questions posed by executives regularly. The following table lists some of the key characteristics associated with each maturity level for the Macro-process of Managing the IT budget.

Maturity Level	Key Characteristics
Sustainable Economic Model	• Growth demands of company supported using a stable IT budget • Balanced budget allocation across appropriate portfolios based on value performance • IT intensity actively managed and compared against other key corporate spending categories • Budget driven by long term organization/business roadmaps and value performance • Budget size appropriate for Organization IT posture and track record of value delivery • Portfolio allocations aligned to strategic decisions
Expanded Funding Options	• Multiple sources of funding attracted • Ability to shift cost savings to strategic investments and/or to bottom line • Budget efficiencies improved through better integration of shadow IT spending • IT budget appropriate to Governance and Principles of IT usage in the firm • IT budget aligned with longer term business value • Portfolio allocations influenced by Industry benchmarks and Value Performance
Systematic Cost Reduction	• Systematic Cost Reduction process in place • IT unit costs trended and reduced annually • More sophisticated budgeting techniques in place • Visibility of Shadow IT Spending

Predictable Financial Performance	• A defined IT budget exists • A defined budgeting process exists • Performance against periodic financial and spending plans tracked • Variance between actual and planned spend is within a specified control limit • Awareness of Shadow IT spending
Unmanaged	• erratic financial performance • no clear owner for the budget • IT spend invisible/fragmented • IT funding not aligned with long term business value

Table 6-4 - MP2 Managing the IT Budget: Key Characteristics

6.2.1 MP2 – Level 1

At level 1, the generic *ad hoc* level, there is typically chaos around the IT budget and often erratic financial performance in terms of actual spend versus planned spend. At level 1, there is no clear owner for the budget and it is often difficult to exactly determine what is being tracked as part of the IT spend. Even if a budget and plan exist, performance to the budget is often spectacularly erratic and IT funding is not aligned with long term business value

6.2.2 MP2 – Level 2

At level 2, IT organizations have a defined budget and performance against the budget is monitored until it is solidly predictable. Achievement of predictable performance against budget is particularly important for firms with proportionally large IT budgets, variance in which could materially impact the quarterly or annual performance of a firm. Predictable financial performance by the IT organization is one of the key accomplishments in winning the respect of the CFO and earning the right to future new investments. Publishing quarterly financial and spending plans and regular performance against schedule reviews are a critical practice in achieving this.

At level 2, there is awareness of shadow IT spending. Shadow IT spending is defined as IT spending that happens in the business units, which is not under the control of the IT organization.

6.2.3 MP2 – Level 3

At Level 3, IT organizations have introduced systematic cost reduction techniques that focus on reducing the aggregate and unit cost of IT products and services. This is a key strategy for CIOs who have had to take cost out of existing operations to yield savings which can be reinvested in new IT investments. Disciplined reduction of unit costs using a variety of methodologies and approaches is key to an IT organization and sometimes even to the firm staying in business in an ever moving playing field. Examples of practices which can help reduce cost are business process redesign, disruptive technology introduction, service level agreement adjustments, outsourcing, off shoring, etc.

[Case example: Intel's use of Linux running on Intel Architecture servers as a disruptive replacement technology for a RISC/Unix platform for the design of its microprocessors is an example of a spectacular success with systematic cost reductions with more than one billion dollars saved through the end of 2005. In this case Intel IT used a Linux solution to solve a significant capital problem for funding ever increasing computing demand to design Intel microprocessors. As Intel continues to deliver faster microprocessors to meet the challenge of Moore's Law, the computing demand for the design of these processors was growing at more than 100% annually – faced with an increasingly unsustainable IT capital budget the CIO authorized use of a disruptive technology to help solve this problem – the result was a $1b saving by end 2005.]

At level 3 there is full visibility of Shadow IT Spending.

6.2.4 MP2 – Level 4

At Level 4, IT organizations achieve funding and resource amplification. At level 4, IT organizations have expanded their funding options beyond simply CFO funding and are obtaining funding from a number of different sources, perhaps even internal and external to the firm. Funding options may include pay-per-view usage fees, business unit funding, and external funding from supply chain partners or grants from Governments. A characteristic at this level is budget flexibility. At level 4, IT organizations are using savings captured from systematic cost reduction either for new IT investments or returning monies directly to the firm's bottom line. At level 4, there are multiple sources of funding attracted and thus funding amplification is achieved. Budget efficiencies are improved through better integration of shadow IT spending and the IT budget is appropriate to Governance and Principles of IT usage in the firm. IT unit costs are trended and reduced annually. Finally the IT budget is aligned with longer term business value and portfolio allocations are influenced by Industry benchmarks and Value Performance and are directly tied to strategy.

6.2.5 MP2 – Level 5

At level 5, IT organizations have achieved sustainable economic models for their budgets with optimized capital expenditures and operational expenditures. At this level, the IT organization has delivered scaleable services to meet the firm's growth while maintaining a stable IT budget over time. The balance of budget allocation between innovation, solution development and maintenance/support costs has been optimized as well. The Growth demands of company are supported using a stable IT budget, with balanced budget allocation across appropriate portfolios based on prior and ongoing value performance. At level 5 IT intensity is actively managed and compared against other key corporate spending categories, whilst the budget is driven by long term organization/business roadmaps and value performance. Also the budget size is appropriate for the organization's IT posture and track record of value delivery

At level 5, the firm has an IT financial model which is quantitatively managed in which the budget is actively managed and balanced to meet ongoing demand and fund new strategic initiatives, with a variety of best practices in place to ensure the IT organization can meet ongoing demand, good cost management techniques are in

place and the budget is modulated in a controlled fashion being moved/down based on the strategic posture, context and ongoing performance on IT investments. Finally at level 5, ongoing IT budget is appropriate for the firm based on the principles of how the firm uses IT for utility or competitive advantage

6.2.6 MP2 – Example Metrics

Listed below are example metrics for each level of MP2.

Maturity Level	Metrics
Sustainable Economic Model	• Service Scope and Scale Ratios defined and normalized by baseline spend[25] • Budget Variance with Budget Actual vs. Budget Planned Trend within defined SPC limits • Allocation Variance as measured by Performance Actual Budget Allocation vs. Planned Allocation • IT intensity trend versus other major category Spend (for example Sales and Marketing, R&D) intensity trends • IT intensity[26] versus Industry Average and as a function of posture • Annual Gross Budget correlation with Annual Value Performance • % IT Investments with BVI > Minimum Alignment threshold

[25] A service scope or scale measurement is a calculation of the growth or decline of a volume or variety of a set of services divided by the corresponding budget in each year. The goal of this measure is to communicate relative improvement or decrease in productivity of a capability.

[26] IT Intensity is measured as the IT Budget divided by Company Revenue or Company Operating expenses

Expanded Funding Options	• Ratio of Corporate IT funding vs. other sources • % Co-funding of IT Investments • % Cost Recovery • % of budget savings achieved • Gross Budget saving • Savings Reinvestment % • Organization IT intensity vs. Industry Average
Systematic Cost Reduction	• Cost Avoidance performance versus targets • Cost Savings performance versus Target • Cost Avoidance / Overall Budget • Cost savings /Overall budget • Gross and Individual IT unit cost trend • #Systemic Cost reduction options employed • Ratio of Corporate IT spending to Shadow IT spending
Predictable Financial Performance	• Performance against budget • Budget Performance Variance (Variance of actual versus Planned budget within defined Control limit)
Unmanaged	• No metrics

Table 6-5 - MP2 Example metrics

6.3 MP3 Managing the IT Capability

Managing the IT Capability on an ongoing basis is crucial to delivering sustainable competitive advantage from information technology. This involves a systematic approach in managing IT's assets, the value chain that creates business value from IT, the core competencies that the IT organization requires to deliver IT business value and the ongoing and complete workflow through the entire IT value chain. The premise of managing the IT capability is that sustainable competitive advantage from IT comes not from individual stove piped solutions but from an IT capability which is especially effective at delivering new strategic applications and which can do this faster and better than the IT capability at competing companies.

Figure 6.3-1 - MP3 Maturity States

The table below shows some of the key characteristics of each level for MP3.

MATURITY LEVEL	KEY CHARACTERISTICS
Level-5 Strategic Core Competency	• The organization has information Superiority and/or Execution Superiority over competition • IT delivers a steady stream of solutions delivered which provide competitive advantage and IT is recognized as a differentiating core competency • Optimal management of the IT strategic assets and value chain, with modular enterprise architecture an enabler of agility • Customer and Supplier relationship management excels • IT leaders jointly lead business teams or business/IT leadership responsibilities fused
Level-4 Strategic Business Partner	• IT leaders are an integrated part of business leadership teams • IT has delivered solutions which add value in specific business areas and IT is recognized as a key competitive capability in specific targeted areas • IT understand the business and proactively proposes solutions to key opportunities and problems, with frequent reuse of artifacts and code • Strategic and Integrated Management of the IT assets and value chain • Systematic Capability assessments have led to year on year improvement in IT capability
Level-3 Technical Expert	• IT has a track record of delivering quality reliable services • Components of IT Strategic Assets and value chain are well managed with effective shared services in place • Systematic Capability Assessments in place • IT sought out as a source of technical expertise • IT provides a reliable utility like service benchmarked on performance and cost

Level-2 Utility or Technology Supplier	• Limited respect for IT • IT viewed purely as a cost centre • IT is a cost to be continuously reduced • IT exhibits characteristics of a utility provider
Level-1 Unmanaged	• Users purchasing and maintaining systems • No formal IT presence • IT completely un-integrated

Table 6-6 - MP3 Key Characteristics

The IT Capability can be defined as what the IT function can do for the business and in the model the IT Capability is viewed as the production engine.

6.3.1 MP3 - Level 1

In a level 1 company, there is no formal IT presence with users themselves typically purchasing and trying to maintain computer systems for their own use. In various departments there may be business users with computer aptitude, but interconnectivity is limited and generally islands of computing solutions exist. In a level 1 capability company, IT is not perceived as a utility provider.

6.3.2 MP3- Level 2

In a level 2 company, IT is viewed as an external supplier or utility provider. External suppliers provide products and services to the enterprise, but have little or no strategic input to the business. Utility providers, such as power or telecommunication suppliers, provide standard services to the business. In a level 2 company, the IT organization and its employees may be treated with little respect and the organization is cast as a pure cost centre. In firms where IT is able to provide utility services with high availability in support of the core business, then more respect is afforded the organization.

6.3.3 MP3 - Level 3

When the IT organization matures to Level 3, it has developed a track record of providing quality services, has delivered some new solutions, and has gained the

reputation as an organization of technology experts. Business managers would rather seek out an IT expert than attempt an ad hoc solution. Level 3 IT organizations are perceived as reliable IT suppliers who have service level agreements in place. Systems are highly available and performance levels are sufficient to meet user needs. At level 3 components of IT Strategic Assets and the IT value chain are well managed with effective shared services in place. There are systematic capability assessments in place which drive consistent and integrated capability improvement actions. At level 3, IT is sought out as a source of technical expertise and IT provides a reliable utility like service benchmarked on performance and cost.

6.3.4 MP3 - Level 4

At Level 4, the IT organization has earned the reputation as a strategic business partner to the enterprise at large. IT leaders are frequently or permanently invited to the business table to discuss and help set strategic direction. Level 4 IT organizations have often developed solutions that give the firm competitive advantage in some key area. At Level 4, IT leaders understand and anticipate business needs and proactively work to provide solutions to these needs. At Level 4, key IT personnel may be invited to lead cross-functional teams developing new strategies or tackling stubborn issues. At level 4, IT has delivered solutions which add value in specific business areas and IT is recognized as a key competitive capability in specific targeted areas. At level 4, IT is perceived to understand the business and proactively proposes solutions to key opportunities and problems, with frequent reuse of artifacts and code. At level 4, there is strategic and integrated management of the IT assets and value chain and systematic capability assessments have led to year on year improvement in IT capability

6.3.5 MP3 - Level 5

At level 5, IT capability is perceived as one of a select few strategic capabilities of the company. IT capability is a differentiator for the company, a critical function that enables the company's core business, and a capability necessary for the company to be competitive. IT at Fedex, for example, is central to the core package delivery business. The use of IT systems for routing, scheduling and tracking packages is a good example of IT as a strategic capability for a company. At level 5, the

organization has achieved information Superiority and/or Execution Superiority over competition. IT also delivers a steady stream of solutions delivered which provide competitive advantage and IT is recognized as a differentiating core competency. At level 5, there is optimal management of the IT strategic assets and value chain, with modular enterprise architecture an enabler of agility. At level 5, customer and supplier relationship management excels, whilst IT leaders jointly lead business teams or business/IT leadership responsibilities are fused.

6.3.6 MP3 Sample Metrics

Listed below are example metrics for each level of MP3.

Maturity Level	Sample Metrics
Strategic Core Competency	• IT enabled Business Performance metrics versus industry average (for example Order to Cash, Days of Inventory performance enabled by better integrated supply chain solutions) • IT Strategic Partner Rating by Business • Innovation Level = Number of New Solutions/Number of existing solutions • Innovation Index = (Composite measure of total Innovation) • Average Time to solution • Artifact reuse > Industry average • Number of Solutions which meet > 80% of combined Functionality, quality, Cost, Speed and Benefits goals versus target • Key Supplier and Customer scorecards exceeding targeted measures • Number of Major. strategic initiatives jointly led by IT and Business executives • Total number of IT enabled Strategic Initiatives versus non IT-enabled Initiatives

Strategic Business Partner	• Net Value contribution • Volume of IT strategic idea contribution to business • IT integrated capability score versus target • Year on Year Capability improvement vs. target
Technical Expert	• IT utility SLA performance • Number of Business Requests for • IT strategic advice • IT benchmark performance (performance/quality) versus peer group
Utility or Technology Supplier	• IT budget year on year reduction
Unmanaged	• No metrics

Table 6-7 - MP3 Example Metrics

6.4 MP4 Managing IT for Business Value

The fourth macro-process is called Managing IT for Business Value and describes the evolutionary levels and key characteristics as an organization improves the processes and outcomes for generating and measuring value from its IT capability.

The integrated IT-CMF approach advocates taking a **Managing for IT Business Value** or benefits realization approach, where IT investments and projects are managed not as technology projects but are managed based on the benefits expected to be delivered. This approach corresponds to the begin with the end in mind mantra that Covey (1998) advocates. This benefits realization approach includes adoption of core business practices including basic return-on-investment measures supported by firm-wide investment coordination, business case discipline and continuous portfolio management and reprioritization.

Depending on the type of IT impact that delivers value, different practices may be used to help more predictably deliver the value promised. For example the process of realizing value from an IT enabled business process transformation may be

enhanced through the consistent management of at least six parallel vectors (Curley, 2006) namely Vision (Opportunity/Problem), Technology Solution, Business Case, Business Process Change, Organizational Change, Customer/Societal Adoption.

Thus the process of value realization is more than just delivering the IT solution but results from active management ensuring the solution is used and that the benefits promised actually get delivered in a particular scenario. The complementary interaction of business and IT investments is a prerequisite for value delivery.

In the following figure the maturity states for MP4 are shown below.

Figure 6.4-1 - MP4 Maturity States

The key characteristics for each level of MP4 are outlined in the table below.

MATURITY LEVEL	KEY CHARACTERISTICS
Level-5 Optimized Investment Return	• Sophisticated Investment and Portfolio analysis performed • Returns from IT enabled investments equal to or better than returns from other investment types in the company • Predictive value of future investments possible with high confidence based on historical data • Automatic integration of benefits and costs associated with IT investments into future years business and IT budgets • Win-Win Investment thinking drive virtuous circle of IT Innovation • Proactive parallel management of all elements of business case to predictably deliver promised benefits
Level-4 Portfolio Management	• Proactive Portfolio Management used to maximize the returns from groups of similar investments and from overall spend • Options Management Approaches used to manage early stage speculative IT investments • Risk and Value at Risk are key components of Business cases • Multiple criteria used to select and evaluate best IT investments • Accountability for both forecast and actual benefits realization • Multi-metric analysis of business cases to determine best quality investments

Level-3 Simple ROI and Business Case Discipline	• Key focus shift to Value and Investment Governance or Business Value Program Office in Place • Disciplined usage and review of Business Cases • Key Business Value drivers identified with associated monetary values and investments routinely targeted to impact these • Full spectrum business case including both business and IT costs and benefits • Systematic & objective valuation and evaluation of business cases
Level-2 Total Cost of Ownership	• Key focus is on Value for Money with Total Cost of Ownership computed for major assets • Key IT cost drivers identified • TCO tracked on a regular period to ensure continuous cost reduction • Full Lifecycle TCO computed
Level-1 Unmanaged	• Decisions made on cost not value • No comprehension or measure of value and Escalating TCO rampant

Table 6-8 - MP4 Key Characteristics

6.4.1 MP4 – Level 1

At Level 1 there are no processes or outcomes associated with MP4. Here Value and Cost are not part of the vocabulary of the IT organization.

6.4.2 MP4 - Level 2

At level 2 the key focus on achieving value for money with total cost of ownership (TCO) a main philosophy for processes and outcomes. Often the main goal at level 2 is to achieve the lowest total cost of ownership across the IT platforms. At level much of the focus on the capability (MP3) is providing infrastructure to support the business and accordingly much of the focus of level 2 in MP4 is measuring and continuously lowering the overall TCO. TCO takes a holistic look at the costs involved in delivering and supporting IT products and services, with a lens typically involving people, process and technology. Also at level 2, key IT cost driver are identified with a robust process for tracking IT unit costs. At level 2, TCO is tracked regularly and trended to show progress in continuous cost reduction. Additionally, TCO is tracked over the full cycle of a product or service, included any projected or contingent modifications.

6.4.3 MP4 - level 3

A significant shift is made from measuring cost to measuring and managing for value. At level 3, this shift is often manifested with a significant improvement in Investment Governance and/or the establishment of a business value program office (Curley, 2004; Sward, 2006). The investment governance process or business value program office ensures there is disciplined usage and review of business cases. At level 3, there is a comprehensive business case template which enables a full spectrum business case to be developed which includes both IT and Business benefits and costs. Tiernan and Peppard (2005) identify four key components of full business cases

- BB – Business Benefits
- SRC – Service Running Costs
- BCI – Business Change Investments
- SCI – Service Creation Investments

Return on investment can be calculated as:

$$ROI = \frac{BB - SRC}{BCI + SCI}$$

where ROI is the difference between Business benefits and the Service running costs, divided by the sum of the business change investment and the service creation investment.

This formula can be modified to generate several different representations of ROI but these four components form the basis of the business case components. Two other components of critical importance are the valuation and justification of the benefits and costs (Curley, 2004). Valuation is a means of evaluating an investment opportunity in monetary terms, usually based on the time sequencing of benefits and costs. Justification is the process of documenting of assumptions and supporting data that lead to a value proposition.

Valuation is typically a difficult process but the Intel value dials (Curley, 2004; Sward, 2006) has been identified as a good working process for this. A business value dial is Intel's term for a standardized indicator of business value and is often described as the monetary value of an incremental improvement of a particular business variable, for example the $ value of a one day reduction in days of inventory. Having a standard set of value dials available for a particular organization means all business cases use the same valuations ensuring better comparisons of overall benefits and ROI can be achieved.

Having value dials in place also enables investments to be routinely targeted to impact these. Coupled with an investment governance process, this also enables systematic and objective valuation of business cases.

6.4.4 MP4 – level 4

At level 4, better returns are made available by matching the type of IT investments with the organizations objectives (Weill and Aral, 2005). Here proactive portfolio management is used to maximize the returns from groups of similar investments and from overall spend. At level 4, firms have identified a specific portfolio lens to use for portfolio management of its IT investments. Aligned with this appropriate governance and program management structures and processes are in place to ensure systematic execution of the process.

Also, Level 4 firms perform structured risk evaluation across all portfolios management. There is systematic risk assessment across all projects and all investments are analyzed for risk mitigating approaches. (Lattimore et al, 2004). At level 4, returns are adjusted based on risk level and a balanced portfolio of investments across a spectrum from low to high risk is maintained appropriate to the IT posture and risk profile of the organization. ING Insurance group is an organization that excels at this. (Rinnoy Yan, 2004).

At level 4, firms begin to use advanced investment constructs such as Value at Risk (VaR) to help determine optimum decisions between TCO reduction and Risk (Tallon, 2002; Curley, 2004). At level 4, firms reserve contingencies in their budgets for investments that run over (Lattimore et al, 2004) and there is accountability for both forecast and actual benefits realization.

At level 4, multi-metric analysis of business cases is performed to determine and pick the best quality investments. An innovation suggested here is the graphing of specific metrics such as NPV, IRR and Payback period to help with investment decision making. An example of this is suggested in the table below. As organizations transition from level 3 to level 4, they move from a single metric decision making (such as a ranked order of investments by descending NPV) to really focusing on the highest overall quality investments. Some organizations may include profitability index (Brealey and Myers, 1999) as a specific measure.

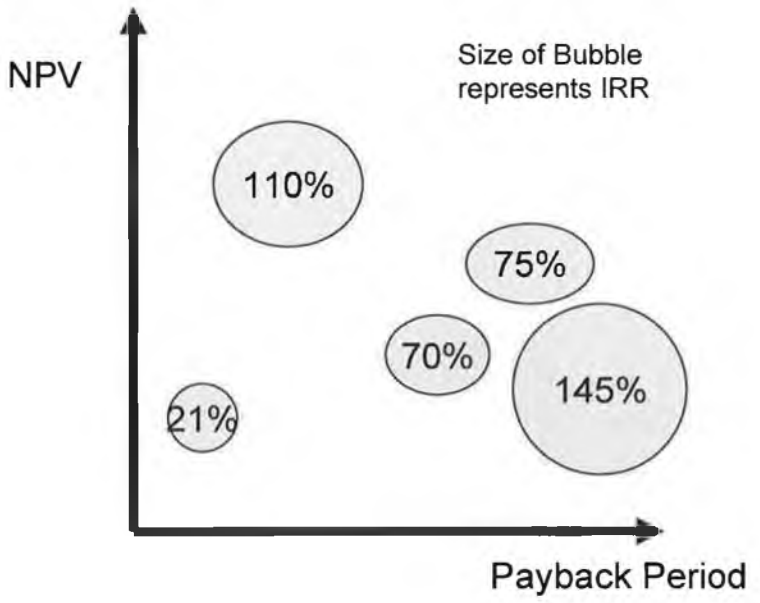


Figure 6.4-2 - Example Visualization of Multi-dimensional Metrics

At level 4, win-win investment thinking has take root. This is where a mental model has been adopted which seeks to find new investments which will not only add business value but will also improve IT efficiency. Continuous adoption of such a model and strategy can lead to a virtuous circle of realizing value and creating space for funding new investments, as the savings realized by reductions in either aggregate IT costs or unit costs, can be used to fund new innovations (Baldwin and Curley, 2007).

At level 4, option management approaches and methods to operationalize these are in place and in systematic use. The Business Value Index (Curley, 2004) is an example of such an approach and method where prospective investments are analyzed along three vectors, business value, it efficiency and financial attractiveness. In this three dimensional assessment index, proposers of new investments respond to questions rating how closely the proposed investment will align with or achieve particular goals such as increase in revenue or decrease in risk. The results of BVI assessments for a series of investments can be plotted on a chart as shown in the following figure with investments falling in the top right hand corner of the chart being given preferential choice for investment as these will likely be investments which will realize a win-win result with both the business and IT benefiting.

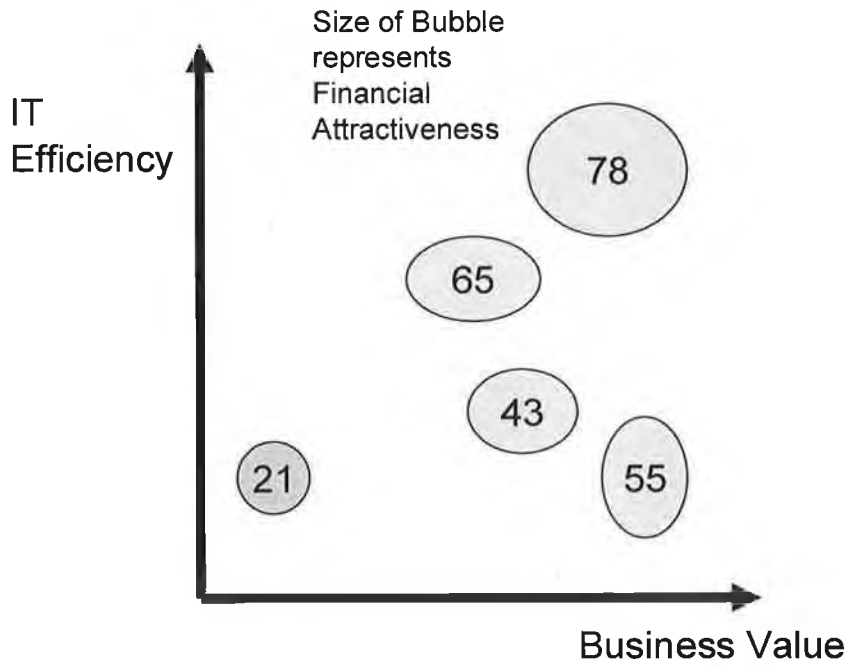


Figure 6.4-3 - Example Business Value Index Chart

The BVI is an example of a method where mmultiple criteria are used to evaluate and select the best IT investments.

6.4.5 MP4 – Level 5

At level 5, Sophisticated Investment and Portfolio analysis is performed on a balanced portfolio of IT investments[27]. At this level the data exists to demonstrate that the returns from IT enabled investments are equal to or are better than returns from other investment types in the company. This means that if there is a marginal dollar or Euro available to invest, the CFO is likely to consider investing in IT because the historical return from IT is better than the firms return on capital and better than other categories of investment in the firm. At level 5, IT investment practices approach achieving the efficient frontier in IT investment management (Lattimore et al, 2004). Additionally, strong practices for alignment, accountability, program and project management and value realization are in place.

[27] During the research ING, the Dutch Insurance and Banking group were identified as an organization with strong practices in this area. ING use the same financial analysis techniques that they use to manage the groups financial assets to manage their IT assets. (Rinnoy Yan, 2004)

At level 5, very good returns are available by matching the type of IT investments made AND by matching IT management practices and competencies with the mix in the IT portfolio (Weill and Aral, 2005). At level 5, the Predictive value of future investments can be determined with high confidence based on historical data. At level 5, approaches such as the Business Value Index (Curley, 2004) which, embedded in a closed loop portfolio management approach, have been correlated with actual value delivered to continuously improve the confidence of picking the appropriate mix of the highest return and highest confidence investments. Additionally historical performance of the investments of each asset class in the overall portfolio are tracked and reviewed to enable ongoing adjustment of returns to the best outcome.

At level 5, there is automatic integration of the benefits and costs associated with IT investments into future year's business and IT budgets. FedEx, a highly respected company with a highly respected IT organization have systematically adopted this practice. Additionally, at level 5, there is proactive management of all vectors associated with delivering the predicted benefits from a particular IT investment. This involves managing the opportunity, the technology solution, the business case, business process change, organizational change and customer adoption in parallel to maximize the probability that the expected benefits are delivered and to ensure early recognition and appropriate resolution of issues (Baldwin and Curley, 2007).

6.4.6 MP4 – Example Metrics

In the tables below example metrics for MP4 Managing IT for Business Value are captured below.

Maturity Level	Example Metrics
Optimized Investment Return	• Rolling Average IT yield • Average Return vs. Industry return • Portfolio Allocation mix driven by value metric • Average Benefits delivered/Benefits Promised, Number of failing investments stopped earlier • Risk Adjusted Return on Capital usage • Portfolio grading by risk category (AAA etc) • Metric: Accuracy Predicted versus Actual Value • M: Cumulative and Average Value, Performance against Predicted Value + other related metrics
Portfolio Management	• IT Yield (Future = ∑ Investment NPVs/IT budget • Conversion Effectiveness (Actual Return/Expected-Predicted Return) • Average Portfolio return and cumulative NPV versus non-portfolio baseline • Average Return of options managed project vs. non-options managed projects • VAR computation, Risk Assessment per project, hurdle rate per risk level • IRR, NPV, Payback period, Profitability • Index • Metric: Value Delivered/Value Promised • Metrics: IRR, NPV, Payback Period, Profitability Index • Metric: Option Value - An option value can be computed through using a Black Scholes (or similar) computation which takes into account multiple factors such as expected variability, managerial flexibility provided. • BVI score • Metric: Risk Adjusted NPV, Risk adjusted hurdle rate • Metric: Cumulative Benefits measured by cumulative NPV

Simple ROI and Business Case Discipline	• Single ROI template, #projects/investments approved with business case • Contribution of specific business dials to Value • M: Percentage of business cases with comprehensive business and IT costs/benefits, Ratio of IT to Business Costs and Benefits • Metric: ROI, % of Business cases using standard template • Metric: Average and Cumulative Net Business Value delivered • Overall organization performance, Performance against business value goal • Metrics: # value dials positively impacted by IT investment, value dial contribution to business case benefits
Total Cost of Ownership	• TCO (investment, scaling, operating) • Ranked List of Products/Services by • ascending cost • M: Full cycle cost ($) • M: Number of Investments inventoried • M: TCO decrease rate: Annual decrease in TCO due to improvement actions
Unmanaged	

Table 6-9 - Example Metrics MP4

6.5 MP4 Practices, Metrics and Outcomes

This section describes an example of artifact 5, the macro process PMOs (practice metrics and outcomes). For each of the four identified macro-processes (as well as the underpinning critical processes), detailed maturity curves can be created as well as an inventory of triplets (Practice, Metric and Outcome) which provide guidance on important practices and associated metrics and outcomes which can help act as a

how-to guide for executives in helping achieve better process maturity and better value outcomes.

The use of a triplet construct is very useful as it guides an executive in three areas what to do (practices), how to measure it (metric) and why do it, i.e. the value or impact of a particular Practice (Outcome). Although this extends beyond the scope of the dissertation sample practices collected and analyzed for each level of the macro process Managing IT for Business Value are captured below. This serves as an example of how research and use of the IT-CMF can be taken to the next level, where the IT-CMF can act as a guide for improvement strategies and actions to achieve a particular level of competency or capability. An examplar of a suite of triplets captured and documented for MP4 Managing IT for business Value are documented below.

6.5.1 Macro Process: MP4 Managing IT for Business Value

MP4 Managing IT for Business Value is focussed on measuring and managing for IT business value. It is here that the focus is on reaping the return from IT investments and below are described a non-exhaustive sample set of PMOs which cumulatively build and contribute to increased capability and value.

6.5.1.1 MP4 Level 2 PMOs

MATURITY LEVEL NAME	PRACTICE	METRIC	OUTCOME	DESCRIPTION	ASSESSMENT QUESTIONS / CRITERIA
TCO	Business Case Costing	Full cycle cost ($)	Full cycle and full spectrum of costs identified associated with IT investments	TCO is computed for deployment, scaling / modification and ongoing operation of an entire solution stack	TCO is computed for the full lifecycle of solutions and infrastructure
	Investment Inventory	Number of Investments inventoried	One version of truth for Investment inventory, help identifies redundant or competing investments	A single list of investments describing the investments and amount of investments	A single inventory of IT investments exists which is regularly updated
	TCO trending	TCO decrease rate: Annual decrease in TCO due to improvement actions	Continuous predictable reduction of TCO achieved for core solutions and services	TCO is computed, tracked and trended for key solutions and services on a regular basis.	TCO is computed, tracked and trended for key solutions and services on a regular basis.

Table 6-10 - MP4 Level 2 PMOs

At level 2 a number of key PMOs are focussed on accurate costing for business cases, investment inventory tracking and trending of Total cost of ownership. The table above is an example of artifact type A5 generated during the research.

6.5.1.2 MP4 Level 3 PMOs

MATURITY LEVEL 3 NAME	PRACTICE	METRIC	OUTCOME	DESCRIPTION	ASSESSMENT QUESTIONS / CRITERIA
ROI and Business Case	Full Spectrum Business Cases	Percentage of business cases with comprehensive business and IT costs/benefits, Ratio of IT to Business Costs and Benefits	All business costs and benefits are captured in the business case ensuring higher integrity business cases	The business case includes cost, benefits, valuation and justification for all components. The business case at least includes Business Benefits (BB). Service Running Costs (SRC), Service Creation Investment (SCI) and Business Change Investment (BCI)	Our business cases routinely comprehend both business and IT benefits and costs
	Standard ROI template	Metric: ROI, % of Business cases using standard template	Outcome: Better focus on value and better consistency of business cases	A common Business case template exists to capture benefits and costs in a common format	A common Business case template exists to capture benefits and costs in a common format
	Practice: Business Value Program Office	Metric: Average and Cumulative Net Business Value delivered	Outcome: quantified business value from IT documented and track	An office and process which provides templates and support the documentation of value delivered from IT	A business value program office exists to enable and support a business value documentation process
	Employee compensation linkage to value goals	Overall organization performance, Performance against business value goal	IT employees more aligned and committed to deliver value goals by tying part of their compensation to achieving an overall IT value goal	IT employees more aligned and committed to deliver value goals by tying part of their compensation to achieving an overall IT value goals	Assessment: employee compensation is tied to achieving of overall value goals and organization performance
	Value Dials	# value dials positively impacted by IT investment, value dial contribution to business case benefits	Barrier to development of good quality business cases reduced, consistent valuation of benefits across organization, full spectrum of key business variables identified for improvement	A value dial is a standardized value indicator and associated valuation which represents a business variable which can be positively impacted by IT.	A standardized set of value indicators tied to key business variables is maintained to enable consistent business case and business impacts to be determined

Table 6-11 - MP4 Level 3 PMOs

At level 3, key PMOs are focussed firmly on value, ensuring full spectrum business cases are completed encompassing lifecycle benefits and costs as well as accurate and consistent valuations and benefits. At level 3 a key PMO includes a structure and organization focussed on providing templates and operations in support of measuring and managing business value.

6.5.1.3 MP4 Maturity Level 4 PMOs

MATURITY LEVEL 4 NAME	PRACTICE	METRIC	OUTCOME	DESCRIPTION	ASSESSMENT QUESTIONS / CRITERIA
Options and Portfolio Management	Value based Post Implementation Reviews	Metric: Value Delivered/Value Promised	Outcome: Higher Probability that value will be delivered (you get what you inspect, not what you expect)	Post implementation reviews are an instantiation of the adage - "you get what you measure". Post implementations review help focus the mind of IT and business managers who are responsible for delivering an IT enabled project. Instead of just focussing on delivering a project on-time and on budget with the right level of quality, project managers are also asked to report out on the value delivered. When an expectation is set that project managers must report out on the value delivered and show how actual benefits mapped to projected benefits this significantly increased the possibility of value ACTUALLY being delivered.	The organization regularly uses post implementation reviews to ensure benefits delivered match to benefits forecasted
	Multidimensional Value Assessments	Metrics: IRR, NPV, Payback Period, Profitability Index	Higher probability of picking the best quality investments	Multi-dimensional value assessment (MDVA) involves making investment decisions and analysing investment performance based on multiple criteria rather than just a single dimensional investment such as Net present value. AN MDVA will typically analyze metrics such as NPV, Internal Rate of Return, Payback Period, and	The organization uses multidimensional valuation criteria to help select the best quality investments

				Profitability Index. Plotting competing investments on a 3-D chart will help show which IT investments are the best quality or are or likely to outperform other investments.	
	Options Management	Metric: Option Value - An option value can be computed through using a Black Scholes (or similar) computation which takes into account multiple factors such as expected variability, managerial flexibility provided.	Outcome: Better Managerial flexibility around IT investment decision making and better valuation of a proposed investment	This is a practice of viewing speculative IT investments like options - an option gives you the right but not obligation to strike an option if value is delivered from an option investment. Different kind of options exist such as scale up and scale down options which provide managerial flexibility in IT investment decision making.	Real option thinking is used to help improve management flexibility around IT investment thinking?
	Business Value Index	BVI score	When combined with a portfolio management approach, the BVI enables organizations to make more effective investment decisions and helps proactively maintain a project portfolio that aligns tightly with organization strategy. It uses a common vocabulary and methodology, which allows disparate investments to be compared so that the best investment choices are made. Besides evaluating IT investments along the vectors of business value, IT efficiency, and the financial attractiveness, the BVI also weights factors impacting the	The Business Value Index (BVI) is an investment decision support tool, which effectively produces a weighted score for an IT investment which corresponds to a proxy value for the option value of an IT investment. The BVI considers a variety of both hard and soft factors which combine to give a relative value assessment for an IT investment.	A data driven methodology exists to value diverse attributes of a speculative IT investment to ensure closet alignment of investments to overall organization goals

			likely value and success of an IT investment based on the ongoing business strategy and business environment.		
	Risk-adjusted NPVs	Metric: Risk Adjusted NPV, Risk adjusted hurdle rate	Outcome: Higher Probability that the correct hurdle rate will be set for a given investment based on an assessed risk level and thus that the right investments will be picked.	Risk Adjusting the business case or NPV of a project is a way of calculating a more correct hurdle rate for an IT investment. Higher risk IT investments should have a higher hurdle rate for project approval that for projects which have lower hurdle rates.	The hurdle rate for IT enabled investments is adjusted appropriately based on a computed risk assessment - higher risk projects are required to exceed higher levels of returns
	Benefits Register	Metric: Cumulative Benefits measured by cumulative NPV	Outcome: Ensure benefits are delivered through Ranked list of cumulative benefits delivered from IT enabled business investments	This practices maintains an ongoing register of benefits which IT enabled investments deliver	The organization maintains a live list of benefits delivered by IT
	Value at Risk	M: VAR expressed in $	O: Better tradeoffs made between TCO reduction efforts and Increased risk	Value at Risk is computed and used as a key construct for modulating cost reduction efforts	The organization computes value at risk for key solutions and infrastructure to enable better TCO decision making

Table 6-12 - MP4 Level 4 PMOs

At level 4 PMOs are focussed on more sophisticated and comprehensive aspects of benefits management.

6.5.1.4 MP4 Level 5 PMOs

At level 5, key PMOs are focussed on optimizing value and sophisticated financial analysis to drive increased future value. At level 5 historical data enables better selection of future investments through an ability to better predict future value.

MATURITY LEVEL 5 NAME	PRACTICE	METRIC	OUTCOME	DESCRIPTION	ASSESSMENT QUESTIONS / CRITERIA
Optimized Value Creation	Predictive Value Creation	Metric: Accuracy Predicted versus Actual Value	Outcome: Based on Historical data and characteristics of new investment the ability to reliably predict the value delivered is significantly enhanced	Based on prior history and a database of cases, it is possible to reliably predict the value a particular investment might deliver (within a given error range) using a predictor methodology (for example BVI correlated against previous value delivery)	The organization is able to predict with some confidence the likely value to be delivered by a IT investment based on analysis of historical returns of IT investments
	Value Dashboard	M: Cumulative and Average Value, Performance against Predicted Value + other related metrics	O: Visible real-time and historic data in dashboard format allowing portfolio adjustment and performance management	A value dashboard is a real-time dashboard showing all IT investments showing current, past and predicted future value performance. It provides a decision support tool for management to modify portfolio allocations based on value performance and other factors.	The organization has a live value dashboard which displays multi-dimensional value assessments as well cost, utilization, portfolio and other views
	Investment Analysis	Efficient Frontier	Ability to achieve as close as possible to the ideal investment portfolio allocation	The investment portfolio is analyzed using an efficient frontier approach to determine the optimal portfolio allocation	The organization continuously achieves the optimal portfolio allocation to maximize value

Table 6-13- MP4 Level 5 PMOs

Having reviewed the IT-CMF in detail in the next chapter I will summarize and explain how the IT-CMF has been used at Intel to improve IT capability.

7 Chapter 7: Recommendations for Practitioners and Further Research

7.1 Summarizing the IT-CMF

This final chapter pulls together the research and demonstrates how the IT-CMF can be used as an assessment and management system for IT capability and value improvement. As a recap, let's review what the IT-CMF is:

- The IT-CMF is a formal archetype which details the states and levels an IT capability goes through as it defines, develops, implements, measures and improves it's capability in support of greater value creation
- The IT-CMF is a management and assessment system to systematically improve IT capability
- The IT-CMF is a framework which supports dynamic capabilities thinking to continuously reconfigure IT capabilities in support of a competitive environment.

A key intent of this research is to provide a generally reusable solution for CIOs who can use it as a wireframe and set of artifacts for systematically improving IT capability for value in the face of demanding and changing challenges. The goal of the IT-CMF is to help create conditions of sustainability, controllability, predictability of the IT capability to lead to increased value creation. It does this through guiding systematic proactive evolution of IT capability and enabling dynamic reprioritization of capabilities in response to changing business strategy and context.

This final chapter focuses on the practical use of the IT-CMF as a management and assessment system for IT capability improvement using Intel IT as a case reference. Charts from Intel have been modified to protect confidentiality and scenarios used in the text are hypothetical to illustrate examples.

7.2 The IT-CMF as an Assessment and Management System for IT Capability Improvement

The IT-CMF can be used an assessment and management system to systematically improve IT capability and value contribution. There are three high levels of guidance provided by the IT-CMF to executives. First the IT-CMF provides guidance on a strategy for improving the IT capability over time in pursuit of increased value. Secondly the IT-CMF will provide guidance on practices, outcomes and metrics that an organization can use in increasing maturity to improve ultimate value realization. These first two levels of guidance are essentially a high level map and a detailed map; however without knowing where you are maps are useless. This is where the assessment tool adds value as it provides guidance to executives to the relative maturity of their organization and then enables the high level and detailed guidance of the IT-CMF to be used for improvement efforts.

Thus the IT-CMF provides an evolutionary improvement roadmap from ad-hoc outcomes, processes and practices to world-leading, repeatable and continuously improving outcomes and process in pursuit of improving value generation from IT. In summary the IT-CMF helps business and IT executives

- characterize the maturity of their IT outcomes, processes and practices
- identify their relative position on the evolutionary improvement roadmap
- set priorities for key improvement actions
- continuously improve their capability maturity and value outcomes through a repeated cycle of assessment and improvement actions

In the IT-CMF there are four macro-processes and thirty six critical processes underpinning these macro-processes. Appendix D contains an example of a summary IT-CMF assessment report from an actual company (some of the scores and observations have been modified to protect confidentially). The version 1 specification of the IT-CMF is documented in Appendix C. The IT-CMF survey instrument allows both the assessment of both the importance and relative maturity of each macro process and different underpinning critical processes. By averaging the responses of different IT and business executives the collective insight of a group of executives can be leveraged. Also by asking for a desired future state in terms of maturity, an aggregate future state can be developed. By carefully considering the assessment results in the context of the firm's business strategy, context and

operating model, a macro-investment strategy can be developed to focus in improving the IT capability in alignment with the firm's needs and strategy.

The figure below shows a suggested process flow for using the IT-CMF as an assessment and management tool.

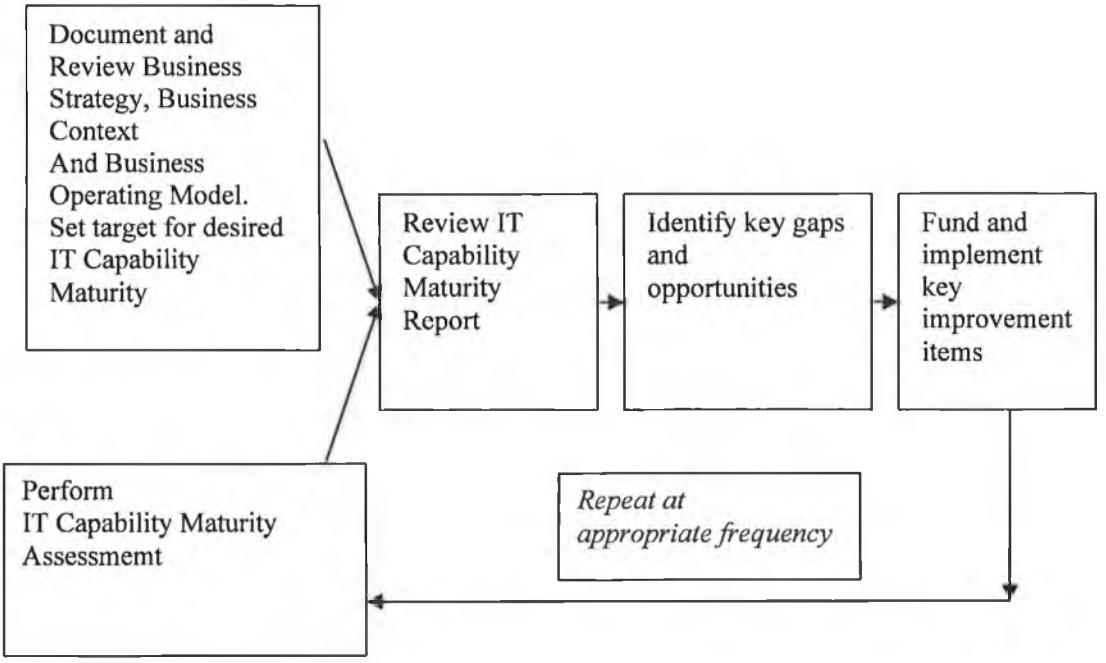


Figure 7.2-1 - IT-CMF Assessment process flow

Key first steps are the identification and documentation of the firm's business strategy, the business context in which the firm operates in and the firms operating model. In parallel the IT Capability maturity assessment should be performed ideally by a composite set of IT and Business executives. The IT capability maturity assessment typically consists of three elements:

- Value Assessment
- Capability Assessment
- IT Posture Assessment.

An IT-CMF report enables the analysis of the state of maturity of the IT capability as well as the goal congruence amongst different executives. A key part of the assessment process is also determining what the firm's posture is with respect to IT.

Using various graphical outputs such as a heat map which maps individual critical processes by level of importance and level on maturity on an X-Y grid can help quickly pinpoint potential areas for improvement.

It is important that the outputs contained in the maturity report should be reviewed in the context of the firm's business strategy, context and operating model to determine which improvement investments should be selected.

It is also important to note that there will likely be a time lag between investment in improved IT capability and a commensurate improvement in value contribution. Charts from an IT-CMF assessment at Intel are used to help illustrate and describe the assessment process (Note: to protect confidentiality of Intel data, maturity and value scores have been changed in these charts).

Following identification of key gaps and opportunities, a shortlist of recommended improvement items is developed and the appropriate investment required to implement these determined. These improvement investments should then be entered into the improvement portfolio of budget planning and allocation process for management like other IT investments.

7.2.1 Capability Maturity Heat Map

A useful approach to determining the highest priority critical processes for targeted improvement actions is to map the importance of each critical process versus its level of maturity on an X-Y axis as shown in table 1 below[28]. Here the Y axis represents the importance of a process whilst the X axis represents the maturity of the process.

[28] This approach was suggested by Jim Kenneally and David Fleming and I would like to thank them for their interest and ideas on how the IT-CMF survey instrument could be improved. Both David and Jim worked on Excel programs to generate automated reports from survey assessments.

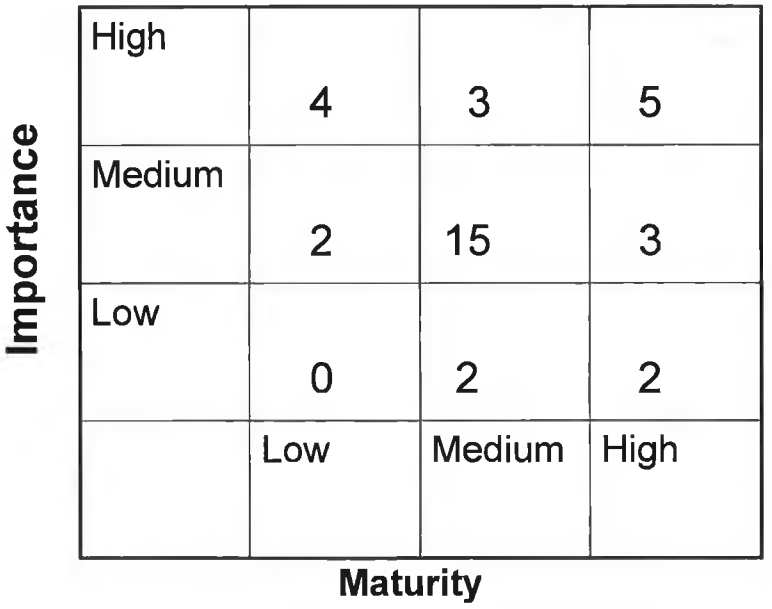


Figure 7.2-2 - IT Critical Process Heat map

The notion of this approach is that the importance and maturity of a critical process should be appropriately matched. Not all critical processes may need to be at a very high level of maturity and indeed this might not even be affordable. The notion is that very important critical processes should be of high maturity whilst medium importance critical processes may just require a medium level of maturity. Likewise low importance may just require some minimum level of maturity. It is suggested that further research is performed to determine the validity of this approach.

In driving future improvement it is important to perform a baseline assessment with respect to capability and value, whilst also inquiring about the desired future state of capability maturity and value contribution. A key parallel task in establishing a baseline is to identify the firm business strategy and business operating model (Ross and Weill, 2006) and then using this knowledge in conjunction with the business context setting goals for improving particular critical processes.

7.3 *Value and Goal Congruence*

Researchers have identified that strategic alignment is important for IT Value creation (Tallon, 2002). Likewise Weill (2004) identified that firms that had above average IT Governance following a particular strategy (for example customer intimacy) achieved 20% better return on assets than firms will less mature governance. In the value contribution assessment, a key insight is the level of congruence within the leadership cohort of a company with respect to the key things that are considered important. Reflecting back to chapter 2 it is crucial that a common goal is identified in order to help achieve outcomes. The value assessment instrument (Ross and Weill, 2004) evaluates the importance of four particular goals and IT's influence on the following key variables:

- cost effective use of IT
- revenue Growth
- asset Utilization
- business Flexibility

7.3.1 Value and Goal Congruence Assessment

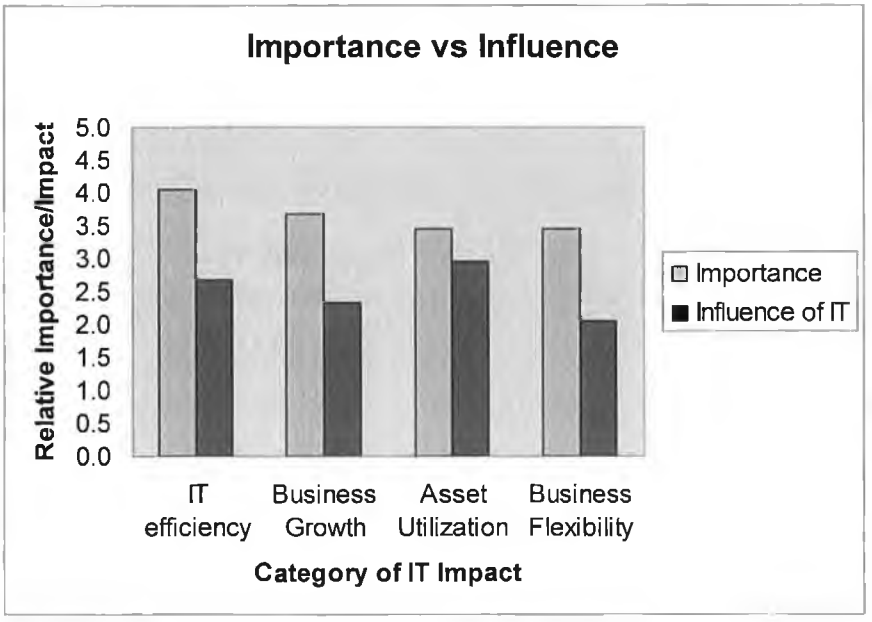


Figure 7.3-1 - Value Assessment Congruence at Intel IT

The figure above shows an example from Intel IT in 2007 showing that cost effective use of IT was the most important vector based on IT executive rankings. There was remarkable consistency in the responses from Intel IT executives showing that the mission of IT was clear and well understood. Analysis also shows that Intel IT executives assessed that there was also a gap in delivery against the relative importance of the goals.

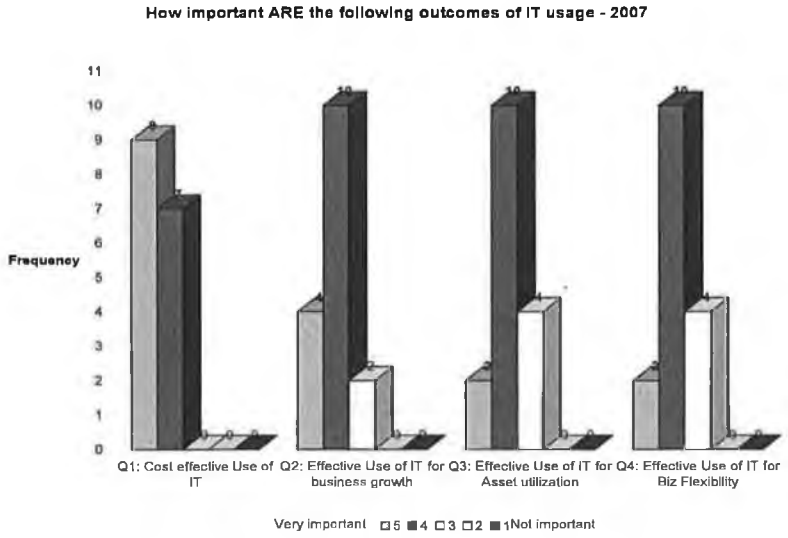


Figure 7.3-2 - Distribution of Prioritization of Value vectors at Intel IT

In the assessment one would hope to see a strong level of alignment and consensus which vector or vectors are most important. If there is considerable dispersion around the responses then this is a very good place to start for improvement and it points to issues with IT governance and business-IT strategic alignment. In the above figure 7.3, also from Intel, cost effective use of IT is identified as the most important goal whilst there is also good congruence and alignment between executives on the relative importance of IT's impact on business growth, asset utilization and business flexibility.

7.4 Overall IT-CMF Maturity

By compiling the average maturity scores of each of the assessment questions a high level assessment of the overall maturity of an IT organization can be obtained mapped to the IT-CMF. In figure 7.4 below the assessment scoring for Intel IT (with adjusted results to protect confidentiality) is shown.

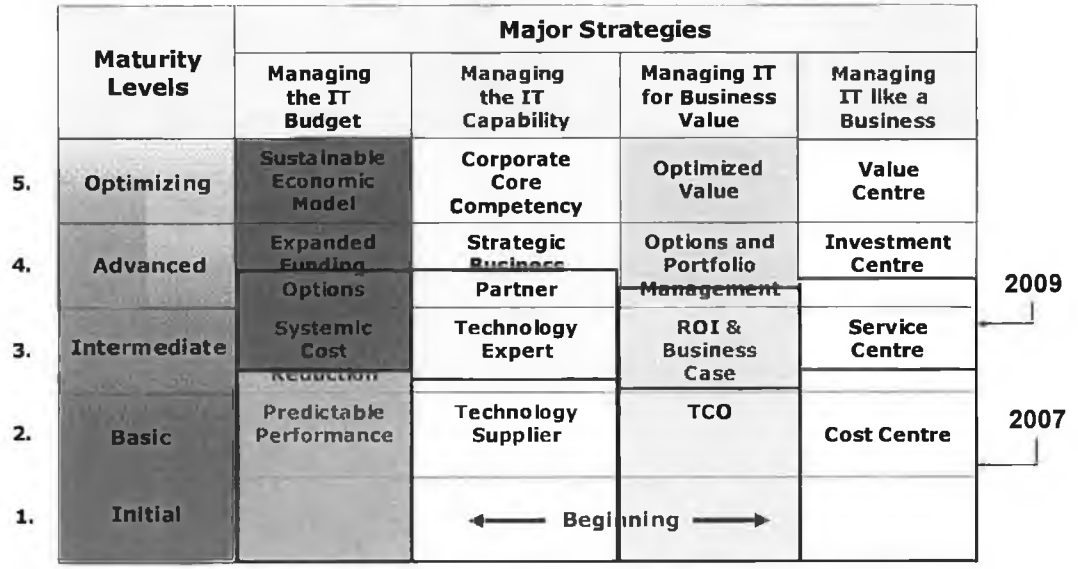


Figure 7.4-1 - IT-CMF assessment Intel IT

At a glance executives can see the current average maturity and desired future states of maturity. In this example the assessment reported that Intel IT was on average at level 3 maturity. Using the survey instrument executives set a desired maturity state of level 4 by 2009.

7.4.1 Benchmarking Performance

An important insight that many executives value is a benchmark report, showing the performance or maturity of a particular organization versus an industry average.
The collection of survey instruments from multiple organizations creates an opportunity to do this. The figure below shows a comparison of an anonymous firm abstracted from the survey assessment versus the average level of maturity.

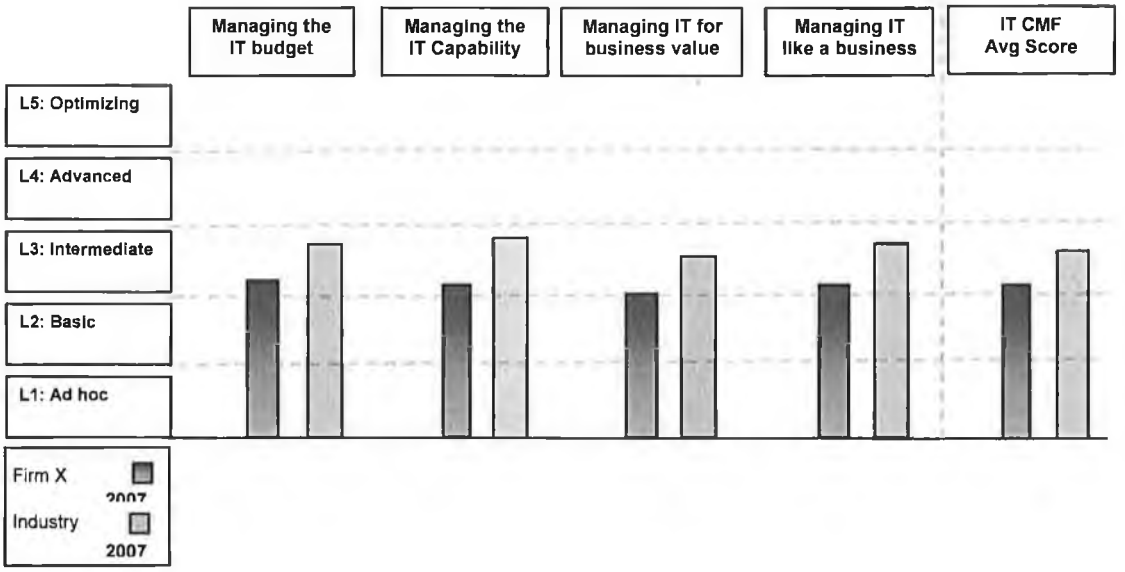


Figure 7.4-2 - IT-CMF benchmark

In this example Firm X is shown to be behind the industry average. As mentioned previously given that Industry type is significant it is important that a benchmark chart versus organizations in the same industry type is reviewed also.

7.4.2 Determining an IT Capability Improvement Plan

Once an assessment is complete the next step is to translate particular insights into key improvement actions and activities. The most important part of an effective IT capability improvement plan is to align the IT capability improvement items with the business strategy, context and the business operating model. Changes in business strategy, context and business operating model design may have significant impact on the IT capability.

It is recommended that improvement actions are identified in the context of the critical process definitions. Following this key improvement actions should be evaluated, decided upon and then the investments required to fund the improvements should be explicitly included in the IT improvement portfolio. In Appendix D an example modified IT-CMF assessment from Intel IT is included for review.

7.5 *Further Research*

The IT-CMF as currently detailed provides a rich platform for further research into the systematic improvement of IT capability, management practices and technologies in pursuit of further value.

7.5.1 Researching and Publishing Maturity Curves for the 36 critical processes

The IT-CMF as currently defined can act as the basis of a detailed research plan to research, identify and detail an integrated set of practices, outcomes and metrics which can be useful for IT executives in systematically improving the IT capability and through this improve the value contribution of IT. The IT-CMF details 36 critical processes (Appendix C) and the taxonomy detailed in Appendix B could be used as a mechanism for collecting, organizing and relating practices, outcomes and metrics associated with each critical process. Such a detailing of the IT-CMF would likely prove very valuable to IT and business executives in helping determine key improvement paths for the IT Capability. After performing an overall IT-CMF assessment the results can be used as described above to determine which critical processes should be identified and targeted for improvement. Once these critical processes are identified then a more detailed assessment of those high priority for improvement critical processes can be performed using the same approach as used for the overall IT assessment. The maturity curves for these critical processes can then be referenced for suggested practices, outcomes and metrics.

7.5.2 Field Testing the IT-CMF assessment process and results

It is recommended that the IT-CMF assessment process is field tested across a broad set of organizations. At the point of writing this dissertation the IT-CMF survey instrument is in formal use at Intel and several other organizations. These organizations have taken the assessment and are using it for prioritizing improvement actions. Further use and testing of the IT-CMF will identify weaknesses, issues and areas for improvement.

7.5.3 Future Empirical Analysis and Validation

Although the primary focus of my PhD work was to create an IT capability framework and an accompanying assessment instrument for use as a management system to improve the capability of IT, a secondary goal was to enable future empirical analysis after completion of my PhD which would enable a preliminary exploration and validation of the relationship between improving capability maturity and value performance. A consistent complaint with respect to the software maturity models has been the lack of empirical validation and I was keen to attempt to provide a platform which could enable some future empirical validation of the IT-CMF artifact.

It was beyond the scope of the PhD work to test and potentially establish a relationship between improving capability maturity and value or actual financials. Also since the intent of the framework was that it would also apply to public sector and not-for-profit firms this would not be a particularly useful approach. During the literature review, an IT Governance performance instrument (Weill and Ross, 2004)[29] was reviewed and since it was shown to be correlated to company financial performance this instrument was chosen as a proxy for value performance by adjusting the assessment questions to focus on value performance and not governance performance. This value component of the assessment instrument was useful but would need more detailed examination if it is to be used for empirical validation of the link between capability maturity and value.

7.5.3.1 Future Empirical Testing

To enable future deductive research the assessment instrument was designed to be used for multiple purposes. This was in the context of a future experimental research design which would have value as the dependent variable, IT capability maturity as the independent variable and IT posture as a potential moderating variable as shown in the following figure.

[29] The author acknowledges the discussion with Professor Peter Weill around the use of this instrument.

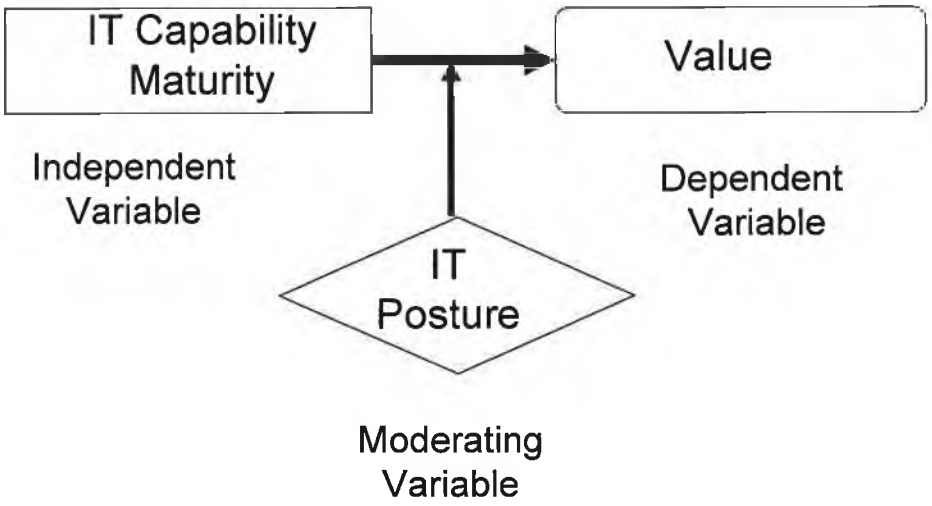


Figure 7.5-1 - Variable Relationships

A key goal of a future research design (beyond the scope of this dissertation) would be to test the hypothesis of whether improving both the process and outcome maturity of IT capability maturity and its four constituent macro-processes leads to improved value delivery. The table below describes the variables that could be associated with a future empirical analysis.

VARIABLE	TYPE	METRIC
Value	Dependent Variable	IT Value Performance Assessment Instrument
Mean IT Capability Maturity	Composite independent Variable	Mean Maturity of four IT Macro-processes
MP1 – Managing IT like a Business Mean Maturity	Independent variable	Mean maturity of MP1
MP2 – Managing the IT Budget	Independent variable	Mean maturity of MP2
MP3 – Managing the IT Capability	Independent variable	Mean maturity of MP3
MP4 – Managing IT for Business Value	Independent variable	Mean maturity of MP4
IT Posture	Moderating Variable	Posture assessment based on adoption profile

Table 7-1 - Study Variables

This is an important activity as it would close the loop from a behavioural science perspective back to the design science perspective.

7.5.4 Value Impacts of the IT-CMF per level of maturity

As further experience grows with the use of the IT-CMF and a cross-industry dataset is developed, it is suggested that a research study is designed and established to see if a shift to a particular maturity level in the IT-CMF produces more value than a shift to another level. In parallel a study should be done to attempt to identify the average investment and length of time required to improve a level of maturity.

7.5.5 Ongoing Development of the IT-CMF

It is recommended that ongoing refinement of the IT-CMF occurs with continued testing in the field as well as further theoretical derivation. MP1 Managing IT like a Business could certainly profit from a theoretical derivation of the connection of the critical processes contained therein. General management literature may be of help here. Equally ongoing refinement of the survey instrument associated with the IT-CMF should continue and it is recommended that an online survey be established so that organizations can easily perform and IT-CMF assessment and benchmark their results against an industry average. There is much opportunity to draw upon theory in other areas to improve and further develop the IT-CMF. For example traditional operations research could be applied to the IT-CMF and would likely be beneficial. It is also recommended that exploratory research work is performed to examine the applicability of the IT-CMF to other fields such as Services Innovation.

7.5.6 The Relationship of IT Posture and Value

In further research it would be useful to test if IT posture has a positive relationship with value. IT posture could potentially be considered as a proxy for top management commitment to IT. Weill (1992) identified management commitment as an important factor for improving conversion efficiency. It is recommended that a more detailed posture assessment be developed to perform more detailed research to better determine the impact of IT posture on value creation. Weill (1992) identified that the same level of IT spend can leads to different value outcomes, perhaps posture is a modulator of this.

7.5.7 Application of Economic Theory in IT Research

There is significant potential to apply economic theory in IT research to the IT-CMF. A substantial amount of research was conducted in this area in the early 1990's (Bakos and Kemerer, 1992) and although interest has waned somewhat there is a rich source of research to be mined. In parallel the conducting of case study led research to help develop macro-metrics for the IT-CMF would be useful. Transfer pricing theory also holds much promise for use in chargeback methods a key component of MP4 *Managing IT like a Business*. It is also suggested that the application of economics based techniques such as a Cobb-Douglas production function and efficient frontier analysis could improve the framework and improve its value to practitioners.

7.5.8 Application of Management and Control Theory

There is a very rich smorgasbord of tempting general management theory which can be applied further to the IT-CMF. Significant potential exists to explore much further management control systems literature and its application to management of the IT capability. In addition the use of applied control theory for IT management holds much promise, for example understanding the impact of the IT capability aggregate control interval (the rate at which output is measured and corrections are applied) and understanding the impact and how to modify the aggregate time constant of the IT capability (the rate at which the system responds to change).

7.6 Research Limitations

The choice of design science as the research paradigm, while it is a nascent paradigm brings some risks and limitations. Carlsson (2006) argues that the underpinning philosophies of design science have had very little discussion and clarification. No doubt in time that this discussion will happen but as the philosophies and indeed methods are improved it may become obvious that there are issues with elements of the current research method. These issues would likely apply to my research as I have tried to apply the current state of the art method.

As the key input to the suggestion phase of the general design cycle I used a case study from Intel. As a central actor in this case there is of course a risk that I was too involved and too subjective in my analysis and the possibility of blind spots also occurs. Indeed some may consider the choice of Intel, as a high technology manufacturer of information technology products and heavy consumer of IT may not have been an optimum choice for the initial source of a draft design pattern for generally reusable solution.

Using the IT-CMF assessment instrument as a way of assessing the capability maturity of an organization has some potential issues. Firstly individuals, are asked to assess capability on an ordinal 1 to 5 scale and this is problematic as one person's interpretation of maturity may differ from another person's. Additionally the assessment instrument creates just a proxy measure of the IT capability of an organization and there is always inherent error in such an approach. In the survey assessment there are sixteen questions per macro-process and one could question whether these provide enough accuracy and precision to provide a useful measure of IT capability.

The value assessment instrument is even more problematic even though I have used the adopted IT governance instrument from Weill and Ross (2004). People with different roles in different parts of an organization may have different views on the impact of IT on for example revenue growth or return on assets. For future empirical analysis it is recommended that a study is performed reviewing capability maturity improvements and dis-improvements against actual financials. In the case of public sector organizations a different approach would likely be needed. Similarly the use of a single variable to assess the IT posture of an IT organization is simplistic and needs to be further developed.

With respect to the case study research methodology, using a single case study often generates a question around replication logic. The use of multiple case studies would have strengthened the data, information and context used to develop the initial design pattern which served as an input to the design science research process. This limitation was somewhat mitigated by the iterative testing and improvement cycle that was executed on the design pattern through the DSR process.

At this point in the research process the artifacts produced have had some validation through the DSR process. Further validation is necessary to test if the artifacts are

indeed generally reusable solutions in a broader set of environments. Given that the artifacts were used in numerous geographies and across different vertical industries there is some evidence that they are generally applicable.

An obvious weakness and clear next step is to look to provide some empirical evidence to support the hypothesis that improving IT capability maturity leads to improved value. The IT capability maturity assessment artifact provides a ready instrument to enable a capability assessment across numerous organizations and various instruments may be used to assess or measure value. For publicly quoted companies reliable financial information is available which with a large enough sample size could create a dataset which would enable credible analyses to be performed. As always there may be difficulties in establishing causal relationships due to the number of different variables which influence a company's financial performance.

This research project has looked to create and validate the artifacts from two perspectives. Initially a design science research approach created the artifacts using an iterative approach and this was followed by a deductive approach to attempt to explain the artifacts from existing research. Further iteration of this inductive and deductive cycle is necessary, particularly as the pace of change in Information technology continues to increase. Maintaining relevance and utility will mean continued improvement and iteration of the artifacts as technology and business context continue to change.

The nature of design science research outputs are perishable and as my research continued other artifacts from both practitioners and academics alike continue to appear and be improved. I have strived to stay current with my knowledge and awareness of the emerging artifacts but used a 2004/2005 baseline against which to compare my initial framework. New version of frameworks such as ITIL, COBIT and VALIT continue to appear and ongoing comparative study should be performed to help cross-innovate across the frameworks. The goal of the IT-CMF as an integrated set of artifacts is not to replace existing frameworks but to extend, compliment and leverage them.

As with any research, more rigorous evaluation is always possible and it is my intent to continue validation and improvement of the artifacts in the future. Hevner (2006) acknowledges that rigorous evaluation methods are difficult to apply in DSR. I have

strived to provide a healthy balance between rigor and relevance of the research but my bias has been slightly more towards the relevance and creating something that is of use to practitioners. The enthusiastic adoption of the research is a validation that perhaps this objective has been achieved.

7.7 Reflective development of the researchers philosophical perspective

A key reflective perspective following my research is the commonality of the challenge facing CIOs and also the enormity of the challenge in designing artifacts that help CIOs improve their capabilities in the context of these forces. An interesting observation was also the hunger and willingness amongst executives and practitioners to find solutions. As I talked and discussed with IT executives in most cases they validated that they were facing significant ongoing challenges and felt ill-prepared to manage these challenges. Their enthusiasm to receive, review and help improve the artifacts that I created was enormously stimulating and indeed helped with the pragmatic validation of the IT-CMF.

Information Technology is one of the driving forces behind global change today and the gap between the rate of advance of technology and the rate of advance of the *management of technology* initially astonished me. However this is not so surprising in that most technology vendors are motivated by sales to advance their products rather than focus on interoperability and value creation.

The most significant insight that I have gained is the existence and fast development of a new research paradigm called design science research. As I struggled to shoehorn my initial research activity into the more standard behavioural science paradigm it was a turning point to become aware of the emergence of design science research. Through learning by doing I effectively served an apprenticeship before finally finding and deciding on a design science research paradigm. I was fortunate to have Professor Lars Mathiassen of Georgia State University serving on my PhD committee and his introduction to me of the design science research paradigm was pivotal in helping classify and illuminate the type of research I was undertaking. Conveniently Georgia State University happened to be on the leading edge of the emerging design science research paradigm. While design science methodology is in its infancy and as a consequence has many unanswered questions, it was perhaps

not ideal for an inaugural doctoral research project, but the approach holds so much promise to address issues faced by managers that it was a challenge worth facing. I was very aware of the problem and research question which I was trying to solve, that of creating a generally reusable solution to helping CIOs manage many challenges as they strove to improve IT capability in pursuit of greater value creation and more traditional and conventional research frameworks fell short of helping me with an overarching research framework. Discovering the design science research paradigm was one of those Eureka moments in the research process.

Supporters of the behavioural science paradigm view information systems as a social science while supporters of the design science view information systems as an engineering science. These two views are indeed two sides of the one coin. An overarching goal of information systems research is to create knowledge that enables the efficient and effective application of IT for organizational, managerial and societal purposes and both of these research paradigms are needed to advance the IT profession towards this goal. Giants of design science such as Hevner and Vaishnavi have been leading the cavalry on the development and socialization of design science as a reputable and accepted research paradigm.

The behavioural science perspective seeks to develop hypotheses and empirically justify theories around the development and use of information systems. Design science seeks to create artifacts or innovations which advance the development and use of information systems and these frequently integrate technologies, concepts, practices and metrics. These two research paradigms form part of a closed loop as behavioural seeks explanation which informs design whilst design science seeks utility. Looking forward it will be necessary for design science to attain parity of esteem with behavioural science and it is indeed possible that the centre of gravity of information systems research may need to move more towards the design science area to make up for a dearth of published work in this area.

I have long been a believer in innovation happening at the intersections of disciplines and across multidisciplinary arenas and it have been gratifying to see a number of ideas which were well established in other fields which I have been able to reapply in my research. For example the use of a Capability Maturity mental model which has been a standard in software engineering, seamlessly crossed the chasm as a wireframe for developing the IT-CMF artifact. This was another *Eureka* moment that arose in the case study part of the research process. The application of a maturity

model approach to organizing information gathered in the case study ultimately helped me create the design pattern that could be iteratively improved in the design science research process. While in hindsight the application of maturity model thinking to Enterprise IT management seems blindingly obvious, at the time I had this insight, this connecting of the dots had not been made. Additionally the concept of a software design pattern was also easy to reapply and adopt in the context of my information systems research.

I received several useful pieces of advice in the research journey. Perhaps the best piece of advice I received was from Prof Mathiassen who cautioned me on making my PhD my life's work. This was indeed crucially important as there was always the temptation to continuously expand scope and take more and more steps to test the validity of the research output. Professor Peter Weill's advice steered me towards taking on a PhD rather than going down the Industrial Doctorate route and this was profoundly helpful.

Sadly perhaps the most heavily criticized element of academic management research (Davies, 2006) and by extension information systems research (Orlikowski and Iacano, 2001) is that there is very little evidence that it has an impact on the thinking and behaviour of managers and practitioners. Too often I have read academic papers which are excellent research papers but offer little value or guidance to a practising executive. A key goal of my research activity was that I wanted the output to be useful and adopted as I witnessed so many CIOs trying to manage their IT organizations without a generally applicable framework. I am very pleased to note that many of the dialogs and relationships I built during the design science phase of the research have extended into a follow-on usage of the IT-CMF in real organizations and extension of the research. It is very pleasing to see the *design pattern* I created being used and reapplied with recursive logic in the Innovation Value Institute to the critical processes which I identified as a secondary output of my research activity. Any innovation has a two part process; that of creation and then of diffusion (Baldwin and Curley, 2007) and typically the diffusion part is often the most difficult. It is very encouraging to see how well peers in the industry are reacting to and adopting the IT-CMF demonstrating the utility of the research output.

7.8 Closing

This dissertation has introduced an integrated set of artifacts and an associated improved theory about how to continuously improve IT capability maturity and increase the value delivered from the IT capability in an organization. The IT-CMF can be used as a *design pattern* or *generally reusable solution* by CIOs to help them improve IT capability and contribution systematically. Dynamic Capabilities thinking combined with a maturity model approach have yield an integrated archetype which details the states and levels an IT capability goes through as it defines, develops, implements, measures and improves its IT capability in support of greater value creation. The IT-CMF serves as a management and assessment system to systematically improve IT capability and related value. It is also a framework which supports dynamic capabilities thinking to continuously reconfigure IT capabilities in support of a competitive environment. Four macro-processes have been identified which are important for IT capability improvement and value creation.

7.8.1 MP1 Manage IT like a Business:

The *Managing IT like a business* macro process and associated improvement strategy advocates taking a business-like approach to managing the IT production function to deliver IT business value. This involves using solid professional business practices and applying them to the IT function, for example managing customers professionally using account managers, ensuring business and IT alignment, using charge back methods to help manage demand and costing and institutionalizing governance principles similar to those used by firms. This management and control approach involves many feedback loops which are closed at different frequencies to help ensure that the IT production engine delivers a value output commensurate with the level of IT budget used as input, in the context of what the firm or organization is trying to achieve through IT. A key focus is on leadership, setting strategy, enabling effective governance, choosing its business model and establishing an overall business process management approach for all IT processes. High maturity IT capabilities may achieve a value centre state where IT helps entrepreneurially lead the business.

7.8.2 MP2 Manage the IT Budget:

The *Managing the IT Budget* process, strategy and maturity curve describes a systematic approach and set of practices and tools which can be used to manage the IT budget and funding. These practices include approaches such portfolio planning/funding and systematic cost reduction approaches such as service level adjustment, supplier negotiation as well as nurturing so called "disruptive" technologies which can deliver new or equivalent services often at much lower cost that existing products or services. The key focus is the management of the IT budget, and how that budget is allocated into portfolio's which support the execution of the strategy and devising a portfolio allocation that is influenced by prior value performance of each portfolio. A key end goal for this macro-process is achieving a sustainable economic model for the IT budget, where ongoing demand for existing and new IT services are met whilst maintaining a stable IT budget.

7.8.3 MP3 Manage the IT Capability:

Managing the IT Capability is crucial to delivering sustainable competitive advantage from information technology. This involves a systematic approach in managing IT's assets, the value chain that creates business value from IT, the core competencies that the IT organization requires to deliver IT business value and the ongoing and complete workflow through the entire IT value chain. Collectively the IT Assets and Value chain form the production engine of the IT capability. The premise of managing the IT capability is that sustainable competitive advantage from IT comes not from individual stove piped solutions but from an IT capability which is especially effective at delivering new strategic applications (Ross et al, 1998) and which can do this faster and better than the IT capability at competing companies. This highest level of maturity is when IT becomes a core competency in a particular organization, although this may not always be the desired end-state as some businesses may opt to pay for a less mature IT capability and compete on other aspects of their business.

7.8.4 MP4: Manage IT for Business Value

The *Managing for IT Business Value* macro process and associated improvement strategy is about managing IT investments and projects not as technology projects but are managed based on the benefits expected to be delivered. This benefits realization approach includes adoption of core business practices including basic return-on-investment measures supported by firm-wide investment coordination, business case discipline and continuous portfolio management and reprioritization. Beginning with total cost of ownership and basic business cases, successively more sophisticated practices such as portfolio management can be put in place to ensure overall optimization of the value that IT delivers. Importantly IT investments need to be managed in parallel with other aspects such as business process and organizational change to help ensure the intended return is delivered.

7.8.5 Summary

The IT-CMF is an archetype of the levels and stages through which an organization traverses and evolves as it defines, implements, measures, controls and improves its IT capability in support of value creation for the organization. In formulating the IT-CMF dynamic capabilities theory has been applied to create an organizing framework for four macro-processes for managing IT for value. A capability maturity lens (Curley, 2004) has been applied as an organizing framework to capture, organize and sequence a series of characteristics, practices and outcomes for increasing the maturity of the IT capability. Chapter 6 introduced named maturity levels and key characteristics associated with each maturity level for each of the macro-processes.

Appendix A shares the IT-CMF capability maturity assessment instrument while Appendix C lists and briefly describes a non-exhaustive list of thirty six critical processes which are organized under the four macro-processes. Appendix B describes briefly a taxonomy and classification schema which could be used to support a further organized research effort to build out maturity curves for each of the thirty six critical processes identified. It is also recommended that further validation and updating of the critical process list is performed.

This chapter discussed how the IT Capability maturity framework can be used as an assessment and management system to improve the maturity of the IT capability and thereby increase the value created by the IT capability.

Practically it is hoped that systematic and repeated use of the IT-CMF in an organization can lead to an improved IT capability delivering sustainable competitive advantage. From an academic viewpoint it is hoped that the research and development of the IT-CMF has contributed new knowledge and an improved theory to the field of Information Systems. Additionally it is hoped that this research can be another exemplar for the emerging design science research paradigm.

8 References

Agarwal, R., and Sambamurthy. V., 2002. Principles and Models for Organizing the IT Function. MIS Quarterly Executive, Vol. 1 p.1-16, March.

Agarwal, R., 2004. IT Capability. MIT Sloan CISR Research Briefing.

Alexander, C., 1977. A Pattern Language: Towns, Buildings, Construction. USA. Oxford University Press.

Allen, B., 2006. "It aint easy but it's up to you" Available at [www.cioupdate.com/insights/article.php/3615931]. Last accessed 17 Nov 2006

Alter, A., 2003. "Do you have any faith in your ROI numbers" March 17, Available at [http://www.cioinsight.com/c/a/Research/ROI-2003-Do-You-Have-Any-Faith-In-Your-ROI-Numbers/1/] Last accessed 30 Sept 2008.

Alter, A., 2006. "Whats the Value of IT? At many companies, it's just guesswork". Available at [http://www.cioinsight.com/c/a/Past-News/July-2006-Survey-Whats-the-Value-of-IT-At-Many-Companies-Its-Just-Guesswork/] Last accessed 30 Sept 2008

Ames, G., 1995. Semiconductor Manufacturing Productivity Overall Equipment Effectiveness, Sematech.

Andreessen, M., 2002. "Sidestepping the next IT crisis" Available at [http://news.com.com/2010-1071-976558.html] Last accessed 28 Sept 2008.

Anthony, R. N., 1965. Planning and Control Systems: A Framework for Analysis. Harvard Business Press.

Appleton. B., 2000. Patterns and Software; Essential Concepts and Terminology. Available at [http://www.cmcrossroads.com/bradapp/docs/patterns-intro.html] Last accessed 26 September 2008.

Ark, B. van, Inklaar, R. and McGuckin, R.H., 2003, Changing Gear' Productivity, ICT and Service. Industries: Europe and the United States. CESifo Economic Studies Vol. 49 3 pp295-318.

Bakos, J.Y., 1987. Dependent Level variables for the study of Firm and Industry-Level Impacts of Information Technology in proceedings of the Eight International Conference on Information Systems, Pittsburgh, Pennsylvania. December.

Bakos, J. Y. and Kemerer, C. F., 1992. Recent applications of economic theory in Information Technology research. Decis. Support Syst. Vol. 8,5 p365-386. Spetember.

Banker, R.D, Kauffman, R.J., 1991. Quantifying the Business Value of Information Technology: An Illustration of the Business Value Linkage Framework. New York University Working Paper Series, Stern School of Business, New York University, New York, NY.

Baldwin, E. and Curley, M., 2007. Managing IT Innovation for Business Value. Intel Press.

Barney, J. B., 1991. Firm Resources and Sustained Competitive Advantage. Journal of Management, Vol. 17,1 p. 99-120.

Barney, J. B., 1986. Strategic factor markets: Expectations, Luck and Business Strategy. Management Science, 32, p. 1512-1514.

Baron, R.M. and Kenny, D.A., 1986. The Moderator-mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic and Statistical

Considerations. Journal of Personality and Social Psychology, Vol. 51, p.1173-1182.

Barua, A. and T. Mukhopadhyay., 2000. Information Technology and Business Performance: Past, Present and Future. In: Framing the domains of IT research: projecting the future through the past. Zmud. R.W. Cincinnati, OH, Pinnaflex Educational Resources. P.65-84.

Berry, J. A., Broadbent, J., and Otley, D., 2005. Management Control: Theories, Issues and Performance, Second Edition, Palgrave Macmillan.

Betts, M., 2006. Summary of Forrester Research Survey of 452 IT decision-makers at North American enterprises. Available at [http://www.computerworld.com/blogs/node/1738] Last accessed 20 March 2008

Bharadwaj, A., 2000. A resource based perspective on information technology and firm performance; an empirical investigation, MIS Quarterly 24 (1), 169-196

Bobel, F., 1998. Overall Fab Productivity - How to measure, How to achieve. Semicon Europa Proceedings, Geneva.

Brealey, R. and Myers, S., 1999. Principles of Corporate Finance (Sixth edition) McGraw Hill

Broadbent. M., & Weill. P., 1997. Management by Maxim: How Business and IT Managers can create IT infrastructures. Sloan Management Review. Spring.

Brown, A., 1992. Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. The Journal of the Learning Sciences 2 (2) p.141-178.

Brown, C.V., and Ross, J.W., 1999. The IT Organization of the 21st Century: Moving to a Process Based Orientation. MIT Sloan CISR WP No. 306, July

Brynjolfsson. E. and Hitt. E., 1993. Is Information Systems spending productive? New Evidence and New results. Proceedings of the 14th International Conference on Information Systems, Orlando, FL.

Brynjolfsson. E. and Hitt. E., 1996. Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value. MIS Quarterly, Vol. 20, No. 2 June, p.121-142

Brynjolfsson, E., 1993. The productivity paradox of information technology: review and assessment. Communications of the ACM, p. 67–77

Brynjolfsson, E. and Hitt. E., 1996, "Productivity, Business Profitability, and Consumer Surplus: Three Different Measures of Information Technology Value" MISQ 1996, Vol. 20,2, p.121-142.

Brynjolfsson, E. and Hitt, L., 2002. Organizational Capital: The Other 9/10ths of Computerization. MIT Centre for eBusiness, November

Brynjolfsson, E. and Hitt, L., 2003. Computing Productivity: Firm Level Evidence. MIT CISR W.P.

Cameron, B., 2005. Stabilizing IT with Process Methodologies Forrester Research Note. Available at [http://www.forrester.com/Research/Document/Excerpt/0,7211,37030,00.html.] Last accessed 26 Feb 2008

Carlile. P.R., and Christensen, C.M., 2005. The Cycles of Theory Building in Management Research. Boston, Boston University-School of Management. Working paper #2005-03

Carlsson, S.A., 2006. Towards an Information Systems Design Research Framework: A Critical Realist Perspective. DESRIST Proceedings.

Carr, N., 2003. IT doesn't matter. Harvard Business Review. MA: Harvard Business School Press, May

CERN, 2006 Glossary for the CEDAR project. Available from http://cedar.web.cern.ch/CEDAR/glossary Last accessed 23 Sept. 2008.

Cimral, J., Lawler, M., Crowley, T., 2004, Getting started with Portfolio Management Prosight White Paper.

Collins, A.J.D., and Bielaczuc, K., 2004. Design Research: Theoretical and Methodological Issues. The Journal of the Learning Sciences Vol. 13 (1) p15-42.

Cook, T.D., 1983. Quasi-Experimentation: Its Ontology, Epistemology, and Methodology. In Beyond Method: Strategies for Social Research, edited by G. Morgon. London: Sage.

CEB Corporate Executive Board. 2003. Improving the Yield from IT. Working Council for CFO's report.

Cosgrove, L., 2001. Measuring IT Alignment. CIO Magazine, April.

Covey, S.R., 1989. The Seven Habits of Highly Effective People. Simon and Schuster

Chang, J.F., 2006. Business Process Management Systems. Auerbach Publication

Chrissis, M.B., Konrad, M., Shrum, S., 2003. CMMI: Guidelines for Process Integration and Product Improvement. Software Engineering Institute, CMU

Christensen, C.M., 1997. The Innovator's Dilemma*: When New Technologies Cause Great Firms to Fail.* Boston, MA: Harvard Business School Press

Christensen, C.M. and Overdorf, M., 2000. Meeting the Challenge of Disruptive Change. Harvard Business Press

Crosby, Philip B 1979. Quality is free: The Art of Making Quality Certain. McGraw Hill

CSU., 2008. Writing Guides: Case Studies. Available at [www.writing.colostate.edu/guides/research/casestudy] Last accessed 28 Sept 2008

Curley, M., 1998. Measuring the business value of Intel's first Intrabay . MBS Thesis, Graduate School of Business, University College Dublin.

Curley, M., 1999. The Business Value Index: Prioritizing IT Investments. Intel Internal Documents.

Curley, M., 2004. Managing Information Technology for Business Value. January Intel Press

Curley, M., 2005. Managing IT for Business Value Presentation. Georgia State University CIS Executive Roundtable, February

Curley, M., 2006. A Value Based IT Capability Maturity Framework. Intel EMEA Forum, Ireland

Curley, M., 2006. IT Innovation, a new Era. Proceedings of the International Conference of Computational Science, Reading, UK.

Curley, M., 2006. The IT transformation at Intel. MIS Quarterly Executive. Volume 5, Issue 4 (1), December: 109 – 122.

Curley, M., 2006. Introducing the IT Capability Maturity Framework. International Conference of Enterprise Information Systems, Portugal

Curtis, B., Hefley, W., and Miller, S. 2001. The People Capability Maturity Model ®: Guidelines for Improving the Workforce Addison Wesley

Darwin, C. 1859. On the origin of the species by means of natural selection: Or, the preservation of favoured races in the struggle for life. --. London: J. Murray.

Davies, H (2006), 'Improving the Relevance of Management Research: Evidence-Based Management: Design Science or Both?', Business Leadership Review 3.3, July, Association of MBAs

Dempsey, Jed and Robert E. Dvorak, Endre Holen, David Mark, William F. Meehan III. 1997. Escaping the IT Abyss. The McKinsey Quarterly, Number 4.

Dedrick, J.,Gurbaxani, V., and Kraemer, K.L. 2002. Information technology and economic performance: a critical review of the empirical evidence. University of California, Irvine, Center for Research in IT and Organizations (CRITO), November

Dedrick, J. Gurbaxani V. and Kraemer K.L. 2003. Information Technology and economic performance: A critical review of the empirical evidence. ACM Computing Surveys, Volume 35, Issue 1

Drucker, P. 1994 The Theory of the Business Harvard Business Review

Earl, M. J. 1990. Putting IT in its place: A polemic for the nineties (Oxford Institute of Information Management, Research, and Discussion Papers, RPD90/2). Oxford, England: Templeton College, University of Oxford

Earl Michael J & Sampler, Jeffrey L. 1998. Market Management to Transform the IT organization MIT Sloan Management review, Summer

Eckert, Andreas,. 2002. Maximizing ROI through User Proficiency SAS com, May

Eccles, R.G. 1987 The Transfer Pricing Problem, Lexington, MA, Lexington Book, 1987

ECSA 2003 Definitions of Terms to support the ECSA Standards and Procedures System Available from http://www.ee.wits.ac.za/~ecsa/gen/g-04.htm#Capability Access [17 September 2008]

Eisenhardt, K. M. 1989 Building Theories from Case Study research Academy of Management Review, 14: 532-550

Eisenhardt, K and Graebner, M. 2007. Theory Building from Cases: Opportunities and Challenges Academy of Management Journal, Vol. 50, No. 1, 25-32

Evers. C.W. and Echo H.W. 2008 On Generalizing from Single Case Studies: Epistemological Reflections. Journal of Philosophy of Education, Vol. 40 Issue 4, Pages 511-526.

Fitzgerald. B., and Wynn, E. 2004. IT Innovation for Adaptability and Competitiveness Kluwer Academic Publishers.

Fowler, Martin 2002. Patterns of Enterprise Application Architecture. Addison-Wesley. ISBN 978-0321127426.

Galavan, R. Harrington, D. Kelliher, F. 2008 A work in progress. The Road to relevance 15 years on – Are we there yet? EDiNEB Conference Paper, Malaga

Gamma, Erich; Richard Helm, Ralph Johnson, and John Vlissides 1994. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley. ISBN 0-201-63361-2.

Gartner 2004. "IT Spending, How Do You Stack Up?", Available at [www.gartner.com/5_about/news/assetmgmt_sample.pdf/] Last accessed 30 Sept 2008

Gibbons, M; Limoges, C.,Nowotny, H.,Schwartzman, S. , Scott, P., & Trow, M. 1994. The new production of knowledge: the dynamics of science and research in contemporary societies. London: Sage. ISBN 0-8039-7794-8.

Glaser, B. 1992 Basics of Grounded Theory Analysis Mill Valley, CA: Sociology Press.

Gruber. T.R., 1993 A translation approach to portable ontologies. Knowledge Acquisition, 5(2): 199-220

Gurbaxani, V. and Kemerer, C.F. 1990. An Agency Theory View of the Management of Information Systems , Proceedings of the International Conference on Information Systems, 279-288

Harmon, Paul 2006. BPM Methodologies and Process Maturity BPTrends Volume 4, Number 9

Helfat, Constance E. and Peteraf, Margaret A. 2003 The dynamic resource-based view: Capability Lifecycles Strategic Management Journal Vol. 24, No. 10. p. 997-1010.

Henderson, J.C. and Venkatraman, N. 1999 Strategic alignment: leveraging information technology for transforming organizations, IBM Systems Journal 38 (2/3), p. 472–484.

Hevner, S. March, J. Park, and S. Ram, 2004. Design Science Research in Information Systems, Management Information Systems Quarterly, Vol. 28, No. 1, March, p. 75-105)

Hevner, A. and March, S. 2003 The Information Systems Research Cycle, IT Systems Perspective Column, IEEE Computer, Vol. 36, No. 11, November, p. 111-113.

Hevner, A. 2006 Design Science Research in Information Systems University of South Florida and NSF seminar presentation,

Hodkinson, P. 2004. Research as a form of work: expertise, community and methodological objectivity. British Educational Research Journal Vol. 30,1 p.9-26.

Husen, T. 1999. Research Paradigms in Education. *In Issues in Education*, edited by J. P. Keeves and G. Lakomski. Amsterdam: Pergamon

Humphrey, Watts S. 1988. Characterizing the Software Process: A Maturity Framework IEEE Software Management

ISACA 2007. COBIT 4.1. Available at [www.isaca.org] Last accessed 20 Sept 2008

Johnson,Carl 1997, Advancing the role of Automation, Fabtech issue 6.

Johnson, Jim. 1994. The Chaos Report www.Standishgroup.com

Jorgenson, D. 2001. Information Technology and the U.S. economy . American Economic Review. Vol. 91, 1, p.1-32

Jurison, J. 1996. Toward more effective management of information technology benefits. The Journal of Strategic Information Systems Vol. 5(4) Pages 263-274.

Kaner, M. and Karni, R. 2004. A Capability Maturity Model for Knowledge-Based Decision-making Information Knowledge Systems Management 4 p. 225-252

Kangas, K., 1999. Competency and capabilities based competition and the role of information technology: the case of trading by a Finland-based firm to Russia. Journal of Information Technology Cases and Applications Vol. 1(2), p.4-22

Kaplan, R.S. 1986 Must CIM be justified by faith alone , Harvard Business Review, March-April.

Kauffman, R.J. and Weill,P., 1989. An evaluative Framework for research on the Performance Effects of Information Technology Investment . In J.I. DeGross, J.C. Henderson, and B.R. Konsynski (Editors), Proceedings of the tenth International conference on Information Systems, Boston, December 1989, p. 377-388.

Kenneally, Jim and Yossi Lichtenstein. 2001. The Optional Value of IS Projects. UCD

Keppel, G., Saufley, W. H., Jr., & Tokunaga, H. 1992. Introduction to. design and analysis: A student's handbook. (2nd ed.). New York:

Kerzner, H. 2001. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. Wiley

King, J.L. and Kraemer, K. L. 1984. Evolution and Organizational Information Systems: An Assessment of Nolan's Stage Model. Communications of the ACM Vol. 27(5), p.466-475

Kirkpatrick, Terry, 2003 "How CIOs figure ROI?". 18 March, www.cioinsight.com

Klein, H.K. and Myers, M.D. 1999. A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems MIS Quarterly (23:1), March 1999, p. 67-94

Kohli, R and Deveraj. 2004. Realizing the Business Value of IT Investments: An Organizational Process , MIS Quarterly Executive, Volume 3 (1), March

Lattimore, J. 2004. Reaching the Efficient Frontier. IBM Consulting whitepaper.

Lawrence, P.R. and J.W. Lorsch. 1967. Organization and Environment: Managing Differentiation and Integration. Boston: Graduate School of Business Administration, Harvard University

Leavitt, H., Whisler, T. 1958. Management in the 1980's. Harvard Business Review, 36(6), 41-48

Loveman, G. 1998. An Assessment of the Productivity Impact of Information Technologies. Working Paper, Management in the 1990s, Sloan School, MIT 1988.

Lucas, H.C, 1993. The Business Value of Information Technology: A historical perspective and thoughts for future research in R.D. Banker, R.J. Kauffman and M.A. Mahmood (Editors), Strategic Information Technology Management: Perspectives on Organizational Growth and Competitive Advantage. Harrisburg, Pennsylvania: Idea group Publishing, p. 359-374

Lu, Anne. 2004. IDC Worldwide IT spending survey www.IDC.com

Lu, Anne et al. 2007. IDC Worldwide IT spending survey www.IDC.com

Luftman, Jerry N. et al. 2004. Managing the Information Technology Resource, Prentice Hall

Lundberg, Abbie, 2005. State of the CIO, CIO Magazine, 2005-07-29

March, L. 1984. The Logic of Design. In Cross, Nigel. Developments in Design Methodology. New York: John Wiley & Sons, 265.

March, S. T., and Smith, G. 1995. D esign and Natural Science Research on Information Technology, Decision Support Systems (15:4), December 1995, p.251-266

Marchand, D. A., Rollins, J. D., and Kettinger, W. J. 2001 Information Orientation: the Link to Business Performance. Oxford University Press

Marchand, Donald A. 2004. Reaping the business value of IT: Focus on usage, not just deployment, to optimize payback , IMD publication No. 114, November

Markus, M.L., Majchrzak. A, and Gasser, L. 2002. A design theory for systems that support emergent knowledge processes , MIS Quarterly 26 (3) .

Markus, M.L. and Soh, C. 1995. How IT creates value, a process theory synthesis Proceedings of the 16th International Conference of Information Systems, Amsterdam, The Netherlands

Markus, M.L. and Soh, C. 1993. Banking on Information Technology, Converting IT spending into Firm Performance. In: Banker, R.D., Kauffman, R.D. and

Mahmood, M.A. (editors), Strategic Information Technology Management: Perspectives on Organizational growth and Competitive Advantage. Harrisburg, Pennsylvania: Idea Group Publishing. P. 405-444.

Marshall P, MacKay. J, and Prananto, A., 2005 Business Value creation from IT investments: towards a process theory of IT governance. AJIS Volume 12, No 2.

Mata, F.J. Fuerst, W.L, Barney, J. 1995. Information Technology and Sustained competitive advantage: a resource based analysis. MIS Quarterly Vol. 19, p. 487-505

McDonald, Mark. 2007. Gartner CIO Agenda 2007 survey Available at [http://www.gartner.com/it/page.jsp?id=501189] Last accessed 20 Mar 2008

Melville, N, Kraemer, K. and Gurbaxani, V. 2004. Information Technology and Organizational Performance: An Integrative Model of IT Business Value, MIS Quarterly, Vol. 28(2) June p. 283-322.

McFarlan, F.W. 1984. Information Technology Changes the way you compete Harvard Business Review, Volume 62, No. 3, May/June, p. 98-103

Mooney, J. et al. 1994. A process oriented framework for assign the business value of Information Technology . University of California, Irvine, Centre for Research in IT and Organizations (CRITO).

Moore, Geoffrey A 1991. Crossing the Chasm, HarperBusiness

Moore, Gordon 1965. Cramming more components onto integrated circuits, Electronics Magazine

Motorola, 2008 Six Sigma Information Available from [http://www.motorola.com/motorolauniversity.jsp] Last accessed 30 Sept 2008.

NASA, 2007. NASA Earthobservatory Glossary. Available from www.earthobservatory.nasa.gov/library/gloassry.php3 Last accessed on 25 September 2008

Needle, David. 2007. "IT Spending a trillion dollar deal" Jan 7, Available at [http://www.internetnews.com/stats/article.php/3653556] Last accessed 30 Sept 2007.

Niessink, Frank et al 2005. The IT Service Capability Maturity Model CIBIT consultants and educators.

Nolan, Richard 1973. Managing the computer resource: a stage hypothesis (399 - 405). Communications of the ACM 16 (7). Association for Computing Machinery

Nolan, R.L., and Gibson, C.F. 1974 Managing the four stages of EDP growth. Harvard Business Review, 52(1):76-86

Nolan, R.L. 1979 Managing the crisis in data processing. Harvard Business Review Vol. 57, p115-126

Otley, D, J. Broadbent and A. Berry, 1995. Research in management control: an overview of its development, British. Journal of. Management. **6** (s1), p. s31–s44

Otley, D, 1999. Performance management: a framework for management control systems research, Management Accounting ResearchVolume 10, Issue 4, , December, Pages 363-382.

Office of Government Commerce 2000. Service Support. The Stationery Office. ISBN 0-11-330015-8.

Office of Government Commerce 2001. Service Delivery, IT Infrastructure Library.The Stationery Office. ISBN 0-11-330017-4.

OGC, 2008. ITIL V3 Available at [http://www.itil-officialsite.com/home/home.asp] Last accessed 20 Sept 2008

Office of Government Commerce., 2002. Planning To Implement Service Management. The Stationery Office. ISBN 0-11-330877-9.

Orlikowski, W.J., and Iacoano, C.S., 2001. Research Commentary: Desperately Seeking the IT in IT Research. Information Systems Research Vol. 12, No. 2, June, pp 121-134

Owen, C. L., 2000. A Philosophical Home for Design. In: Buchanan, R. et al, editors. Proceedings of Foundations for the Future: Doctoral Education in Design. Staffordshire, UK: Staffordshire University Press.

Pant, L.W. and Yuthas, K., 2001. Using the management control system to promote competitive advantage in organizations: Behavioral and sociological perspectives. Advances in Accounting Behavioral Research JAI, Vol. 4, p. 155-183.

Peffers, K., Tuunanen, T., Gengler, G.E., Rossi, M., Hui, H., Virtana, V. and Bragge, J., 2006. The Design Science Research Process: A Model for Producing and Presenting Information Systems Research. DESRIST Proceedings.

Penrose, E. 1959. The Theory of the Growth of a Firm. Wiley, New York.

Pierce, C. S: 1935. Collected Papers. Harshorne, C. and P. Weiss, Eds. Cambridge, MA, Harvard University Press.

Paulk, M.C., Curtis, B. Chrissis, M.B., and Weber, C., 1993. *Capability Maturity Model for Software*, Version 1.1, Software Engineering Institute, CMU/SEI-93-TR-24, DTIC Number ADA263403, February

Peppard, J. and Ward, J. 2004. Beyond strategic information systems: towards an IS capability, Journal of Strategic Information Systems, Vol. 13, No. 2, p. 167-194

Piccoli, G. and Ives, B. 2005. Review: IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature. MISQ VOL 29; No. 4, p. 747-776

Pisello, T., 2004. ValueIT: IT Value Chain Management for CIOs and IT Executives. Alinean White Paper

Polayni, J. 1958. Personal knowledge: Towards a Post-Critical Philosophy. University of Chicago Press.

Pope, T. 2003. Defining the Value of e-Business. Intel White Paper

Porter, M.E. and Miller, V.E. 1985. How Information gives you competitive advantage. Harvard Business Review, Volume 63, No. 4, July/August, p. 149-160

Prahalad, C.K., 1993. The role of core competencies in the corporation. Research-Technology Management.

Prahalad, C.K and Hamel, G., 1990. The core competence of the corporation. Harvard Business Review.

Purao, S., 2002. Design Research in the Technology of Information Systems: Truth or Dare. GSU Department of CIS Working Paper. Atlanta.

Quinn, J. B., and Hilmer, F.G., 1994. Strategic Outsourcing, Sloan Management Review.

Renken, J., 2004. Developing an IS/ICT management capability maturity framework. In: Proceedings of the Annual Research Conference of the South African institute of Computer Scientists and information Technologists on IT Research in Developing Countries. Stellenbosch, South Africa. October.

Rinnoy Kan, A.H.G., 2004. IT Governance and Corporate Governance at ING. Information Systems Control Journal. Vol. 2.

Rivard, S. R., and Verreault, D., 2006. Resource-based view and competitive strategy: An integrated model of the contribution of information technology to firm

performance. The Journal of Strategic Information Systems. Vol. 15, Issue 1, March. p. 29-50.

Rogers, E. M. 1967, Diffusion of Innovations. New York Free Press.

Ross, J. W., Beath, C.M., Goodhue, D.L., 1996. Developing Long-Term Competitiveness through Information Technology Assets. Sloan Management Review, Vol. 38, Fall.

Ross, J. W., and Beath, C.M. 2001. Strategic IT Investment. MIT Sloan CISR Research Briefing No. 2A.

Ross, J. W., Beath, C.M., and Subramani, M. 2002. Synchronizing IT Management Practices for Business Value. MIT Sloan CISR Research Briefing No. 2C.

Ross, J.W., 2005. Forget Strategy: Focus IT on your operating model. MIT Sloan CISR Research Briefing No. 3C.

Ross, J.W., Vitale, M., and Beath, C.M., 1999. The Untapped Potential of IT Chargeback MIS Quarterly Vol 23. No 2, p. 215-237.

Ross, J.W., Weill, P., and Robertson, D., 2006. Enterprise Architecture as Strategy: Creating a Foundation for Business Execution. Harvard Business Press.

Rossi, M. and Sein, M., 2003. Design Research Workshop: A Proactive Research Approach. Presentation delivered at IRIS 26, August 9 – 12, 2003. Available at [http://tiesrv.hkkk.fi/iris26/presentation/workshop_designRes.pdf] Last accessed October 03 2008.

Rubinstein, D., 2007. Standish Group report. There's less development chaos today. Available at [http://www.sdtimes.com/article/story-20070301-01.html] Last accessed 23 March 2008.

Salman, R and Younis, N., 2005. Lessons to Management from the control Loop Phenomenon. Transactions on Engineering, Computing and Technology.

Salman, R and N. Younis, 2005. Lessons to Management from the Control Loop Phenomenon. Proceedings of the International Conference on Automation Technology, IEC 2005, p. 334-337. Prague, Czech Republic.

Sambamurthy, V., and Zmud, R.W. 1994. IT Management Competency Assessment: A tool for Creating Business Value through IT. Working Paper, Financial Executives Research Foundation.

Sambamurthy, V, and Zmud, R. W., 2000. Research Commentary: The Organizing Logic for an Enterprise's IT activities in the Digital Era – A Prognosis of Practice and a call for Research. Information Systems Research Vol. 11, No. 2 June

Samuel C. 2002. Modern Management (9th edition), Prentice Hall.

Sanchez, R., and Mahoney, J.T., 1996. Modularity, flexibility, and knowledge management in product and organization design, Strategic Management Journal, Vol. 17, p.63-76.

Sanchez, R., 2001. Resources, dynamic capabilities, and competences: Building blocks of integrative strategy theory. in Rethinking Strategy, Elfring. T., and Volberda, H., editors, Thousand Oaks, CA: Sage Publications.

Scavo, F., 2007. IT spend, staffing, technology trends 2007/2008. Computer Economics.

Schell, C. 1992. The value of case study as a research strategy. Manchester Business School.

SEI, 2003. Capability Maturity Models. Software Engineering Institute, Carnegie-Mellon University, Available at [www.sei.cmu.edu/cmm/cmms/cmms.html] Last accessed 16 June 2008.

Sekeram, U., 2003. Research Methods for Business Fourth Edition, Wiley.

Shewhart, W, L,. 1939. Statistical Method from the Viewpoint of Quality Control New York. Dover.

Shrout PE, and Fleiss J.L., 1979. Intraclass correlations: Uses in assessing rater reliability. Psychol Bulletin; Vol. 86 p.420-427

Simons, R., 1995. Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal. Harvard Business School Press. Boston.

Solow, R. 1987. We'd better watch out. New York Times Book Review, p. 37. July 12.

Spafford, G., 2007. There is no evidence for ITIL. Available at [http://www.itsmwatch.com/itil/article.php/3660826]. Last accessed 1 Oct 2008.

Strassman, P., 2002. Why ROI ratios are now crucial to IT Investment. Butler Group Review. September.

Strassman, P., 2004. Six Rules for Finding IT Value. Cutter IT journal Vol. 17, No. 8.

Strassman, P., 2005. The Politics of Information Management. The Information Economics Press.

Strauss, A., 1987. Qualitative analysis for Social Scientists. Cambridge University Press.

Susman, G.I., & Evered, R.D., 1978. An assessment of the scientific merits of action research. Administrative Science Quarterly, Vol. 23, p. 582-603.

Sward, D., 2006. Measuring IT for Business Value. Intel Press.

Takeda, H., Veerkamp, P., Tomiyama, T., Yoshikawam, H. 1990. Modeling Design Processes. AI Magazine, p37-48.

Tallon, P., 1999. Executives' Perspectives on IT: The Link between Business Strategy, Management Practices and IT Business Value. AISS.

Tallon, P., Kraemer, K. L., and Gurbaxani, V. 2000. Executives' perceptions of the business value of information technology: a process-oriented approach. Journal of Management Information Systems. Vol.16, 4, p.145-173

Tallon, P. and Kraemer, K. 2002. Investigating the relationship between strategic alignment and IT Business value: The discovery of a paradox, Idea Publishing Group.

Tallon, P., 2003. Why alignment can be a barrier to IT value: Uncovering an alignment Paradox, CIO Insight.

Tallon, P. and Kraemer, K. L. 2003. Investigating the relationship between strategic alignment and IT business value: the discovery of a paradox. In: Creating Business Value with information Technology: Challenges and Solutions, N. Shin, Ed. IGI Publishing, Hershey, PA, 1-22.

Tallon, P., and Kraemer, K., 2007. Fact or Fiction? A Sensemaking Perspective on the Reality behind Executives' Perceptions of IT Business Value. Journal of MIS , Vol. 24 (1), p.13-55.

Tallon, P. 2008. A Process-oriented Perspective on the alignment of Information Technology and Business Strategy. Journal of MIS, Vol. 24,3 p. 231-272.

Teece, D. and Pisano, G., 1994. The Dynamic Capabilities of Firms: an Introduction Industrial and Corporate Change. Oxford Journals.

Teece, D. J., Pisano, G. & Shuen, A., 1997. Dynamic Capabilities And Strategic Management, in: Strategic Management Journal. Vol.18 (7), p.509–533.

Teece, D., 2002. Managing Intellectual Capital: Organizational, Strategic and Policy Dimensions. Oxford University Press, Oxford.

Teeravarunyou, S., and Teixeira, C. 2002. Perspectives on building a philosophy of design. Visible Language. Available at [http://findarticles.com/p/articles/mi_qa3982/is_200201/ai_n9028271/pg_1?tag=artBody;col1]. Last accessed 3 October 2008.

Tellis, W. 1997 Introduction to Case Study *The Qualitative Report*, Volume 3, Number 2, July, Available at [http://www.nova.edu/ssss/QR/QR3-2/tellis1.html] Last accessed 20 Sept 2008.

Tiernan, C. & Peppard, J. 2004. Information technology: Of value or a vulture?. European Management Journal, Vol. 22, No. 6, p. 609-623.

Tocher. K.D., 1970. Control, Operational Research Quarterly Volume. 21, No. 2, p. 159-180.

Tocher. K.D., 1976. Notes for Discussion on Control, Operational Research Quarterly Volume. 27, No. 1, part 2 p. 231-239.

Trochim. M.K., 2006 Research Methods Knowledge Base. Available from [http://www.socialresearchmethods.net/kb/] Last Accessed 28 Sept 2008.

Vaishnavi, V. and Kuechler, W. (2004/5). "Design Research in Information Systems", Available at [http://www.isworld.org/Researchdesign/drisISworld.htm] Last accessed 15 Oct 2008.

Van Aken, J.E. 1004. De Bedrijfskunde als Onterpwetenschap. Bedrijfskunde, Vol. 66(1), p.16-26.

Van Aken, J. E., 2005. Management Research as a Design Science: Articulating the Research Products of Mode 2 Knowledge Production in Management. British Journal of Management, Vol. 16, No. 1, p. 19-36, March.

Van Ark, B., Inklaar, R. and McGuckin, R 2003. Changing Gear; Productivity, ICT and Services: Europe and the United States. Research Memo GD-60 University of Groningen.

Van Bon, Jan. 2006. Frameworks for IT Management. Van Haren Publishing September.

Van Schaik, E. A. 1985. A Management System for the Information Business. Englewood Cliffs, NJ, Prentice-Hall, Inc.

Van Schaik, E. A. 2006 2nd Ed.. A Management system for the Information Business. Red Swan Publishing.

Venkatraman, N. 1997. Beyond Outsourcing: Managing IT Resources as a Value Center MIT Sloan Management Review, Spring.

Wade, M. and Hulland, J., 2004. The Resource-Based View and information Systems Research: Review, Extension, and Suggestions for Future Research. MIS Quarterly, Vol. 28, p107-142.

Walls, J. G., Widmeyer, G.R. and El Sawy, O.A., 1992 Building an Information System Design Theory for Vigilant EIS, Information Systems Research, Vol. 3(1), March , 36-59.

Walton, Mary. 1990. The Deming Management Method, Putnam Publishing Group.

Ward, J. 2006 Delivering Value from Information Systems and Technology Investments: Learning from Success Cranfield ISRC report.

Weill, Peter. 1990. Do computers pay off? A study of Information Technology Investment and Manufacturing Performance. ICIT Press.

Weill, Peter. 1992. The Relationship between Investment in Information Technology and Firm Performance: A study of the Value Manufacturing Sector. Information Systems Review, Volume 3, Number 4, pp 307-333.

Weill, P and Ross, J. 2004. How Top Performers manage IT decisions rights for superior results, Harvard Business School Press.

Weill, Peter. 2004. Don't Just Lead, Govern. How Top-performing firms govern IT. MIS Quarterly Executive, Vol. 3 (1), March.

Weill, Peter and Aral, Sinan. 2004. Managing the IT portfolio: Returns from the Different IT asset classes. MIT Sloan CISR Research Briefing Number 1A.

Weill, Peter and Ross, Jeanne W., 2004. IT Governance on One Page MIT Sloan Working Paper No. 4517-04; CIS Research Working Paper No. 349.

Weill, P. 1992 The Relationship between Investment in Information Technology and Firm Performance: A study of the Valve Manufacturing Sector Information Systems Review, Volume 3, Number 4, , p.307-333.

Weill, Peter. and Aral, S., 2005. IT Savvy: Achieving Industry Leading returns from your IT portfolio MIT CISR Research Briefings Vol V Number 2A. July.

Westerman, G., Weill, P. and McDonald M., 2006 Business Agility and IT Capabilities, MIT CISR Research Briefing. March.

Worren, N., Moore, K., and Elliot. R., 2002. When Theories become Tools: Toward a Framework for Pragmatic Validity, Human Relations, Vol. 55,10 p.1227-1250.

Yin, R. 1994. Case study research: Design and methods (2nd ed.). Beverly Hills, CA: Sage Publishing

Zachman, J.A. 1987. A Framework for Information Systems Architecture. IBM Systems Journal, vol. 26, no. 3, IBM Publication G321-5298.

Zachman. J,A, and Sowa, J.F. 1992. Extending and Formalizing the Framework for Information Systems Architecture. IBM Systems Journal, vol. 31, no. 3, IBM Publication G321-5488

Zigurs, I., Buckland, B., Connolly, J., & Wilson, E.V. 1999. A test of task-technology fit theory for group support systems, Data Base for Advances in Information Systems. Vol. 30,3, p.34-50.

A Appendix A: IT-CMF Assessment Tool

Appendix A: IT Capability Maturity Assessment

Notes

Survey Purpose	The purpose of this survey instrument is to provide you with an IT maturity assessment score to help guide you on improvement actions for your IT organization and firm. The survey produces a raw maturity score - the survey will be analyzed versus aggregate industry scores to produce a normalized maturity score. The survey will also be used by Martin Curley of National University of Ireland/Intel to research IT capability, management practices and IT value contribution.
Confidentiality	All individual information will remain confidential and will not be disclosed to any other party except in aggregate form.
General	This survey is divided into three parts: 1) General information, 2) Maturity Assessment, 3) Value Assessment

Section 1: General Information

1	Your Name
2	E-mail address
3	Position
4	Company or Organization name
5	Ticker (e.g. INTC)
6	Industry

		2002	2006
7	Company Size (Number of Employees)		
8	Number of IT employees		
9	Annual IT budget $m		

10	Estimate the percentage of your IT budget allocated to:	2002	2006
	a) Innovation and Research: *(Prototypes and research to help discover new solutions and infrastructure that will provide competitive advantage to your firm)*		
	b) Solutions delivery: *(Software development and testing)*		
	c) Service provisioning: *(Deployment, Operation and Maintenance of infrastructure and solutions)*		
	d) Other (State)		
	Total	100%	100%

Section 1 cont...	2002	2006

11	What is or can you estimate the Business Value contribution in Net Present Value to your firm from IT in 2002 & 2006: *Example: At Intel it was aprox. $400m in 2004) - Please state 'Unknown' if this is unknown*		
12	Do you know or could you estimate the average return from your IT investments in the following years: *Please state 'No' if this is unknown*		
		A-E (2002)	**A-E (2006)**
13	In general what is your firm's overall posture to the use of IT? *A) Aggressive Innovator, B) Early Adopter, C) Early Majority Adopter, D) Late Majority Adopter, E) Laggard*		

Section 2: IT Maturity Assessment

Instructions:

For the maturity assessment please indicate the importance of each statement and then score each item on a scale of 1 to 5 estimating the level of maturity for both 2002 and 2006.

1.0 Managing the IT Budget

		Scoring: 1= Not Imp. to 5= Very Imp.
		Importance (1-5)
1	A consistent process exists for preparing the annual and quarterly IT budgets	
2	A consistent process exists for tracking and verifying spending against plan	
3	Financial performance with respect to budgets is predictable and within the variance range	
4	Systematic cost management/reduction processes and systems are in place (e.g. supplier mgt, service levels models, discretionary, etc.)	
5	Cost Reduction and IT budget performance are tracked and communicated regularly	
6	An ability exists to create strategic funding buffers to invest in new IT solutions	
7	IT cost structure is understood and benchmarked against industry best practices	
8	The refresh cycle for PC and server infrastructure has been analyzed and optimum refresh cycle for your firm/organization determined	
9	Capital expenditure (CapEX) and Operational Expenditure (OpEx) are balanced to enable the lowest overall IT spend while meeting business performance requirements	
10	Value at Risk versus TCO tradeoffs are regularly made to help ensure the right level of cost reduction	
11	The right balance is achieved between innovation, solutions delivery and services provisioning spending for your firm or organization	
12	Different funding and financing options are available and are considered for funding a variety of IT initiatives	
13	IT regularly examines major proposals to determine the most appropriate financing mechanism for the initiative/project	
14	The IT budget or IT intensity is increased based on continued and demonstrated value creation from IT investments	
15	The IT Budget or IT intensity trend is compared with other major categories of expense spending in the firm	
16	The IT organization has a sustainable economic model for it's budget, with the ability to meet the growth demands of the firm while avoiding a runaway IT budget	

Scorings for Maturity Levels:
1 = None, 2 = Beginning, 3 = Basics in Place,
4 = Maturing, 5 = Fully Mature

2002 Maturity Level	2006 Maturity Level	Comment/ Justification

2.0 Managing the IT Capability

		Scoring: 1= Not Imp. to 5= Very Imp. **Importance (1-5)**
1	IT has the necessary capability assessment tools and processes in place to give a holistic view of IT capability	
2	IT delivers a steady stream of solutions which provide competitive advantage to the firm.	
3	IT is perceived as a differentiating core competency for your firm or organization	
4	A flexible modular technical, application and data architecture which enables business agility is in place	
5	A high level of enterprise data quality and integrity exists and IT enables Information Superiority over competitors (e.g. better customer data and market intelligence)	
6	Industry Best Practice models (e.g. CMM-I) are an integrated part of developing IT solutions and software development capability	
7	Industry Best Practice models (e.g. ITIL) are an integrated part of developing the IT Services Provisioning Capability	
8	An advanced innovation management and measurement system is in place delivering significant results for the business	
9	A standardized technical infrastructure exists delivering a reliable and cost-efficient computing platform to the firm	
10	A consolidated virtualised technical infrastructure exists which delivers on demand computing services	
11	An enterprise data/information lifecycle management strategy exists to minimize cost whilst ensure the appropriate data/information is available within the appropriate service level agreement	
12	A robust IT workforce planning system is place to ensure the right people are in the right place at the right time	
13	IT Organizational Competencies for the future are known and the right personnel are being trained on them	
14	A robust IT strategic procurement organization and process exists to strategically manage suppliers and leverage economies of scale	
15	A customer account management and IT marketing team is in place and is effective	
16	A high level of trust exists between the business and the IT organization	

Scorings for Maturity Levels:
1 = None, 2 = Beginning, 3 = Basics in Place,
4 = Maturing, 5 = Fully Mature

2002 Maturity Level	2006 Maturity Level	Comment/ Justification

3.0 Managing for IT Business Value

		Scoring: 1= Not Imp. to 5= Very Imp. **Importance (1-5)**
1	An effective Total Cost of Ownership (TCO) measurement and tracking system is in place	
2	TCO is trended on a regular schedule to validate continuous progress in cost reduction	
3	A standard business case template for reviewing proposed investments is in place (including lifetime costs of supporting the solution)	
4	A formal set of proposal valuation criteria that maps to key business variables is deployed	
5	A standard methodology for managing approved projects is in place (i.e. Program Governance, Project Office)	
6	A methodology that validates, tracks and manages benefits realization (including post implementation reviews) is in place	
7	IT project managers and business mgrs are jointly held accountable for delivering results and business value	
8	An effective IT Governance Process including a formal investment decision making body/committee with funding authority is in place	
9	Risk Assessments are performed on proposed investments and Hurdle rates for expected returns on IT Investments are adjusted upwards based on increasing risk	
10	A formal portfolio management approach with pre-defined investment categories and allocation mix is in place	
11	A formal process exists to identify and end of Life solutions which no longer warrant sustaining due to low business value	
12	An options management approach is used to manage early stage speculative IT investments	
13	The business feels that IT delivers Superior Value AND Value for Money	
14	Advanced Investment Analysis Techniques are used to analyze IT investment performance to improve future IT business Value	
15	Business Cases are credible and audited by business or finance function to ensure accuracy and credibility	
16	Historical data exists to show IT led investments returns in the context of returns from other business investments	

Scorings for Maturity Levels:
1 = None, 2 = Beginning, 3 = Basics in Place,
4 = Maturing, 5 = Fully Mature

2002 Maturity Level	2006 Maturity Level	Comment/ Justification

4.0 Running IT as a Business

		Scoring: 1= Not Imp. to 5= Very Imp. **Importance (1-5)**
1	An effective asset management system is in place	
2	An effective product/service costing system is in place	
3	An effective customer billing and chargeback process is in place	
4	Formal customer survey processes are in place and acted upon	
5	IT Governance arrangements and structure exist and are clearly known across the business and IT	
6	The Principles for IT usage in the firm are explicitly stated and known (e.g. IT is a differentiator and will be used to enable company growth or IT is a utility and the objective is to minimize IT spend)	
7	Business and IT **Strategic and Financial Planning** processes are effective and closely linked	
8	Business and IT **Performance management** processes are effective and closely linked	
9	IT **service management and service support** processes are in place and are effective	
10	An effective flexible IT resource redeployment mechanism exists to address changing business priorities	
11	The IT Organization is agile and is re-organized at an appropriate frequency to optimally match business needs	
12	A comprehensive demand management and capacity forecasting system is in place capturing strategic demand right through to operational demand	
13	A comprehensive business model and business plan for the IT function/organization exists and is being implemented	
14	IT publishes regular Value metrics to demonstrate ongoing value return	
15	A comprehensive balanced scorecard/dashboard with integrated metrics is used to measure performance and help run IT like a business	
16	A high level of Business and IT alignment exists and IT is perceived as operating in a professional business-like fashion	

Scorings for Maturity Levels:
1 = None, 2 = Beginning, 3 = Basics in Place,
4 = Maturing, 5 = Fully Mature

2002 Maturity Level	2006 Maturity Level	Comment/ Justification

Section 3: IT Value Performance Assessment

Adapted with permission from IT Governance Performance Assessment tool (Peter Weill / Jeanne Ross – MIT Sloan)

2002 Assessment		In **2002** how important **WERE** the following outcomes of IT usage on a scale from 1 (Not Important) to 5 (Very Important)?	In **2002** what **WAS** the influence of the use of IT in your business on the following measures of success on a scale from 1 (Not Successful) to 5 (Very Successful)?
1	Cost effective Use of IT		
2	Effective Use of IT for business growth		
3	Effective Use of IT for Asset utilization		
4	Effective Use of IT for Biz Flexibility		

2006 Assessment		In **2006** how important **ARE** the following outcomes of IT usage on a scale from 1 (Not Important) to 5 (Very Important)?	In **2006** what **IS** the influence of the use of IT in your business on the following measures of success on a scale from 1 (Not Successful) to 5 (Very Successful)?
1	Cost effective Use of IT		
2	Effective Use of IT for business growth		
3	Effective Use of IT for Asset utilization		
4	Effective Use of IT for Biz Flexibility		

Would you be interested in performing a more detailed IT maturity assessment?	*Yes/No*

THANK YOU

B Appendix B: IT-CMF Classification Taxonomy

This appendix specifies a potential classification schema for the IT capability maturity framework of the IT CMM (IT Capability Maturity Framework). This can be used as a starting point for a full research activity and specification for a complete IT-CMF applied to the critical processes described in the following Appendix

B.1 Macro-Process (MPn)

There are four core macro-processes to the IT CMF

MP1 Manage IT like a Business

MP2 Manage the IT Budget

MP3 Manage the IT Capability

MP4 Manage IT for Business Value

B.1.1 Maturity Level

The Maturity level is an overall maturity level measure of the integrated maturity level of a particular macro-Process and also of the degree of synchronization of critical process maturity

B.1.2 Name

The name of the maturity level reflects the aggregate maturity of the macro-process and associated critical processes, for example Sustainable economic model is the name of Level 5, macro-Process 2 Managing the IT Budget

B.1.3 Description

This is a succinct description of the aggregate maturity of the macro-Process and associated critical processes at a particular maturity level of the macro-Process -for example supporting firm growth through providing scaleable services whilst maintaining a stable IT budget is a description of Level 5 *Sustainable Economic Model* of macro-Process 2 *Managing the IT budget.*

B.2 Critical Process CPn

In each macro-Process there are critical process areas (**CP)** for example MP4.CP1 is the Asset Management critical process under the managing IT like a business Macro-Process. CPs are listed by name and number. Each critical process area has an overall goal, a description and five maturity levels (unmanaged, basic, intermediate, advanced, optimized). These maturity levels describe the increasing sophistication and maturity of the critical process, not the institutionalization of the process which CMMI maturity levels describe.

A reference table for each macro-Process exists documenting the critical processes which exist for each macro-Process. The model is designed to be scalable so that as new critical processes are identified they can be easily added to the model.

B.2.1 Overall Goal

Overall Goal (OG) describes the key function or goal of the critical process

B.2.2 Description

Description describes the key aspects of the process

B.2.3 Maturity Level Mn

Each critical process area has five maturity levels (unmanaged, basic, intermediate, advanced, optimized).

In level 1 there is no formal process and a critical process is executed in an ad-hoc manner.

In level 2 there is basic process functionality to deliver a basic service

At level 3 there is an intermediate level of process sophistication and functionality to deliver an intermediate level of functionality

At level 4 there is an advanced level of process sophistication and functionality to deliver an advanced level of functionality and process output.

At level 5 the critical process optimized both within the process area and in the context of outer related critical processes

B.2.3.1 Name

The name of the continuous maturity level reflects the aggregate maturity of the critical processes and associated practices and metrics

B.2.3.2 Description

This is a succinct description of the aggregate maturity of the critical process and associated practices and metrics at a particular maturity level of the critical process.

B.2.3.3 Practice Pn

A Practice describes a key practice associated with this critical process area which helps deliver a desired result. Different practices will exist at different levels of maturity of a critical process. MP1.CP1.4.P1 is a **practice** of automated discovery and tracking of assets existing at level 4 **maturity** of Asset Management **critical process** in the Managing IT like a business **macro-Process.**

B.2.3.4 Metric Mn

A metric is a measure which is used to validate the degree of success of a particular practice in a process area - for example MP1.CP1.4.P1.M2 is the second metric (say % of assets automatically discovered and actively tracked) in the a **practice** of automated discovery and tracking of assets existing at level 4 **maturity** of Asset Management **critical process** in the Managing IT like a Business **macro-Process.**

B.2.3.5 Outcome On

An outcome describes the key impact or outcome delivered by a particular practice.

B.2.3.6 SubPractice sPn

A subPractice describes a practice associated with a practice area which helps deliver a desired result.

B.2.3.7 Metric sMn

A sub-metric is a measure which is used to validate the degree of success of a particular sub-practice

B.2.3.8 Outcome sOn

A sub-outcome describes the key impact of an outcome delivered by a particular sub-practice.

B.2.4 Related Process Areas

Related Process Areas notes other critical processes which interact with this critical process

B.3 Reference Table

The reference table for each macro-Process documents the list of Critical processes used under a particular macro-Process. Critical Processes can be identified by number for example CP1 or a three letter acronym AMT

C Appendix C: IT–CMF Critical Processes

In this Appendix are listed an initial list of critical processes which are important for the IT capability, organized under each of the four macro-processes. This is a non-exhaustive list developed through the research process. This list has had some limited validation through the design science research approach as the assessment questions in the survey were aligned to particular critical processes. Page 219 contains a mindmap showing a view of the integrated macro-processes and critical processes. This mindmap is artifact A6 generated during the research. Thereafter follows a listing of the critical processes and a short description of these.

C.1.1 Critical Process Listing & Description

C.1.2 Macro Process 1: Managing IT like a Business:

CP num	MP1	Acronym
1	IT Governance	ITG
2	IT Business Process Management	BPM
3	IT Strategy & Planning	ISP
4	IT Business Planning	BP
5	Organization Planning and Design	OPD
6	Capacity Forecasting and Planning	CPA
7	Sourcing	SCM
8	Innovation Management	AM
9	Supply and Demand Management	SDM
10	Risk Management	RIM
11	Financial Management	FMT
12	Resource Management (including asset management)	REM
13	Performance and Quality Management	PQM
14	Value Analytics & Intelligence	VAI

C.1.3 Macro Process 2: Managing the IT Budget

CP Num	MP2	Acronym
1	Funding and Financing	FF
2	Portfolio Planning and Prioritization	BM
3	Budget Management	PPP
4	Budget Oversight & Performance Analysis	BOA

C.1.4 Macro Process 3: Managing IT Capability

CP num	MP3	Acronym
1	Enterprise Architecture	EAM
2	Infrastructure Mgmt	IFM
3	People Asset Mgmt	IAM
4	Intellectual Asset mgmt	PAM
5	Relationship Asset Management	RAM
6	Research and Development	RDM
7	Solutions Delivery	SDM
8	Services Provisioning	SPM
9	User Experience Design	UED
10	User Training Management	UTM
11	Supplier Management	SM
12	Program and Project Management	PPM
13	Integrated Value Chain Management	VCM
14	Capability Assessment and Management	CAM

C.1.5 Macro Process 4: Managing for IT Business Value

CP Num	MP4	Acronym
1	TCO Management	TCO
2	Value Management	VM
3	Portfolio Management	PM
4	Investment Analysis & Performance	IAP

The remainder of this appendix contains brief descriptions of each of these critical processes.

C.2 MP1 Managing IT like a Business

C.2.1 CP1 IT Governance

This critical process is focussed on ensuring there is a focussed and robust IT Governance arrangements in place in the organization. Effective IT governance requires careful analysis about who makes decisions and how decisions are made in at least five critical domains of IT (Weill 2002): Principles, Infrastructure, Architecture, IT application portfolio and Investment and prioritization. In addition to defining the appropriate governance archetype to maximize company performance is a critical modulator. Research evidence (Weill and Aral, 2006) shows that top performers routinely achieved 20% better performance through choosing a Governance archetype aligned with the primary firm goals (for example revenue growth or asset efficiency). Additionally both business and IT leadership awareness of the IT Governance arrangements in a firm is an important modulator of overall value delivered (Weill et al, 2004).

C.2.2 CP2 IT Business Process Management

IT Process Management is a critical process which deals with documenting and managing the range of business processes that IT uses. An accurate inventory of processes accompanied with associated workflows can substantially help running IT like a business. While IT is arguably one of the most complex businesses within a business, typically IT itself supports itself with rudimentary process and workflow management tools. As the IT function matures, everything IT does increasingly is supported through processes. IT Business Process Management helps set improvement plans for each IT process and coordinate actions across IT to help achieve optimized performance. It also provides a blueprint for implementation of an ERP system for IT, which can likely improve the efficiency and effectiveness of the IT organization in support of the overall firm.

C.2.3 CP3 Strategic Planning

The Strategic Planning process is focussed on having a repeatable efficient process that develops, maintains and improves an IT strategic plan which drives the IT capability to deliver to the firm or organization's strategic goals. This outcome of this process will typically include documented business objectives, IT strategic objectives, agreed IT investment plans documented in terms of IT Initiatives, Programs and Projects.

C.2.4 CP4 Business Planning

Business Planning defines a strategy for developing the IT Capability based on the outcome of the IT strategic plan. It defines and tries to predict the enterprise demands of the IT Capability through the strategic plan period. This is a process which is updated periodically with inputs such as enterprise or organization strategy, environmental scan etc and creates a business plan for the IT organization which defines key objectives and key areas for investments (for example investment in improving the innovation process, investment in improving the supply network capability)

In effect this is the IT business plan to support the firm's business plan. A key decision in IT Business Planning is to decide and plan for the predominant business model for the IT capability - i.e. cost centre, service centre, investment centre or value centre.

C.2.5 CP5 Capacity Forecasting and Planning

Capacity forecasting and management is a process which strives to help the IT capability continually right-size in support of the overall organizations goals and trends. This process involves synthesizing different inputs such as business objectives/trends and utilization statistics to forecast and plan IT assets requirements. For example output will be a forecast and plan for infrastructure capacity as the firm expands, shrinks or acquires other firms in support of its strategic objectives.

C.2.6 CP6 Organization Design and Planning

This is the ongoing review and reorganization of the IT organization to meet the needs of the business. This is a process which should be managed on an ongoing basis with regular evaluation of the organization to see if it is optimally designed to meet the business or organization needs.

C.2.7 CP7 Sourcing

Sourcing is a critical process associated with identifying and agreeing supply agreements with vendors or internal providers of products and services. The concept of

taking internal company functions, processes, services and paying an outside firm to perform them is known as outsourcing and is an important part of sourcing. Outsourcing objectives are typically done to save money, improve quality, or free company resources for other activities.

C.2.8 CP8 Innovation Management

Innovation Management comprehends the full life cycle process of creation, development, deployment and use of solutions to create value. We define Innovation as the creation and adoption of something new which adds value to the organizations. The definition of Michael Schrage from MIT is useful in scoping this process *Innovation is not Innovators Innovating but customers adopting.* Innovation only happens when customers adopt something and value is actually created.

Innovation comes in many forms and could be a new solution, a business process reengineering exercise or the introduction of a new product with a high IT intensity. The IT Innovation process refers to a systematic process for improving the culture of the IT organization, the innovation tools/methodologies deployed, the metrics and incentives used to track and encourage innovation and ultimately the value delivered to the organization through IT. IT Innovation is also the process of systematically being creative, inventing, and developing prototype solutions to envision and realize potential solutions which can add value through IT to the firm. The field of IT innovation covers innovation across a wide number of areas - for example enabling business process innovation through IT, enabling or developing new products or services through IT, enabling new solutions for decision support which give better information and knowledge for decision making

C.2.9 CP9 Demand and Supply Management

This is the critical process which strives to achieve supply/demand equilibrium so that the IT capability operates as efficiently and effectively as possible in support of the overall organization's goals.

Demand Management should give a holistic view of all demand including strategic requests or opportunities, tactical development pipeline activities etc.

Supply Management is about predicting, anticipating, preparing and managing supply side resources, including suppliers to meet prioritized demand.

The objective is to be as close as possible in matching supply and demand across multiple categories to maximize the efficiency and effectiveness of the IT capability.

C.2.10 CP10 Risk Management

Risk Management is the process of analyzing exposure to and impact of risk and determining how best to proactively manage and mitigate risk exposure and potential outcomes of same. Risk Management is an essential part of ensuring business continuity one of the most fundamental contributions of value that IT delivers. Risk Management is also important in helping set appropriate hurdle rates for future and current investments. Information Security, Information Assurance and compliance are key aspects of Risk Management and should be defined as critical sub-processes of Risk Management.

C.2.11 CP11 Financial Management

This critical process is associated with full lifecycle financial cost and accounting management of the IT capability. It includes characterizing and calculating the cost associated with the IT Products and Services. This could use approaches such as activity based costing or more traditional IT costing methodologies. Equally this process includes a resource usage and utilization process that helps organizations accurately allocate costs of IT to help maximize the return from IT Investments and encourage desirable behaviour in the usage of IT. Key areas include Billing and Chargeback and Product/Costing.

C.2.12 CP12 Resource Management

This critical process is concerned with optimizing the entire resources (both people and physical resources) available to the IT organization in response to business or organization priorities. More sophisticated resource management practices allow dynamic resource allocation, alignment of the right resources to the right projects and optimal utilization of the entire resources available.

A subset of resource management is asset management. Asset Management. Asset Management is the process of deploying, inventorying and managing the presence and utilization of IT assets from computers/networks to deployed applications to achieve optimal usage of these assets in support of the organizations objectives. IT asset management focuses on building, securing, accessing, managing inventories and managing utilization of all IT resources including hardware, software, storage and networks.

C.2.13 CP13 Performance and Quality management (IT/Business Alignment)

This is the ongoing process of ensuring the IT capability delivers the results committed and needed, in alignment with the business goals. Typically balanced scorecard and dashboards approaches are used as this process get more sophisticated with control feedback mechanisms driving real-time adjustments.

C.2.14 CP14 IT Value Analytics & Intelligence

This process understands and maps connectivity from multiple levels of IT capability performance to business performance so that the overall performance of the IT capability in terms of efficiency and effectiveness in support of the organizations objectives can be optimized. IT Analytics is the set of mechanisms used to capture, model and analyse information (transactional, organisational and enterprise) in order to provide visibility and control of the IT Service in an organisation by defining and quantifying the relationship between infrastructure , applications/services, business processes, the enterprise and in doing so, facilitates effective and efficient improvement of the IT capability in support of increasing value.

C.3 MP2: Managing the IT Budget

C.3.1 CP1 Funding and Financing

This is the process of determining how best to fund and finance the IT portfolio and then implement this. Multiple options exist in terms of how to fund IT which will be determined by different factors such as the firms operating model - is the firm structured using a decentralized organization with multiple business units or perhaps using a unification design where the organization uses a centralized organization design. A unification model drives the need for low cost and reliability by standardizing business processes and would likely strongly prioritize shared services. In this case a centrally funded IT organization may predominate whilst in a diversified company predominately business unit funding may be driven through the business groups with an element funded through a corporate office to enable some levels of efficiency through shared services.

Equally strategic decisions to be made about how to finance strategic IT investments for example through the companies cash, perhaps through vendor leasing or indeed through commercials loans. Driving these decisions requires careful analysis of what options lead to lowest or optimal TCO based on CapEX and OpEX.

(The IT portfolio includes the IT solutions in production, development and prototyping phases and also includes investments in IT assets such as People and IT infrastructure.)

C.3.2 CP2 Budget Planning and Management

Budgeting is the process of preparing annual and other period based budgets for the IT organization and it's portfolio of IT investments. Many different approaches can be used to prepare a budget - for example zero baseline budgeting is one approach.

Cost Management is a critically important activity for CIOs with many CIO's only able to invest through saving spending from their operational or keep the lights on budget. Budget management consist of both operationally managing the spend against budget and proactively managing the budget and entities

consuming budget so that there is continuous cost reduction to enable the creation of strategic funding buffers

(It is important to note that most IT investments will require complimentary business investments - these may or may not be included in the IT budget.)

C.3.3 CP3 Portfolio Planning and Prioritization

This is the process of allocating budget against different portfolios based on a number of factors including business priorities, benchmark data and historical returns from particular portfolios. Many different portfolio lenses can be applied - one example is the Ross/Beath strategic investment portfolio consisting of four portfolio categories: Process Improvement, Renewal, Experiments and Transformation (Ross, 2001).

An alternative portfolio lens is that advocated by Peter Weill breaking IT investments into four categories Informational, Strategic, Transactional, and Infrastructure. Weill's work on returns from these four asset classes is an example of historical return data which can be used to tune future portfolios.

C.3.4 CP4 Budget Oversight/Variance Analysis

This is the process of analyzing the budget and analyzing variance for spends against the budget with a view to continuous improvement of both the budget process and the allocation of budget to specific portfolios. This process also reviewed historical returns and helps produce data which can lead to better predictive value in choosing the right future investments.

C.4 MP3: Managing the IT Capability

C.4.1 CP1 Enterprise Architecture

Enterprise Architecture is the core organizing logic for an organization's data, applications, infrastructure and business processes captured in a set of policies and technical choices to achieve desired business effectiveness and agility with technical standardization and integration. (Adapted from Ross et al). It typically may consist of four sub-architecture components.

Business Architecture

Business Architecture reflects a view of the functions and processes required for the firms business to be successful or the organizations objectives to be achieved

Data/Information Architecture

data architecture represents what must be know to effectively executive and support the business processes

Application Architecture

Application architecture defines the applications required to support the business functionality and identifies the delivery methods for information

Technical Architecture

Technical Infrastructure architecture defines and manages the infrastructure enabling access to information by providing the environment and platforms to run applications and solutions (for example networks, servers, storage)

C.4.2 CP2 Infrastructure Management

The Infrastructure Management critical process is focused on managing the distributed technology assets or infrastructure that the firm or organization has. By way of example the current draft aggregate maturity levels are

1) Unmanaged: Infrastructure is largely unmanaged

2) Standardized: The organization has reduced TCO through standardizing on platforms and minimizing configurations

3) Consolidated: The organization has reduced TCO through server, storage and other consolidation activities

4) Virtualized: The organization has reduced TCO and improved performance through taking advantage of virtualization capabilities

5) On demand Infrastructure: The organization can deploy infrastructure in real-time as and when needed whilst maintaining optimal availability and utilization performance.

The Infrastructure management critical process consists of constituent maturity curves for servers, clients, network and storage.

C.4.3 CP3 People Asset Management

The People Asset Management critical process describes the process of managing the IT people asset based on the strategy and goals of the business. This includes a systematic approach to managing the people in an IT organization including activities such as workforce planning, leadership development, future competency identification etc. People CMM is identified as a best practice for managing the improvement of the organizations people asset. A key aspect of developing the people asset is changing the culture of IT to become value and customer focussed.

C.4.4 CP4 Intellectual Capital Management

The Intellectual Capital asset is the suite of business applications/solutions and the information and knowledge which is codified in corporate and employee databases and computing devices which enable business capabilities. It also consists of uncodified knowledge as well as responsibility for overall data

quality. The goal of developing the intellectual capital asset is to deliver a set of solutions which give the firm or organization a sustainable competitive advantage and deliver information and/or execution superiority over its competitors.

The Intellectual Capital Asset maturity states will consist of constituent maturity states for all elements of the firms value chain - for example manufacturing, design, and marketing. The Intel Enterprise Capability Framework is an example of best practice in supporting appropriate improvement and investment in the Intellectual Capital asset to deliver sustainable value and the appropriate amount of competitive differentiation and value.

Potential high level maturity states could include

1) Unmanaged

2) Utility solutions

3) Improved Solutions

4) Transformational Solutions

5) Value Chain and Information Superiority

Example capabilities could include: Supply Network, Sales and Marketing, and Collaboration

Data Quality

A key component of the Intellectual Asset management is data quality. The old axiom G*arbage in, Garbage out* particularly applies here. Careful attention to Master Data Management (MDM) and overall data quality are particularly important for the effectiveness of the Intellectual Assets. Additionally processes for re- use of data, software etc are important in improving efficiency of the Intellectual Capital assets.

Application Management: A key component of the Intellectual Asset Management is Application Management. Application Management is responsible for building and maintaining knowledge of all the applications that support the firm or organizations business processes.

C.4.5 CP5 Relationship Asset Management

The relationship asset is the relationship that exists between the business and IT. It consists of all the complimentary investments that the organization or business has made to enable value to be created from IT. Careful management of the relationship asset can improve the relationship between IT and the business from one which is customer/vendor based to a symbiotic one where there is complete shared risk/reward and accountability for success of the outcomes of IT investments. Important activities supporting the ongoing stewardship of the relationship asset include customer relationship management, IT marketing, customer surveys and similar activities.

C.4.6 CP6 Research and Development

The research and development process refers to the process of formally researching new technologies and exploring key opportunities and then developing the most attractive research options into a variety of value adding elements. In many IT organizations one output of the R&D process will be an option, potentially manifested as a prototype which is handed over to the solutions delivery critical process for full development as a solution which would subsequently be supported by the services provisioning critical process. Other outputs of the R&D process could be an enterprise architecture change, a patent filing or a white paper.

C.4.7 CP7 Solutions Delivery

Solutions Delivery is the process of developing and delivering new solutions into operation. Solutions delivery typically may take the output from the R&D process and deliver the work product while managing the constraints of cost, schedule, functionality and quality to best meet the needs of the business. Equally the solutions delivery process may involve systems integration or active configuration of an out of the box product. CMMI is currently a best practice model for driving maturity of this critical process.

C.4.8 CP8 Service Provisioning

Services Provisioning is about delivering the primary services and products to support the firm. Activities include the allocation and provision of IT services and resources such as data centres, help desks, services, solutions etc. Service delivery and service management are two critical components of this critical process and ITIL is recognized as a leading best practice for this critical process. The two major components of ITIL are IT Service Management and IT Service Delivery.

C.4.9 CP9 End User Management – User Experience Design

End User management is an important process in delivering value from IT investments. According to Donald Marchant business value is maximized when there is IT service Excellence AND outstanding usage. The critical process of end user management is focussed on improving the maturity of end user usage of systems. This consists of two major critical processes (1) User experience design and (2) Training and Learning Proficiency. User experience design helps improve both the actual and perceived usefulness and ease of use of new solutions to ensure optimal adoption and usage.

UED is about designing solutions from the end user perspective to maximize the efficacy, ease of use, productivity and value that comes through usage of a solution.

C.4.10 CP10 End User Training and Adoption

This critical process describes the maturity curve around maximizing user proficiency and ensuring users acquire the right skills at the right time. The maturity curve could be developed using the synthesis of several existing maturity models shown below.

A key component in enabling adoption would be the perceived usefulness of a new solution and the perceived ease of use - these two items importantly influence user's attitude to the adoption of a new solution and must be comprehended in the design and deployment of new solutions.

C.4.11 CP11 Program/Project Management

This critical process describes the process of program and project management. A project is an initiative that has a specific objective, consumes resources and operates under functionality, cost, time and quality constraints. A program is a collection of related projects which collectively enable a higher level capability to be delivered. Improving the maturity of the program/project management process in an organization increases the predictability that specific objectives (in many cases the delivery of a solution) will be delivered within defined constraints reducing the lateness of delivery, avoiding cost over-runs and delivering functionality at the right level of quality which meets both customer and users needs.

C.4.12 CP12 Supplier Management

This critical process concerns the management of suppliers so that the basis of the relationships moves from transactional and potentially win-lose to strategic and win-win. As maturity increases the use of practices such as performance based contracting or joint strategic planning can help an organization achieve more value from its key supply base.

C.4.13 CP13 Integrated Value Chain Management

The goal of integrated value chain management is to maximize the output of the IT Value chain as measured by agility (beat rate), functionality, cost, quality, and schedule. Active management of the value chain is necessary ensure it operates as flexibly, quickly and efficiently as possible. Approaches such as Constraint Management are very useful in this context so that improvements made in the integrated IT value chain process directly translate into measurable improvement and benefit.

The key inputs to the value chain are business opportunities and business needs that can be matched with potential IT solutions. The sequence of activities in the value chain consists of dreaming up a solution, building that solution, then delivering the solution and finally using the solution to meet the business need or capitalizes on the business opportunity.

Depending on the profile and maturity of the firm, the resource allocation profile

across the steps in the primary value chain will differ. Many IT organizations place a significant majority of their resources on services provisioning. For these organizations, an objective for improvement may be to move resources up the value chain by driving cost out of services provisioning and investing the savings in improved innovation and solutions development.

Ultimately the macro portfolio needs to be balanced against the priorities of business continuity and future value creation. Typically services provisioning delivers the value through enabling business continuity whilst Innovation and Solutions delivery enable future value through both future value creation and improved business continuity.

C.4.14 CP14 Capability and Organizational Assessment

This is a critical process involving continuous management and improvement of the IT capability and organization. It typically involves increasing breadth, depth and maturity using different assessment instruments and capability performance measurement and driving corresponding improvements in maturity through related improvement actions

C.5 MP4: Managing IT for Business Value

C.5.1 CP1 Total Cost of Ownership

Total Cost of Ownership is the critical process for managing the total cost of ownership of the infrastructure and solutions - TCO is a holistic view of IT costs across the organization/enterprise over time. Specifically it helps assess the direct and indirect cost for the acquisition, operation and future modification of infrastructure or a solution.

C.5.2 CP2 Value Management

Value Management is the process of maximising the value delivered from IT investments. The value management process concerns both the active realization and assessment of value. Value does not happen through just delivering a service but through active change management ensuring for example users are using the service appropriately and any organization or business process changes happen in synchronization. A key focus is properly assessing the value delivered and using practices like post-implementation reviews to ensure value is delivered. Building business cases which include both direct and indirect costs for both the business and IT is important to ensure credible and realistic value propositions.

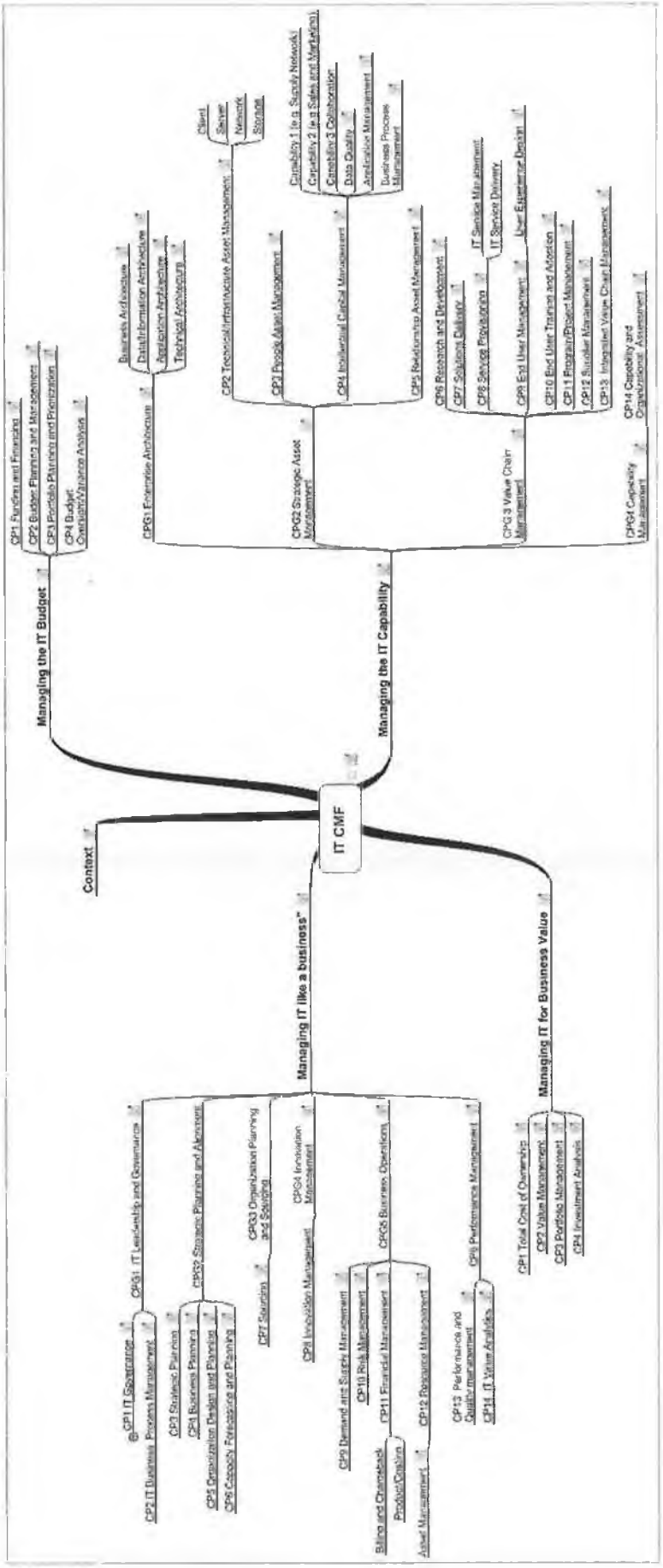
C.5.3 CP3 Portfolio Management

This is a business process by which an organization actively manages the mix of active projects, staffing and budget allocated to each project. New classes of investments or portfolio weightings are modified to determine the optimum mix of investments to yield the best return for the organization in supports of its overall objectives. This critical process is closely linked to the portfolio planning and allocation critical process in the Managing IT like a business macro-process.

C.5.4 CP4 Investment Analysis

This is the process of proactively analyzing and managing different portfolios to determine the best future mix of investments and building a history of investment performance to enable predictive forecasting and selection of new investments as well as recommended portfolio weightings. Using investment analysis techniques can yield significant optimizations.

Artifact A6: IT-CMF Mindmap



D Appendix D: Example IT-CMF assessment report

Example Alpha IT-CMF Assessment Report and Recommendations

To protect company confidential information the company whose IT capability was assessed has been referred to as Alpha and assessments and recommendations have been changed also.

Alpha IT-CMF Maturity and expectations for 2009

	Maturity Levels	Major Strategies			
		Managing the IT Budget	Managing the IT Capability	Managing IT for Business Value	Managing IT like a Business
5.	Optimizing	Sustainable Economic Model	Corporate Core Competency	Optimized Value	Value Centre
4.	Advanced	Expanded Funding Options	Strategic Business Partner	Options and Portfolio Management	Investment Centre
3.	Intermediate	Systemic Cost Reduction	Technology Expert	ROI & Business Case	Service Centre
2.	Basic	Predictable Performance	Technology Supplier	TCO	Cost Centre
1.	Initial		← Beginning →		

2009

2007

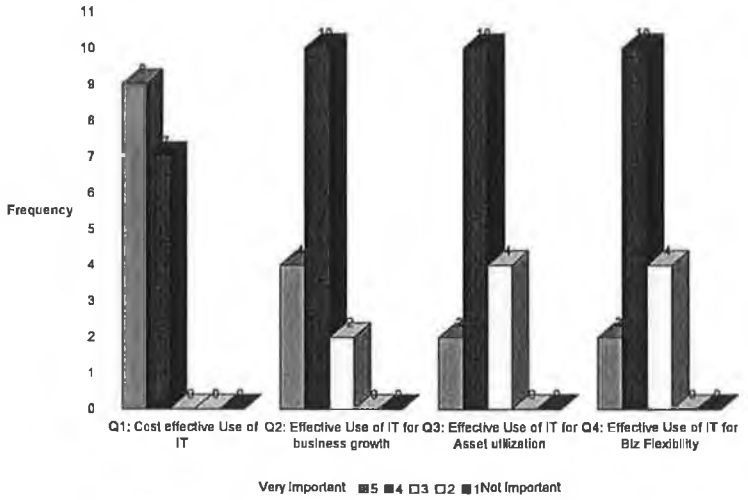
Source: Martin Curley, Alpha / National University of Ireland

Alpha IT assessed as Level 3, Targeting level 4 maturity in 2009

Strong bias towards
Cost effective use of IT

Alpha IT - 2007

How important ARE the following outcomes of IT usage - 2007

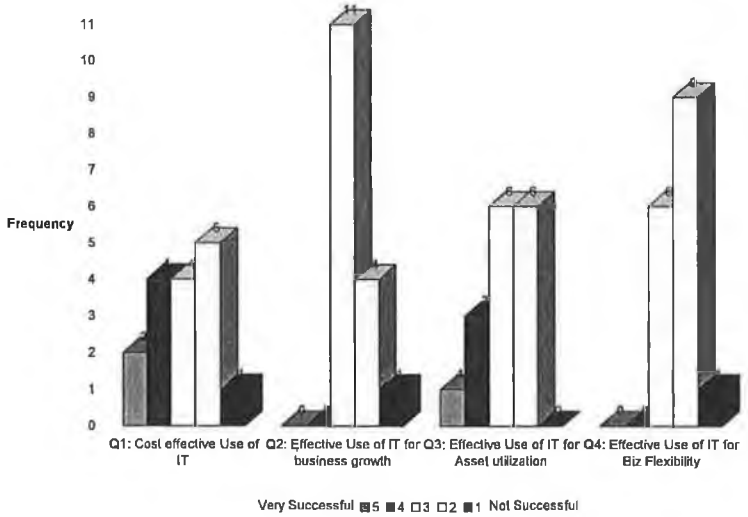


Alpha IT CMF Assessment 2007

Neutral to Negative
Impact on these drivers

Alpha IT - 2007

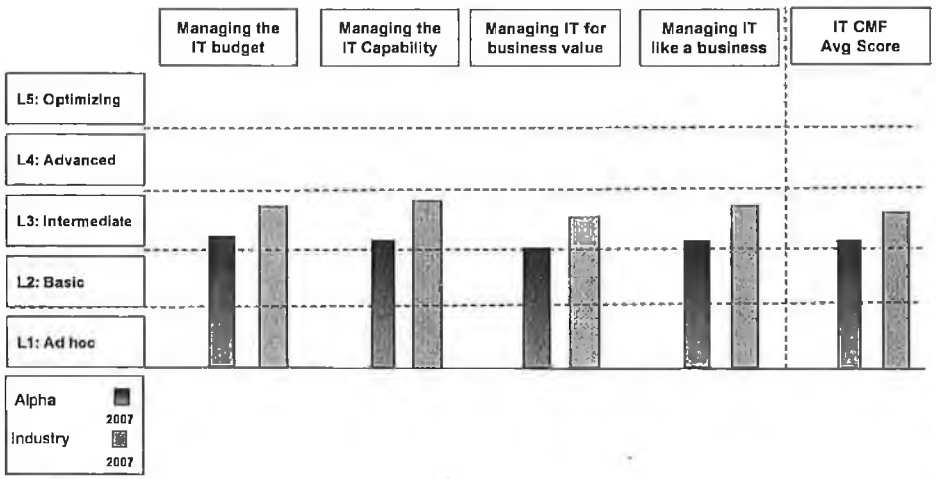
What IS the influence of the use of IT - 2007



Alpha IT CMF Assessment 2007

IT 2007 CMF Results & Comparison with Industry Group

Alpha IT lagging
Industry average Maturity



Alpha IT CMF Assessment 2007

Interpretation of comparison with Industry Benchmark

Industry		S1	S2	S3	S4	Mean Maturity	Value
	2002	2.02	1.85	1.73	1.91	1.88	49.29
	2006	2.74	2.8	2.51	2.77	2.7	64
Change		0.72	0.95	0.78	0.86	0.82	14.71
%Change		36%	51%	45%	45%	44%	30%

Intel IT		S1	S2	S3	S4	Mean Maturity	Value
	2002	3.08	2.46	2.46	2.74	2.685	66.83
	2006	3.41	3.16	2.41	3.12	3.025	61.2
Change		0.33	0.7	-0.05	0.38	0.34	-5.63
%Change		11%	28%	-2%	14%	13%	-8%

Intel delta 2002	1.06	0.61	0.73	0.83	0.805	17.54
Intel delta 2006	0.67	0.36	-0.1	0.35	0.325	-2.8

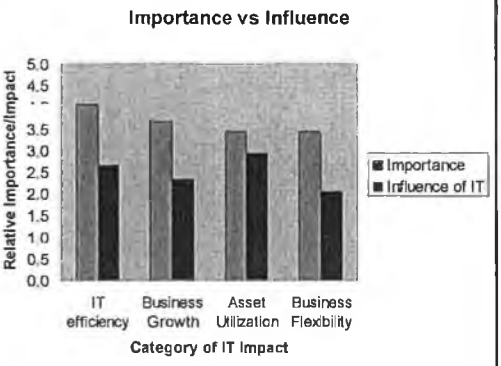
•Alpha IT still ahead of Industry maturity average in 2006 but losing ground, peer group improving at a faster rate.
•Alpha IT value performance now behind industry average, likely modulated by IT posture change and strong IT efficiency focus

Alpha IT CMF Assessment 2007

Goal Congruence and Performance Goal Gap

- Strong goal congruence/ perception of importance
- Everyone knows IT efficiency is king.
- Significant Performance vs Goal Gap
- IT impact neutral to negative on IT efficiency, business growth, asset utilization and business flexibility

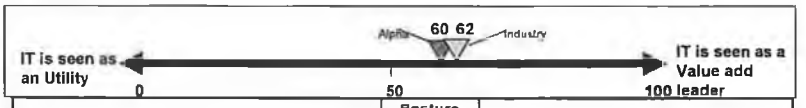
- **IT Posture questions**
  - Is IT efficiency the right over-riding goal?
  - Should the focus be fix the sins of the past or enable the future?



* Adapted from IT Governance Performance Assessment tool (MIT CISR, P. Weill/ J. Ross)

Alpha IT CMF Assessment 2007

Alpha IT Posture - 2007



	Posture Score 1 – 5	
In IT, we are laggards in adopting new technologies	3.3	In IT, we are aggressive early adopters of new technology
We deploy IT in support of current business operations	2.5	We view IT as a fundamental driver of future business activity
We view IT as an expense to be managed	2.4	We see IT as a resource to be leveraged for future competitive advantage
We view IT outsourcing as a threat to our IT operations	2.8	Our sourcing strategy balances in-sourcing with out-sourcing
We use one criterion for assessing value from IT	3.6	We use multi-dimensional criteria for measuring IT value
Our operations reflect a captive, internal monopoly	2.6	Our IT operations act as a solutions integrator to business requirements
Our IT spend is less than the average for our industry	3.8	We invest more in IT than the average in our industry
Overall Posture = (Score / 35)*100	60%	

- 2007 Data shows Alpha IT posture is neutral to moderately positive and is slightly less than average posture.
- With the structure and efficiency program, Alpha IT's posture changed from reasonably bullish to more bearish. Significant cost reduction targets shifted focus to improving the efficiency of core IT systems with dis-investment in innovation/research related activity The combination of reduced IT budgets and a less aggressive posture on IT would likely lead to improved value for money but less value due to overwhelming focus on improving IT efficiency

Summary of Critical Processes

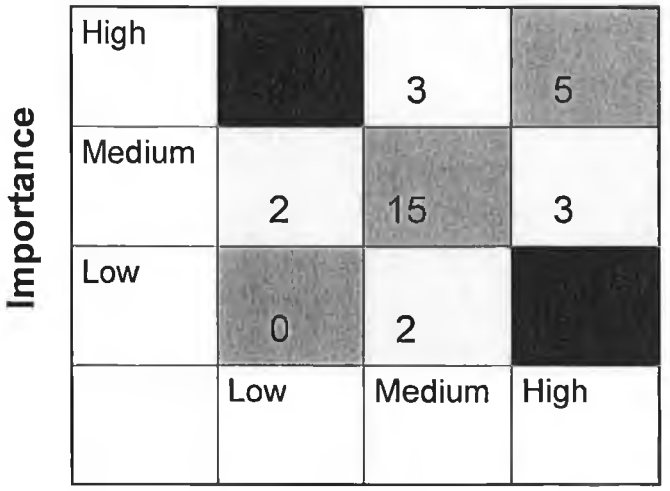


Chart modified to protect confidentiality

- Approx 55% of Critical Processes (CP's) in their desired position
- 11% of CP's (Highly Important/Low Maturity) in the "Red" Zone
- C.5% of CPs currently over-invested in.

IT-CMF Summary Findings

Strong goal congruence

- **Everyone knows IT efficiency is king.**

Significant Performance vs Goal Gap

- **IT impact neutral to negative on IT efficiency, business growth, asset utilization and business flexibility**

Alpha has lots of room for improvement

- **11% of critical processes (36) in red zone (high importance, low maturity)**
- **Alpha IT now behind industry mean on maturity of IT processes and management**

Alpha IT CMF Assessment 2007