A measurement model to link process operational measures to risks associated with attainment of business critical success factors

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Abstract
There is currently no evidence of a measurement model to associate IT Service Management (ITSM) maturity with financial profitability which prompts the research question: *how can a model and method be developed to link ITSM process capability and process performance with financial performance?* The purpose of this study was to develop and apply a measurement model and present a pragmatic and cost effective method to link ITSM process capability and financial performance by operationalizing Key Performance Indicators (KPIs) to support Critical Success Factors (CSFs) and associating CSFs with business risks to determine CSF risk levels.

This paper presents a conceptual measurement model derived from the literature, a description of the mixed method approach to collect data from the organization, the application of the model to the Incident Management process at Company X and a discussion of lessons for practice, theoretical contributions, limitations and an agenda for further research.

The study found that the measurement model and method developed can be used as a starting point for self-improvement for businesses, identifying gaps in processes, benchmarking within an organization as well as guiding an organization's improvement efforts. The measurement model can be used to conduct What-If analyses to model the impacts of future business decisions on KPIs and CSFs. The measurement model presented in this study can be quickly implemented, adapted and evolved to meet the organization's needs.

This study employs the resource-based view of the organization to exhibit a firm's IT capability characteristics of, and its relationship to, organizational performance. The research offers an example from which other organizations can learn to measure their financial return on investment in ITSM improvement.

Keywords IT Infrastructure Library (ITIL®), Process Assessment, Financial Performance, Key Performance Indicators (KPIs), Critical Success Factors (CSFs), Resource-Based View (RBV).

1 INTRODUCTION

As technology is at the core of almost every leading industry, organizations are increasingly scrutinizing their IT group's performance so that it is more in line with the overall business performance and contributes to the business' *bottom line* (Holtsnider & Jaffe, 2009; Johnson, Hately, Miller, & Orr, 2007). Many IT departments are not equipped to meet these increasing IT service demands (Cater-Steel, 2009). They continue to operate as passive-reactive service providers, utilizing antiquated methods that do not adequately provide the quality, real-time solutions that organizations need at present to be competitive.

Organizations need efficient Information Technology Service Management (ITSM) processes in order to cut costs, but ironically, in order to implement highly capable processes, there are significant costs involved, both in terms of time and resources. A potential way to achieve better performing and higher capable processes is to employ methods to compare an organization's processes against best-practice standards to identify gaps and receive guidance to improve the processes. Many of the existing methods require large investments. The key problem in the industry is that most IT organizations have not yet embraced the business side (specifically Service Portfolio Management and IT Financial Management) aspects of ITSM (Steinberg, 2013). Service Portfolio Management (SPM) is used to manage investments in Service Management across the organization, in terms of financial values. SPM enables managers to assess the quality requirements and associated costs. IT Financial Management aims to provide information on IT assets and resources used in delivering IT services. Providing a Service Portfolio and practicing IT Financial Management requires a high level of maturity for an organization. It seems reasonable and logical that the organization's Chief Information Officer should be able to articulate and justify the IT services provided, can report the costs (by service) to deliver these services, and can communicate the demand for those services, i.e. how they are being consumed and will be consumed in the future. However, a major investment in terms of time and resources may be needed to catalogue such information and report on it. The research problem that this paper addresses is the lack of a pragmatic model and method that associates ITSM process maturity (process capability and performance) with financial performance for organizations that lack mature ITSM processes.

Previous studies report on cost savings (Cater-Steel, Tan, & Toleman, 2009; Jäntti, Rout, Wen, Heikkinen, & Cater-Steel, 2013; Pollard & Cater-Steel, 2009) but there is currently no measurement model to associate ITSM maturity with financial profitability which prompts the research question: *how can a model and method be developed to link ITSM process capability and process performance with financial performance?* The purpose of the study reported in this paper was to develop and apply a measurement model and present a pragmatic and cost effective method to link ITSM process capability and financial performance by operationalizing Key Performance Indicators (KPIs) to support Critical Success Factors (CSFs) and associating CSFs with business risks to determine CSF risk levels.

The research was based on a single case study of a global financial services firm *Company X* that had implemented the IT Infrastructure Library (ITIL®) framework to improve the quality of its IT services. The paper is structured as follows. A conceptual measurement model is presented that was developed from findings of the literature review. A mixed method approach to collect data from the organization is described. The model is applied to the Incident Management process at Company X. The final section provides a conclusion, lessons for practice, theoretical contributions, limitations and an agenda for further research.

2 LITERATURE REVIEW

The literature review involved investigative research to analyze academic literature and practitioner resources, to logically synthesize studies around ITSM process assessments, performance measurements, financial measurements, CSFs and KPIs, and to identify relationships across these focus areas. The focus was on ITSM peer reviewed literature that covers the adoption, maturity levels, performance measurement and benefits. This research extends previous studies and addresses the gaps in current literature around the research question.

2.1 Resource-Based View

The resource-based view (RBV), that is deeply rooted in management strategy literature, proposes that companies compete due to "unique" resources that are valuable, rare, difficult to imitate, and non-substitutable by other resources (Barney, 1991). Furthermore, RBV posits that organizational resources are the source for improved company performance and on-going competitive advantage (Wade & Hulland, 2004).

From the resource-based perspective, a company is perceived as a bundle of resident, stationary and strategically relevant resources. Put another way, it is perceived as a bundle of assets or factors necessary for the company to execute its strategy (Mills, Platts, & Bourne, 2003). From this perspective, the basic building blocks of a competitive advantage are strategically relevant resources owned, controlled or occupied by the company. Consequently, a company's performance is determined by its ownership or control of the unique, strategically relevant resources needed to achieve its competitive advantage.

A company's capabilities depend on both the tacit and explicit knowledge that exists within the company. Operational capabilities are essential for a company's existence as they are required to produce products or deliver services and constitute a "must have" set of know-how (Grant, 2002). Dynamic capabilities are required for companies to expand and adapt to the ever-changing environment (Eisenhardt & Martin, 2000), and to enable companies to improve or extend their existing strategy, resource base and processes.

2.2 ITSM Process Capability Assessment

Process assessment is described in the literature as a series of steps targeted to compare an organization's everyday processes with reference processes that comprise typical activities for the process at different capability levels (Barafort et al., 2009). Process assessments are primarily conducted by organizations to benchmark results against an international standard (Juran & Godfrey, 1999). The international standard for process assessment ISO/IEC 15504 suggests that process assessments can be used for process improvement or to determine process capability (ISO/IEC, 2005). The primary goal of a process assessment is to provide guidance to improve processes (Shrestha, 2015). Practitioner resources suggest that organizations prefer an easy, cost effective and timely process assessment mechanism that unveils a realistic indication of process capability (Mainville, 2014). This is particularly true for smaller organizations that are undertaking their first experience with assessments (Juran & Godfrey, 1999).

The Software Mediated Process Assessment (SMPA) approach is supported by the international standard for process assessment and associated assessment models in order to conduct ITSM process capability assessments using a software tool. The SMPA approach uses online surveys for data collection and a decision support system for analysis and reporting. The detailed design of the SMPA approach is available in a previous publication (Shrestha, Cater-Steel, Tan, & Toleman, 2014). The SMPA approach allocates online assessment questions to the survey participants, via an online interface, based on their role within each process: process performers; process managers; and external process stakeholders. Questions were based on the process assessment model (PAM) from an exemplar process assessment model for ITSM (ISO/IEC 15504 part 8). The PAM for ITSM (ISO/IEC, 2012) consists of a set of base practices to achieve the process outcomes and a set of generic practices for process management (CL2), standardization (CL3), quantitative measurement (CL4) and innovation (CL5) of process capability (Shrestha et al., 2014).

Process attribute achievement ratings are calculated by the software tool using the measurement framework of the ISO/IEC 15504 standard. The process capability score is based on the average rating of all responses and uses the following process attribute achievement scale:

F	**Fully**	There is certainty that process activities are usually performed.	>85%-100%
L	**Largely**	Process activities are performed in the majority of cases.	>50%-85%
P	**Partially**	Process activities are performed but not frequently.	>15%-50%
N	**Not**	Process activities are not or rarely performed.	0%-15%

The process capability level can then be derived from the attribute ratings. From the literature review, it is evident that ITSM process assessments provide guidance to improve processes and that benchmarking process capabilities against an international standard in a transparent fashion is worthwhile.

2.3 ITSM Performance Measurement

An ITSM performance measurement framework can be valuable for organizations to measure and improve the performance of their IT services (Gacenga, Cater-Steel, & Toleman, 2010). There has been little research to date to explore the KPIs to measure ITSM performance regardless of global interest in measuring the benefits of ITSM (Gacenga, 2013). One of the challenges faced by organizations that adopt a service orientation is how to measure the performance of ITSM (Jäntti, Lahtela, & Kaukola, 2010). Organizations can use a performance measurement framework to realize the benefits gained from ITSM implementation to improve IT service.

ITSM frameworks, such as ITIL, are capable of having a positive impact on knowledge transfer in organizations and influence the IT organization's resources and competences, and eventually lead to improvement of a business's competitive advantage (Grant, 1996). The maturity of ITSM is directly related to the number of realized benefits (Gacenga et al., 2010; Marrone & Kolbe, 2010). The benefits listed by Gacenga et al. (2010) are mainly aligned to IT and not the general business. Previous empirical studies focused on process-specific benefits, and not financial returns (Gacenga et al., 2010). Previous studies included reports of savings in number of staff and infrastructure by implementing ITSM, but there is no study formally linking ITSM processes to cost factors. Investment in ITSM processes requires that the benefits are justified economically, but thus far, there has been little research on quantifying the benefits from ITSM implementation. Although it is generally accepted that customer satisfaction and operational performance improve with the use of the ITIL framework, many organizations have found it difficult to determine tangible benefits from ITIL adoption (Cater-Steel, Toleman, & Tan, 2006).

2.4 ITSM Financial Measurement

In a detailed review of the literature, Dehning and Richardson (2002) broadly classified financial measurement methods as accounting measurements or market measurements. Accounting measurements are metrics such as return on assets (ROA), return on investment (ROI), return on equity (ROE), and return on sales (ROS). Market measurements are metrics on stock market returns, such as Tobin's q (market value/asset value), and shareholder value (Dehning & Richardson, 2002). Dehning and Richardson (2002) focused on providing accounting researchers with a model to guide future research in the evaluation of returns of investments in IT.

In a case study research of three organizations that aimed to identify the effects of business process redesign (BPR) projects, organizational and process level measurements were examined by Kohli and Hoadley (2006). Organizational level measurements were identified as customer value, efficiency and profitability, while process oriented measurements comprised labor costs, cycle time, efficiency, administrative expenses, responsiveness, resource usage, reporting, throughput, and effectiveness (Kohli & Hoadley, 2006).

Total cost of ownership (TCO) and real option valuation (ROV) was proposed by Lei and Rawles (2003). Three primary categories of TCO costs were identified as acquisition cost, control costs and operation costs. Acquisition costs consist of the hardware and software costs. Control costs include centralization and standardization costs. Operation costs are made up of support, evaluation, installation, upgrade, training, downtime, audit, and documentation costs. Real option valuation considers the options to defer, expand, contract, abandon, switch use, or alter a capital investment (Lei & Rawles, 2003). Although Lei and Rawles focused on using TCO and ROV to address IT investment evaluation problems, they considered the acquisition, control and operation costs in the development of the measurement model.

Identifying the related cost and time in business processes associated with ITSM processes could assist in measuring the financial impact of ITSM processes and business performance. The measurement process should be run as a project to gather data within a period, or apply a simulation model to generate the necessary measurement data related to ITIL service management processes (Tiong, Cater-Steel, & Tan, 2009).

The literature on financial measurements in ITSM focused on accounting measures related to ITSM implementation. There is little academic research on the potential impact of ITSM processes on improving business performance and ultimately financial profitability (Gacenga et al., 2010).

2.5 Critical Success Factors and Key Performance Indicators

The critical success factor (CSF) method was originally established for an organization's alignment of IT design and strategic direction, to serve as a means for identifying the key elements of organizational success (Aitken, 2003). CSFs can be defined as "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department or organization" (Rockart, 1979, p. 85). CSFs are the few main areas where "things must go right" for the organization to succeed and for a manager's goals to be attained (Van Bon, 2008).

Multiple CSF dimensions have emerged in the literature over the years, with the two most common types being strategic and tactical CSFs (Amberg, Fischl, & Wiener, 2005). While strategic factors seek to identify *which* goals are to be achieved, the tactical factors describe possible alternatives in regard to *how* these goals can be met (De Sousa, 2004).

A key performance indicator (KPI) denotes a specific value or characteristic that is measured to evaluate whether an organization's goals are being accomplished. KPIs support the CSFs, and take into account the needs of stakeholders, and the organization’s expectations. An organization’s KPIs need to be specific, measurable, agreed upon, realistic, and time-based (SMART), in order for them to be effective. KPIs can use both financial and non-financial metrics (Kerr, 2000). KPIs are metrics that are used to indicate the performance level of an operation or process. KPIs are used to provide a foundation for actionable management decisions. While operational metrics are generally historical in nature, KPIs are really the “metrics that matter” (Steinberg, 2013).

Outcome risks are key indicators of general business risk areas (Steinberg, 2013). Categories of risk include: operational, financial, regulatory, reputation, security. Outcome risks are associated with performance indicators that identify the success, at risk or failure of KPIs or CSFs. Outcomes are used to quickly assess the level of risks created by process or operational deficiencies. In short, outcome risks are the kind of things that the IT department is trying to protect against.

2.6 Conceptual Model

Steinberg (2013) proposed a measurement model that uses several metrics categories that are integrated into an overall metrics framework. The model is designed around these categories interacting with each other to translate observations and operational events into performance indicators that can be used to make key IT and business management decisions. Operational metrics are calculated into KPIs. KPI results fall into tolerance thresholds, i.e. acceptable levels of performance. KPIs are mapped to the business’s existing CSFs. CSFs are then mapped to business outcomes in terms of risks to produce a dashboard of CSF risk levels.

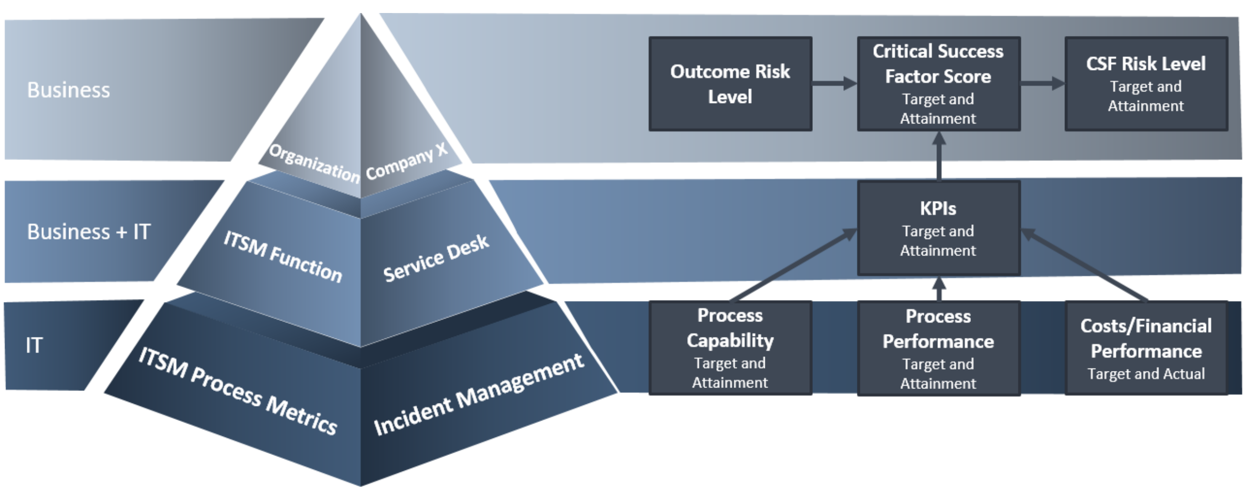

Figure 1. Conceptual measurement model linking process capability, performance and financial profitability to KPIs, CSFs, and outcome risks

Although Steinberg's model made a valuable contribution, one critical dimension is missing: financial measures. We extend Steinberg's work to propose a measurement model (Figure 1) to include financial measurements and incorporate outcome risks to chart the target and actual risk levels of CSFs. Figure 1 depicts a *top down* model of measurement and control. At the business level an organization is concerned with the association of outcome risks with CSFs to derive CSF scores to determine CSFs risks. Both the business and IT are involved with the ITSM function to derive KPIs that support the organization's CSFs. At the operational level, IT is engaged in the ITSM process metrics such as process capability, process performance and financial performance.

3 METHODOLOGY

The study is based on a pragmatic research philosophy using a case study approach to answer the research question. The research was based on a single case study of a global financial services company that uses the ITIL framework for IT Service Management. As the findings contain commercially sensitive information, the identity of the company cannot be revealed. In this paper it is referred to as Company X. A case study approach is appropriate to study a phenomenon in its natural setting, using a mixed method data collection strategy to collect information from one or a few entities (people, groups or organizations) (Benbasat, 1984; Yin, 2013).

Company X is a global financial services company with over 200 employees, headquartered in North America, with offices in various global locations. Company X has about 70 IT staff who attend to incidents, problems and changes on a daily basis. Company X has implemented three ITSM processes: Incident Management, Problem Management and Change Management. The Incident management process was selected as the example to apply the measurement model. Twenty six employees who are actively involved in incident management at Company X were purposively selected for the study. The participants were drawn from three business units: Support Tier 1, Support Tier 2 and Operations. The research involved the measurement of three components: process capability, process performance and financial performance.

For this study, data were collected from multiple primary and secondary sources (Myers, 2008) for the six month period 1 May 2015 to 31 October 2015. Qualitative methods were applied in the form of interviews, focus groups and observation (Oates, 2006). In addition, quantitative methods used data from online surveys and the case company's internal systems to measure process performance and calculate costs. The following method was devised to operationalise the model:
1) Identify operational metrics for the process and capture the raw data from various data sources;
2) Develop KPIs based on operational metrics;
3) Determine where the KPI result falls within predetermined tolerance thresholds;
4) Associate KPIs with CSFs;
5) Determine operational risks from the CSFs;
6) Create a dashboard to present the CSF risk profile.

The **process capability measurement** was facilitated by the use of the SMPA Web based survey tool. Although ISO/IEC 15504 provides for capability levels from zero (incomplete) to five (optimizing), only questions relating to level 1 (performed), level 2 (managed) and level 3 (established) of the SMPA tool were used, as it was anticipated from observation that the case organization was not performing higher than level 3.

The questionnaire data collection used the SMPA approach to enable the researcher and case study organization to assess ITSM process capability. The SMPA tool is hosted by an industry partner Assessment Portal Pty Ltd that specializes in online assessment services.

The **process performance measurement** used an adapted version of the ITSM Metrics Model proposed by Steinberg (2013). ITSM tools collect data that can be used to report on process performance. There are many commercially available service management tools such as Jira Service Desk™ (Atlassian, 2016), Zendesk® (Zendesk, 2014), ServiceNow™ (ServiceNow, 2016) and Oracle Service Cloud (Oracle, 2016). The tools available allow an organization to customize the process workflow as needed. These cloud-based systems are targeted at the Service Desk and customer service and are offered using a subscription-based pricing model.

Company X uses Zendesk, a cloud-based customer service platform for both internal IT service desk requirements as well as external customer service. Zendesk was developed to incorporate many ITIL best practices. The software is used by Company X to manage ITSM processes and report on metrics. The software provides an analytic plugin module, GoodData® (2015) that reports on operational metrics such as the number of incidents reported, the number of incidents resolved, and the number of incidents unresolved over a period of time. Zendesk was the source for operational data for the study.

The **financial performance measurement** followed a pragmatic approach of directly linking costs with the adapted ITSM Metrics Model. Costs associated with ITSM Management activities and costs due to outages and major incidents were measured. Incident Management costs were calculated based on the actual time spent by staff on the ITSM process (using process-oriented financial measures) and taking into account acquisition costs such as hardware and software in the total burdened labor rate. The on-cost items and average salary per business unit were obtained from an internal HR system at Company X. The amount of leave hours per year per business unit employee was retrieved from timeOut™, a cloud-based leave management and vacation tracking system. The researcher was granted access to these systems for the data collection. The cost of outages and major incidents considered fines and penalties, credit to customers, and opportunity costs (based on the literature review of operations costs of TCO measures). Opportunity costs were calculated using customer historical data on average hourly trading volume for the period of the outage or major incident, while information on credit to customers, fines and penalties was retrieved from an internal billing and reporting system accessible to the researcher.

A set of five **Critical Success Factors** were established in 2015 by the executive staff of Company X and presented to staff in 2015 at a company-wide meeting. The researcher met with the process managers to derive a set of measureable KPIs to support these CSFs.

A list of **Outcome Risks** was derived from industry white papers and a brainstorming session with process managers and an executive manager at Company X. The impact of each outcome risk can be represented as High, Moderate or Low reflecting the probability that the risk will occur. The outcome risk level is calculated as the maximum CSF score when the risk is associated with the CSF. In this model the CSF risk level is low if the maximum CSF score for the outcome risk is 1, moderate if 2 and high if 3.

Scoring for an Outcome Risk level runs opposite to how the attainment level of a CSF is derived. If a CSF attainment scores Low, meaning the likelihood of achieving that CSF is low, then the Outcome Risk would score High. This is because the risk of the Outcome occurring is high when the CSF attainment is low.

4 DATA ANALYSIS AND FINDINGS

4.1 Process Capability Assessment

The SMPA online assessment was conducted in November 2015**.** An assessment report was generated by the software. This report presented the process attribute achievement ratings and provided process improvement recommendations when any area of process demonstrates risk (a score of *partial achievement* or lower). The summary of the assessment results for the Incident Management process is shown in Table 1.

Table 1. Incident Management Process Assessment Results

	Level 1 Performed	**Level 2 Managed**		**Level 3 Established**	
Process Attribute	Process Performance	Performance Management	Work Product Management	Process Definition	Process Deployment
Rating Score	L	L	L	L	L
Score Reliability	High	High	High	High	High
Number of Responses	26	26	26	26	26

The Incident Management process was rated at capability level 1, indicating that the incident management process activities are performed. The process achieves its purpose but in a non-repeatable way and with few controls. During each instance, the process is not implemented in a managed fashion (planned, monitored, and adjusted). The process inputs and outputs are not appropriately established, controlled, and maintained. Moreover, the way the process is managed is not uniform throughout the organization.

A focus group discussion was then held at Company X in January 2016, with a cross section of survey participants to evaluate the SMPA tool and discuss the assessment report.

4.2 Process Performance Measurement

Operational metrics

Operational metrics are the basic observations of operation events for the Incident Management process that serve as a starting point for the model and will be used to calculate the KPIs for the Incident Management process. Operational metrics are derived from Zendesk and labor reports. The operational metrics selected for the case organization, with their source and actual data for the period assessed are shown in Table 2.

Table 2. Operational Metrics & Data

Operational Metric	Data Source	Count	Time Hours
Total number of incidents	Zendesk	9,216	
Average time to resolve Severity 1 and Severity 2 incidents	Zendesk		19.5
Number of incidents resolved within agreed service levels	Zendesk	9,216	
Number of high severity/major incidents	Zendesk	3,397	
Number of incidents with customer impact	Zendesk	4,363	
Number of incidents reopened	Zendesk	1,543	
Average incident response time	Zendesk		3.8
Incidents completed without escalation	Zendesk	7,009	
Total available time to work on incidents	Zendesk		22,080
Total time spent resolving incidents	Labor reports		8,000

4.3 Measuring Costs

Cost of Outages/Major Incidents

An outage or major incident at Company X is categorized into five classes: system down, risk position, no price updates, pending trades and software upgrade/installation issues. The financial measures for outages and major incidents at Company X were calculated as the sum of the average loss in trading volume for the outage period, payments/credit offered to customers.

Company X's revenue model is based on earning a dollar amount per one million dollars traded per customer. The dollar amount earned varies by customer and trading volume ranges. For the six month period 1 May 2015 to 31 October 2015, there were three major incidents and one outage at the case organization. As shown in Table 3 the cost of outages and major incidents at Company X during this period totalled $17,370.

Table 3. Cost of outages and major incidents at Company X

Category	Events	Financial Measure	Cost
Major Incident	28/06/2015 21:05 Support received 200+ Risk Position alerts. 21:37 Customer A's connection was restored and trading resumed.	Average loss in trading volume	32 minutes $40,000,000 @ $5/million = $200
		Credit offered to customers	Risk Position = $30,000 Credit Offered @50% = $15,000
Major Incident	26/07/2015 21:22 Email from Customer B regarding connectivity issues over their FIX sessions. 22:05 Application server restarted and Customer B was able to connect.	Average loss in trading volume	43 Minutes $60,000,000 @ $7/million = $420
Outage	10/08/2015 06:15 Notification of a connectivity issue from a customer. 07:25 Issued identified as related to the packet drop on one of Company X's ISPs.	Average loss in trading volume	1 hour 37 minutes $300,000,000 @ an average of $5/million = $1,500

	07:52 Operations disabled all routing via the affected ISP and switched to alternate ISP.		
Major Incident	29/10/2015 14:39 Customer C users were unable to login to Portal, and LP prices were refreshing sporadically on the trading UI. 14:50 Operations observed high load on one of Customer C's servers. 15: 00 Service restored and prices resumed on the trading UI.	Average loss in trading volume	21 Minutes $50,000,000 @ $5/million = $250
Total cost of outages and major incidents			$17,370

Incident Management Costs

There are two components required to measure the cost of incidents: employee fully-burdened hourly cost and the number of hours consumed in working to resolve incidents. The labor assumptions for Company X are outlined in Table 4.

Table 4. Labor Metric Assumptions for Company X

Labor Assumption		
Available hours to work per year	40 hours x 52 weeks	2,080
Total leave hours per year	15 days of vacation, 10 holidays and 5 days of sick leave (30 days per year x 8 hours)	240

Company X's annual costs in addition to an employee's hourly wage include payroll taxes, insurance, medical benefits, onsite lunch, equipment, software, supplies and training costs. Table 5 shows the calculations for Company X's on-cost to calculate the fully-burdened annual cost per employee.

Table 5. Company X's fully-burdened costs per employee

Cost Item	Tier 1	Tier 2	Operations
Average annual salary	$82,291	$100,625	$76,173
Add: On-cost items:			
Payroll taxes (8%)	$6,583	$8,050	$6,094
Insurance (5%)	$4,115	$5,031	$3,809
Medical benefits (1%)	$823	$1,006	$762
Onsite lunch	$2,000	$2,000	$2,000
Equipment	$579	$550	$1,186
Software licenses	$1,200	$1,212	$1,750
Supplies	$100	$100	$150
Training costs	$0	$800	$1,500
Total on-costs	$15,400	$18,750	$17,250
Total fully-burdened cost	$97,691	$119,375	$93,423

As shown in Table 6, the number of staff in each business unit, and the proportion of time spent resolving incidents is applied to calculate the total number of hours spent per business unit on incidents. The total number of hours is multiplied by the hourly rate to calculate the cost per business unit according the following formulae:

Total hours spent on all incidents (x) =
[(Avail. hours – Leave) Assessment Period * % time spent on incidents] * Total no. of staff*
Cost per Hour (y) = Total Cost / Avail. Hours
*Total Cost = x * y*

Table 6. Incident Management Costs per Business Unit at Company X

Business Unit	Time[a]	# Staff	Hours on Incidents	Cost/Hour	Total Cost
Support Tier 1	80%	7	5,152	$46.97	$241,973
Support Tier 2	30%	4	1,104	$57.39	$63,361
Operations	25%	13	2,990	$44.91	$134,296
				Total cost of Incidents	$439,630

a) Proportion of Time Spent on Incidents

Key Performance Indicators

KPIs are derived from one or more Operational Metrics. The most applicable KPIs that meet the organizational goals of Company X were selected from the ITIL guidelines. Table 7 shows the list of KPIs for Incident Management as agreed by IT and the business at Company X.

Table 7. Key Performance Indicators

KPI	KPI Meaning
Incident Management Process Capability	How good are we at our Incident Management practices?
Process performance metrics	
Number of incident occurrences	How many incidents did we experience within our infrastructure?
Number of high severity/major Incidents	How many major incidents did we experience?
Incident resolution rate	How successful are we at resolving incidents per business requirements?
Customer incident impact rate	How well are we at keeping incidents from impacting customers?
Incident reopen rate	How successful are we at permanently resolving incidents?
Average time to resolve severity 1 and 2 incidents (hours)	How quickly are we resolving incidents?
Average incident response time	How quickly are we responding to incidents?
Percentage of incidents completed without escalation	How successful are we at one-touch tickets?
Incident labor utilization rate	What proportion of available labor capacity was spent handling incidents?
Financial Measures	
Incident Management Cost	What does it cost us to manage the process?
Cost of Outages	What do outages and major incidents cost us?

Tolerance Thresholds and KPI Scoring

Tolerance thresholds represent upper and lower boundaries for acceptable KPI values. They should be set by the IT Service Manager and agreed to by IT and Business Senior Management. These are critical, as they form the basis for when management needs to take action or make a key decision.

Each KPI should be associated with target and warning tolerance values. The target value may be more or less than the warning value depending on the KPI being measured. For example, it is desirable to target a lower value for the number of incident occurrences with a warning value above target, and target a higher percentage for the incident resolution rate with a lower warning percentage. KPI results can be color coded Green, Yellow or Red depending on how they fall within the specified target and warning thresholds.

KPI Scoring

For each KPI target, the result is compared to the target and warning threshold to deduce a KPI score. If the KPI result is meeting the target, score=1; if KPI results are within the warning level and target, score=2; and if KPI results are outside the warning level, score=3. The KPI items, established threshold targets, the desirable result (polarity), the calculations of the KPI results, and the actual results for the case organization are shown in Table 8.

Table 8. KPI Threshold Targets, Results and Scores

KPI Item	Target Level	Warning Level	Calculation	+/-[a]	KPI Result	KPI Score
Incident management process capability	2	1	Outcome of process assessment as described in §4.1	+	1	2
Process performance metrics						
Number of incident occurrences	8,000	10,000	Total number of incidents	-	9,216	2
Number of high severity/major incidents	2,500	3,000	Number of high severity/major incidents	-	3,397	3
Incident resolution rate	90%	80%	Number of incidents resolved within agreed timeframe/ Total number of incidents	+	100.0%	1
Customer incident impact rate	30%	50%	Number of incidents with customer impact/ Total number of incidents	-	47.3%	2
Incident reopen rate	10%	20%	Number of incidents reopened/ Total number of incidents	-	16.7%	2
Average time to resolve severity 1 and 2 incidents (hours)	15	20	Average time to resolve severity 1 and 2 incidents	-	19.5	2
Average incident response time (hours)	4	6	Average incident response time	-	3.8	1

Percentage of incidents completed without escalation	90%	70%	Incidents completed without escalation / Total number of incidents	+	76.1%	2
Incident labor utilization rate	50%	75%	Total labor hours spent resolving incidents/ Total available labor hours to work on incidents	-	36.2%	1
Financial Measures						
Incident management cost	$400,000	$500,000	Calculation shown in Table 6	-	$439,630	2
Cost of outages	$15,000	$20,000	Calculation shown in Table 3	-	$17,370	2
Note: a) Polarity: - indicates a lower value is desirable; + indicates a higher value is desirable						

Linking KPIs to Critical Success Factors

Company X had established two strategic CSFs: *Improve IT and Business Productivity*; and *Maintain IT Service Quality*; and two tactical CSFs: *Quickly Resolve Incidents* and *Effectively Resolve Incidents*. Recently, a fifth CSF of *Cost Savings* was included as an outcome of a process improvement initiative at the organization. CSFs scores are calculated from one or more KPIs by comparing how those KPIs performed within the tolerance range.

A CSF is usually indicated with a performance level that indicates the extent to which the CSF was achieved. Typically, this performance level can be rated on a simple scale such as High, Medium or Low. A recommended approach to derive a CSF score is to first identify the KPIs that relate to it and then rate the CSF based on the highest value observed in any one of those KPIs (Steinberg, 2013), to model the worst case scenario. Table 9 shows the KPIs associated with each CSF.

Table 9. Mapping of KPIs to CSFs

Critical Success Factor	Key Performance Indicator
Quickly resolve incidents	Incident resolution rate Incident reopen rate Average time to resolve severity 1 and 2 incidents Average incident response time
Maintain IT service quality	Number of incident occurrences Number of high severity/major incidents Customer incident impact rate
Improve IT and business productivity	Incident labor utilization rate Average incident response time Incident management process capability
Effectively resolve incidents	Customer incident impact rate Incident management process capability Percentage of Incidents completed without escalation
Cost savings	Incident management cost Cost of outages

Table 10 shows the CSF attainment level and scores derived from the highest value of the associated KPI scores (as shown in Table 8).

Table 10. CSF Attainment and CSF Scores

Critical Success Factor	CSF Attainment	CSF Score
Quickly resolve incidents	Medium	2
Maintain IT service quality	Low	3
Improve IT and business productivity	Medium	2
Effectively resolve incidents	Medium	2
Cost Savings	Medium	2

Outcome Risks

After determining the CSF attainment levels, the researcher worked with process managers at Company X to compile a list of outcome risks and then associate these risks with one or more CSFs. To derive the risk levels of the CSFs, all non-zero values were replaced with the highest CSF score for that outcome risk, and then the average of the non-zero values for each CSF were calculated, as shown in the last row of Table 11. Table 11 provides a list of Company X's outcome risks, derived risk levels and the associated CSF scores.

Table 11. Mapping of Outcome Risks to CSF Scores

Outcome Risk Item	Quickly resolve incidents	Maintain IT service quality	Improve IT and business productivity	Effectively resolve incidents	Cost savings	Risk level
Service outages	0	3	0	3	3	High
Rework	0	0	2	2	2	Moderate
Waste	2	0	2	2	2	Moderate
Delayed solutions	0	0	2	2	0	Moderate
Slow operational processes	0	0	2	2	0	Moderate
Security breaches	0	0	0	2	2	Moderate
Slow turnaround times	2	0	0	2	0	Moderate
Unexpected costs	3	3	3	3	3	High
Higher or escalating costs	3	3	3	3	3	High
Slow response to business needs and changes	0	0	2	2	2	Moderate
Inability to scale	2	0	2	0	0	Moderate
Fines and penalties	0	0	0	0	2	Moderate
High levels of non-value labor	2	0	2	2	2	Moderate
Loss of market share	0	3	3	3	3	High

Loss of revenue/sales	0	3	0	0	3	High
Average CSF Score	2.3	3.0	2.3	2.3	2.5	

As an example, the *service outages* outcome risk is mapped to three CSFs: *maintain IT service quality*, *effectively resolve incidents* and *cost savings*. From Table 10, the attainment of the CSF *maintain IT service quality* is low, scoring 3, while the attainment of the CSFs *effectively resolve incidents* and *cost savings* is medium, scoring 2. To model the worst case scenario, all CSF scores for *service outages* are transformed to score 3 – the highest CSF score for *service outages* outcome risk as shown Table 11.

Critical Success Factor Scorecard

The researcher met with the process managers at Company X and the decision was made to set the target risk threshold level at 1.7 for all CSFs. For each CSF, the average CSF score from Table 11 is compared to the threshold to deduce a CSF Risk Level. If the average CSF Risk Level Score from Table 11 is less than the target of 1.7, the risk level is low, if less than 2.5 moderate, otherwise high. Table 12 shows the CSF Risk Level and scores derived from the average CSF score.

Table 12. CSF Risk Levels

Critical Success Factor	**Average CSF Risk Level Score**	**Risk Level**
Quickly Resolve Incidents	2.3	Moderate
Maintain IT Service Quality	3.0	High
Improve IT And Business Productivity	2.3	Moderate
Effectively Resolve Incidents	2.5	Moderate
Cost Savings	2.3	Moderate

Risk Profile Dashboard

The average CSF risk levels in Table 12 can be represented graphically to show their deviation from their targets as shown in Figure 2 for Incident Management. As a result of this outcome, Incident management process improvement plans have been developed and are currently being executed at Company X. Company X plans to evaluate the actions taken over the next six months and to then run this measurement model again to re-evaluate the CSF risks.

Figure 2. CSF Risk Level Scorecard for Incident Management

5 CONCLUSION

This paper presents research that aimed to answer the research question *how can a model and method be developed to link ITSM process capability and process performance with financial performance?* It presents the development and application of a measurement model and practical cost effective method to link ITSM process capability and financial performance by operationalizing KPIs to support CSFs and then associating the appropriate CSFs with business risks to determine CSF risk levels. It aims to assist organizations that lack mature ITSM processes and have not implemented a measurement framework to link operational and strategic outcomes.

5.1 Contribution to Practice

The study contributes to ITSM practice by providing a measurement model and method to identify opportunities to reduce costs and increase efficiency in ITSM processes that can ultimately lead to increased competitiveness. The research aims to meet the challenges and opportunities that arise in businesses. The challenges are to increase revenue or decrease cost through the design of effective business processes.

The results suggest that it is possible to use the method as a starting point for self-improvement for businesses, identifying gaps in processes, benchmarking within an organization as well as guiding an organization's improvement efforts.

Some of the key features of this measurement model include:

- support for continual improvement
- offers a process- and service-based IT service management approach
- presents a scalable and flexible fit-for-purpose model
- aggregates metrics to formulate key performance indicators
- derives a method for filtering improvement initiatives and tracking performance status
- provides the ability to report on CSF risk levels to develop performance improvements.

A practical measurement model was developed to link ITSM process capability and process performance to financial performance. The model can be used to conduct *What-If* analyses to model the impacts of future business decisions on KPIs and CSFs. This can be achieved by increasing or decreasing the values of the Operational indicators that may be related. The model may also be used for analytics, for example, drilling down to more specific operational metrics. The measurement model presented in this study can be quickly implemented, adapted and evolved to meet the organization's needs.

The practical contribution of the research is that it offers an example from which other organizations can learn to measure their financial return on investment in ITSM improvement. It seeks to provide an understanding of how to derive KPIs from operational metrics, link KPIs that operationalize CSFs to applicable CSFs to achieve organizational goals and associate business/outcome risks to these CSFs to ultimately determine the risks of these CSFs or business objectives. It aims to provide an understanding of the potential degree of financial benefits realizable due to process improvements. The application of the model uncovers the link between IT capability and performance and financial measures.

5.2 Contribution to Theory

The research provides a structure and synthesis to the academic literature in the field of ITSM. We present a comprehensive and empirically validated conceptualization of the factors pertaining to the association of process capability, performance and financial benefits. Although this paper presents a measurement model based on the incident management process, the model and method can be generalized for any ITSM process. This study draws on the resource-based view of the organization to demonstrate the attributes of a firm's IT capability and its relationship to organizational performance. This study contributes to the growing body of literature linking IT and the resource-based view and provides a framework for understanding how IT may be aptly viewed as an organizational capability.The research contributes to extend the theoretical grounding in the area of ITSM frameworks, and offers a sound basis for further research.

5.3 Limitations and Agenda for Further Research

This study used the SMPA tool for the process capability assessment, primarily for its transparency and convenience. A path for future research when using the SMPA approach is to further analyze the reliability of the assessment results before determining the capability rating of a process. The process attribute scores and corresponding maturity level should be considered in light of the reliability measures. This study did not analyze the assessment reliability scores in detail, but merely used the results at face value. Results from other process assessment methods can be easily incorporated into the measurement model by following the method outlined in section 3.

This paper is based on a single case study for one ITSM process. However, using the framework developed in this research, the approach can be easily extended to other organizations and all ITSM processes. It can also be extended to work beyond ITSM. Further research can be undertaken with different industry sectors, using different tools for data collection and methods to calculate financial measures.

As unveiled by the literature review, further research can be conducted using standard accounting measures and/or market measures to fit the model developed in this paper. As a result of these efforts, improvements in the performance of IT groups should contribute to overall business performance and profitability.

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