

# Value Cost Impact Analysis

## Estimating the IT Cost Impact of Business Developments

Susanne Magdalene-Glissmann  
IBM Almaden Research Center  
IBM  
San Jose, CA, USA  
smglissm@us.ibm.com

Heiko Ludwig  
IBM Almaden Research Center  
IBM  
San Jose, CA, USA  
hludwig@us.ibm.com

*Abstract—Predicting the cost of IT infrastructure for a dynamically developing organization is difficult due to the complexity of understanding which IT infrastructure costs are driven by what kind of organizational developments. This is relevant in particular for organizations that spend a high proportion of their revenue on IT as well as for outsourcers who commit to providing IT infrastructure in innovative business models such as billing a percentage of a client’s revenue. However, the creation of a detailed model of business developments driving IT costs for a particular organization is cost prohibitive in most cases due to extensive data gathering efforts. This paper proposes an approach based on the customization of default cost models assigning IT infrastructure cost categories to major business functions dependent on specific business metrics. This approach enables a cost effective way of estimating IT delivery costs dependent on a business’s development.*

*Keywords—IT cost management; IT spending; IT operation costs; business modeling; IT service management; ITIL*

### I. INTRODUCTION

#### A. Motivation

Managing the cost of IT infrastructure services is an important issue, in particular for organizations whose IT costs represent a comparatively high percentage of their overall costs, e.g., in the finance, telecommunication or media industry sectors, or for IT infrastructure service outsourcers whose primary business is providing IT infrastructure services for others. Many measures have been taken to reduce IT operating costs such as the adoption of best practices including ITIL [15] and CoBit [10], the adoption of lower-cost, standardized Intel-based servers in the data center, and data center automation.

In the past, planning for a new application or additional demand typically involved building a new environment for this application with dedicated servers and storage, sized to also consider future demand. This has led to low utilization rates of data center capacity in the past [1]. Migrating applications into virtualized environments inhouse or by a public provider improves hardware utilization, enables further automation, and has the potential to align capacity with demand more elastically if a Cloud provider is used. While much of the technical capacity planning issues are addressed in a virtualized or Cloud environment the impact of business developments on IT costs

still remain, independently of the efficiency and elasticity of IT service management. We use the term business development as a reference to the future development of key business metrics such as revenue or number of employees.

Predicting the IT cost development of an organization depends on changes in IT infrastructure consumption based on business decisions or exogenous events. We need to relate relevant business metrics such as revenue, number of customers and the like to the consumption of IT infrastructure services such as server capacity, storage, end user devices and the corresponding management and support. Oftentimes, we find empirical data of average IT cost as a percentage of revenue in a particular industry or the cost of a benchmark company in this industry. This is often too coarse, not accounting for changes in the services the market demands.

Let’s use the simplified example of a mobile phone service provider: The provider offers mobile voice and data services as separate packages, charging separately. However, the competitive situation causes the provider to bundle unlimited multi-media messaging in its market at the base price given a rising trend of smart phone adoption. As a result customer habits change and customers send many more multimedia messages containing images and videos, causing storage demand and its associated cost to rise significantly while impacting revenue only marginally. Our example company needs a method of estimating its additional IT service demand beyond simple rules of thumb such as percentages of revenue. Alternatively, our provider could estimate in detail for different business development scenarios how many additional managed storage devices it would need, how many additional servers this might take and the corresponding data center fabric, raised floor space and labor depending on the current situation. This, however, is typically too much effort, in particular if a number of different scenarios need to be considered.

This is an even bigger problem for IT service providers offering metric-based pricing alternatives to traditional service consumption-based pricing methods, as they have become increasingly relevant in the IT outsourcing marketplace. In business metric based pricing schemes an IT outsourcer charges a customer according to metrics relevant for a customer’s business such as revenue or subscriber numbers in our mobile phone example. It is important for an IT outsourcer

to understand the relationship between contracted business metrics and IT infrastructure service consumption because it does not make the business decisions driving changes in IT costs such as the increase in multi-media messages in our example. In today's practice models to relate business metrics to IT service costs are often created specifically for each IT service contract in collaboration between the customer and the service provider, considering a limited set of scenarios for future business development due to the high cost of model creation. This creates significant risk to profit for IT outsourcers and limits this approach to very large deals due to the high cost of model creation.

### *B. Objectives and structure of this paper*

This paper proposes an approach to model the relationship between a company's business metrics and IT service costs in an effective way. It uses default models based on empirical data that relate business capabilities and associated metrics to IT service elements based on proportional allocation typical for a specific industry. For a given company, this model can be adjusted based on differences in scale and company specifics in its given market. Such a model can then be the basis of a cost sensitivity analysis, iterating through various business development scenarios identifying those business metrics having potentially large cost impact. The approach will be illustrated in the context of a use case.

The remainder of the paper is structured as follows: The next section presents the background of this work and related work in the field. Section III describes the model elements and section IV the modeling approach. Subsequently, we discuss the approaches limitations, ongoing and future work .

## II. MEASURING COST IMPACT

Associating business metrics with IT cost drivers requires understanding how a business consumes IT services. The notion of business architecture is used to describe the structure of a business and provides a good foundation to assess how changes to high-level metrics such as revenue or number of customers impact the number of processes executed and inputs consumed. Understanding the business architecture of an organization we can then tie it to the IT services used to implement the architecture and operate the business in practice. Costs are typically accounted for in the context of IT services. Since not all parts of a business consume IT services equally or linearly, we need to understand how IT consumption is measured, the last element to tie business metric development to IT cost drivers. In this section we discuss these three topics and some related work.

### *A. Business Architecture*

The elements and approach proposed for the value cost impact analysis in this paper is based on the concept of Business Architecture (BA). Several Business Architecture propositions and different fragments of BA exist from academia and industry. Examples include TOGAF's Business Architecture [16], Business Architecture Working Group propositions [18], the Business Layer in ArchiMate [16], and

the Business Motivation Model [1]. These business architectures differ in their objectives, the type and number of elements, as well as their granularity level [8]. As the development of these models can be time-consuming industry default models have been developed that can be customized to a specific company situation and thus reducing the development effort of a model. Common industry default models are, for instance, the enhanced Telecom Operations Map (eTom) Business Process Framework [11] or the IBM Insurance Application Architecture [9].

The BA foundation used in this paper leverages the notion of modularization or componentization of business operations, also referred to as business components or business capabilities. These BA elements are modular building blocks that collectively make up the operational structure of the specialized enterprise. A business capability conducts a set of activities supported by resources such as people, processes, applications, etc. Decision makers use component based analysis of their business operations, particularly to identify areas of the business that require attention given certain performance measurements or other targets. Heatmaps for identifying the most relevant components for the business are in particular used in strategic decision making.

Further elements that are common in business architecture are IT related elements, such as IT assets, IT resources, IT solutions, applications or IT services [17], [16]. These elements are associated with typical elements of the business (e.g., business processes or business capabilities) to illustrate how the IT supports the business.

### *B. IT Services*

A significant part of IT costs are the labor costs of IT operation services. Thus, in order to predict how the overall IT costs will develop over time, a good understanding of the impact business changes have on IT operation services is required. While IT service providers often have their own IT services specified, commonly used best practice processes of IT service management is provided by The Information Technology Infrastructure Library (ITIL) [15]. The ITIL framework was initially developed by the Office of Government Commerce (OGC) of the UK government to provide guidance to UK government departments.

ITIL practices provide recommendation for IT service management in the areas of service strategy, service design, service transition, service operation and continual service improvement. IT services described in ITIL IT service operation are the services that are addressed in the proposed approach for Value Cost Impact Analysis. Typical IT operation services include but are not limited to the following: Event management to monitor all events that occur through the IT infrastructure; Incident management to restore unexpectedly degraded or disrupted services to users; Problem management to determine and resolve the underlying causes of events and incidents, and access management to grant authorized users the rights to use a service. Additionally, backend IT functions are defined by ITIL, including server and mainframe management and support, network management, storage and archive, database administration, as well as internet management.

However, most IT service providers and in-house IT departments are not structured along ITIL or Cobit [10] best practice processes areas but along the lines of technology services (storage, servers, networking) or customer user groups (end user services, help desk). This might be complemented with strategic functions such as planning and development. In most cases, IT cost is accounted for along these organizational lines.

### C. IT Metrics

Since this paper deals with relating business metrics to IT infrastructure service costs we need to understand to measure what determines the cost. This is primarily the utilization of IT infrastructure services, as opposed to quality-of-service (QoS) metrics. A more differentiated cost discussion may consider choosing between violating an SLA or provisioning additional resources (e.g., [3], [4]) but for the purposes of this paper we will focus on IT infrastructure service consumption.

Consumption metrics for IT infrastructure services typically relate to:

- the consumption of IT infrastructure itself such as servers, storage and network bandwidth;
- the use of licenses;
- the consumption of services related to user requests such as incident and problem management as well as service request management;
- the consumption of services directly related to users such as identity and access management.

*Infrastructure consumption metrics* can often be collected and processed automatically from system instrumentation, in particular from automated environments such as cloud platforms and storage management systems. This data is routinely used for accounting and billing within organizations but also for external customers. While metrics instrumentation, definition and access has been standardized by industry organizations such as the Distributed Management Task Force (DMTF) [6] actual metric definitions are often idiosyncratic to a specific technology vendor or IT infrastructure service provider but are typically generally understood. Examples are given in TABLE I. from an example service contract.

Environmental costs such as raised floor area, power consumption and routine service operation can often be aligned with infrastructure consumption itself.

*Software license use* can often be detected automatically and some standards are proposed to facilitate discovery and usage metering [7]. While it is possible to meter license usage in the context of the compute unit that uses the license, such as images, this is often not convenient. Beyond the operating systems there is typically too much variety of software configurations on a system to count each configuration type separately.

*Service management consumption* metrics relate to service processes such as those discussed in the previous section. We can measure them instrumenting a service management system, a practice widely used. We often find types of “tickets” as the

units to be counted. The number of tickets expected often aligns with the number of users rather than the number of systems.

TABLE I. EXAMPLE CONSUMPTION METRICS.

Service	Unit
Servers	Rack Units
Intel Server Image	Intel Images
Unix Server Image	Unix Images
Networking	TB/Day
Application Operations	Application Images
Batch Operations	Batch Kjobs/Mon
Database_DB2	DB2 DBs
Database Oracle	Oracle DBs
Middleware	MQ Series Instances
Server Planning	Images Types Planned
Help Desk	Busines Hour Calls/Day
Media Management	Tape GB
Managed Storage	DASD GB
...	...

Metrics related to *identity and access* are mostly directly related to the number of IDs required and the effort to maintain them, e.g. password resets.

In our problem area of aligning business metrics with IT cost drivers, the relevant set of metrics for a specific case is determined by their alignment with IT infrastructure service costs specific to the service providing IT organization in question.

## III. MODELING ELEMENTS FOR VALUE COST IMPACT ANALYSIS

In the following, the key elements to create industry default and company specific models for a value cost impact analysis are explained. Figure 1 provides an overview of the elements as well as the relationships between them. The model describes the business and IT environment of a company with the goal to predict efficiently and accurately the impact business changes have on the long term IT service delivery costs and profit risks. The elements contain architectural components, measurement components, as well as qualitative and quantitative connectors.

### A. Architectural components

To keep the model manageable, the architectural components contain a small subset of BA elements.

The business capability represents thereby a proficiency that is in a company’s long term interest and that predictably produces observable outcomes [14]. Industry capabilities maps, which are available for various industries, can be used to select the key capabilities of relevancy for a specific client. The enhanced Telecom Operations Map (eTom) Business Process Framework, for instance, offers industry maps in different levels of granularity [11]. The processes defined in the higher level eTOM maps can be used as business capabilities. The IBM Insurance Application Architecture [9] or other component or capability maps provided by IT consulting companies, such as IBM [5] or Capgemini [12] are further examples.



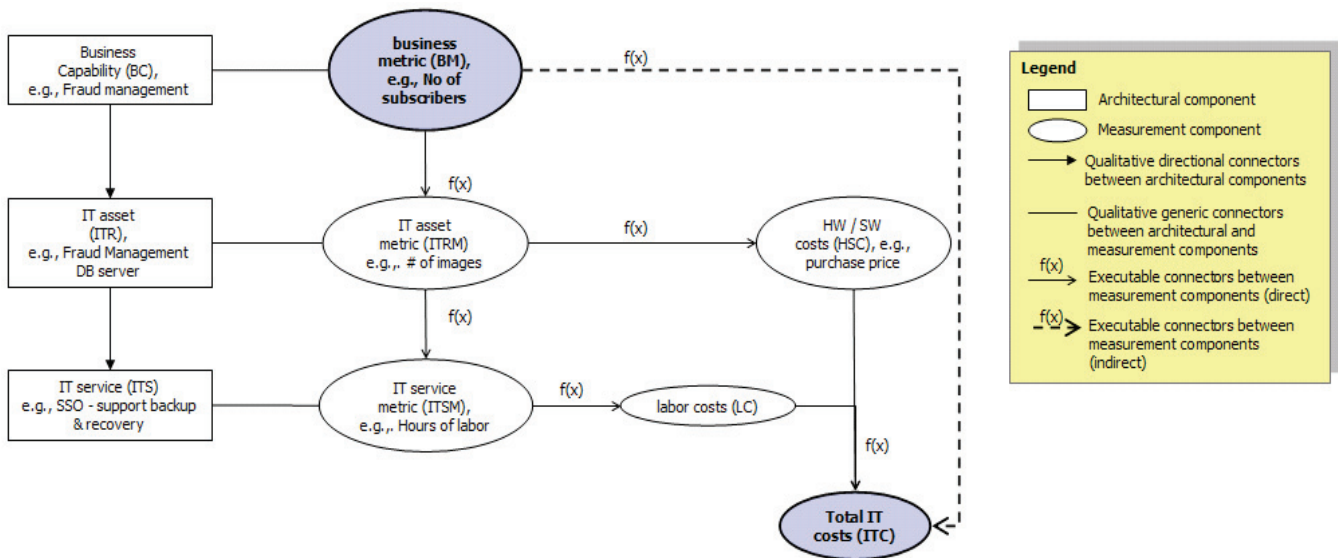


FIGURE 1. VALUE COST IMPACT ANALYSIS MODELLING ELEMENTS

The second architectural component is the IT asset. The IT asset can be of type hardware or software. A key software that needs to be modeled are the business applications used by the business capabilities. Other relevant software might be supporting SW, such as operating system or storage management SW. Key hardware assets are in particular different types of servers, such as the application server, web server, database server, or the test server. To minimize the modeling effort, instead of specific instances, only the IT asset types are defined with information on how many instances are required for the specific business capability and the specific characteristics of the company.

The third architectural component is the IT service. IT services are rather labor intensive and thus usually represent a large part of the long term IT costs. Typical examples for IT services are provided by ITIL [15], including services, such as event management, incident management, problem management or access management.

### B. Measurement components

This group of components represent components that measure the corresponding architectural components. Measurement components comprise components of the following type: business metric (e.g., revenue, number of subscribers), IT asset metric (e.g., number of images, number of CPUs), IT service metric (e.g., hours of labor), HW / SW cost metric, labor cost metric and total IT costs.

### C. Relationships between the modeling components

The modeling components introduced before are associated with each other using three different relationship types.

Qualitative directional connectors define the dependencies between architectural components. The direction of these connectors determines the direction of the executable connectors between measurement components.

Qualitative generic connectors define the dependencies between the architectural components and the measurement

components, i.e., the specific measurement components of an architectural component.

The executable connectors define the dependencies between the measurement components. Measurement components may be independent variables determined by the user, or dependent variables if they are computed with a formula referencing one to many source measurement components to determine the value of the target measurement component. The indirect executable connectors represent the indirect association between the initial source measurement components, i.e., business metrics, and the final target measurement components, i.e., the total IT costs.

## IV. VALUE COST IMPACT ANALYSIS APPROACH

This chapter describes the required steps for creating a specific client or industry model without the benefit of a model template. The model aims at providing general indications on how IT costs will be impacted by the company's changing business. Each step is briefly explained and illustrated with selected data of an industry default model created for the Telecom industry (see Figure 1). The data and formulae used in this model are based on a real case in the Telecom industry.

### A. Identification of business capabilities

To create a specific case model, users first define the business capabilities to be outsourced to the IT service provider. For this purpose, a user reviews industry capability maps to select key business capabilities that matter most to the client.

In the case example three key business capabilities were selected from the eTOM process framework, i.e., Product Marketing Communications & Promotion, Order Handling and Problem Handling [11]. The marketing capability is responsible for the issue and distribution of marketing collateral directly to a customer and the subsequent tracking of resultant leads. The order handling capability deals with pre-order feasibility determination, credit authorization, order

issuance, order status and tracking, customer update on order activities and customer notification on order completion. The problem handling capability is responsible for receiving trouble reports from customers, resolving them to the customer's satisfaction and providing meaningful status on repair and/or restoration activity to the customer.

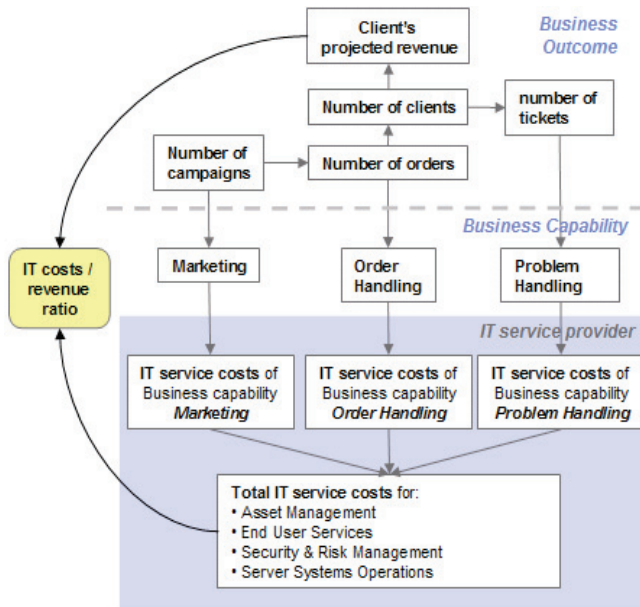


FIGURE 2. CASE – MODEL (SIMPLIFIED QUALITATIVE VIEW)

### B. Identification of IT assets and IT services

As a next step, the solution architect defines the IT assets that are used for a particular business capability, as well as the IT services required for the selected IT solutions.

In the sample case, the solution architect focused in particular on the business applications typically used for the defined business capabilities. For the marketing capability two, for order handling one and for problem handling one business applications were identified. For simplicity of the model no further SW types were defined in the first version of the model.

Furthermore, following four IT services that are related to some of the ITIL IT services were identified as main cost drivers and connected to the business applications: *End User Services* to deliver help desk, desk side support, and software platform management services across the globe. *Security and Risk Management* to provide discrete rate card services to supplement security programs and ensure audit readiness. *Server Systems Operations* to manage the operations of server, storage, and operations of internal and customer commercial datacenters. *Asset Management* to track and manage hardware and software assets from acquisition to disposal.

### C. Development of business performance model

In a following step, the industry expert develops bottom-up the business performance model. First, he defines the business metrics that have a direct impact on the business applications and thus on the IT service costs of the identified business capabilities. Next, building a metric graph further business metrics are defined that connect these first metrics to the

highest level of business metrics representing the overall business objectives of the company (e.g., revenue increase). This way, the company's business changes can be simulated by determining values for the company's general business objectives and other important business metrics. Besides company internal metrics external business metrics can be applied to describe their impact on the company's internal business metrics. Examples include number of cell phone users or fix line users per country, customer spending behavior, unemployment rate, etc.

Illustrated in the sample model in Figure 2 for the business capability marketing the business metric number of email campaigns, for the business capability order handling the number of orders and for the business capability problem handling the number of tickets are defined as key metrics that drive IT costs. These metrics are then connected as follows with the company's objective to increase revenue. To increase the company's revenue the number of subscribers has to grow. In order to grow the number of subscribers, the company has to increase the number of email campaigns entailing an increase in number of orders given a certain email campaign and order success rate. With an increasing subscriber base also the total number of problem tickets will increase.

After creating the qualitative business performance model, the quantitative view of the model is developed for the simulation of different business scenarios. For this, the dependent and independent variables are identified, the initial values of the independent metrics are determined and the formulas to compute the dependent variables are described. Finally, further auxiliary independent variables, such as the order success rate or email campaign success rate, are defined to allow the simulation of the model. TABLE II. lists selected business metrics defined for the sample case.

TABLE II. CASE – SELECTED BUSINESS METRICS (BM)

Business metrics			Metric level			
Name	Type	Initial value (year 0) / simplified formula	Enterprise	Marketing	Order handling	Problem Handling
Revenue	Indep.	\$ 3,000,000,000	X			
Avg. revenue per subscri.	Indep.	\$1,200	X			
No. of subscri.	Dep.	$\frac{\text{Revenue}}{\text{Avg. revenue per subscri.}}$	X			
No. of new subscri.	Dep.	$\frac{\text{No of subscri. (year } i) - \text{No of subscri. (year } i-1)}}{\text{No. of new subscri.} + (\text{No. of new subscri.} \div \text{Order success rate} \times (100 - \text{Order success rate}))}$	X			
No. of orders	Dep.	$\frac{\text{No. of new subscri.} + (\text{No. of new subscri.} \div \text{Order success rate} \times (100 - \text{Order success rate}))}{\text{No. of new subscri.} + (\text{No. of new subscri.} \div \text{Order success rate} \times (100 - \text{Order success rate}))}$			X	
Order success rate	Indep.	50%			X	
No. of email campaigns	Dep.	$\frac{\text{No. of orders} + (\text{No. of orders} \div \text{Campaign success rate} \times (100 - \text{Campaign success rate}))}{\text{No. of orders} + (\text{No. of orders} \div \text{Campaign success rate} \times (100 - \text{Campaign success rate}))}$		X		
Campaign success rate	Indep.	30%		X		

Business metrics			Metric level			
Name	Type	Initial value (year 0) / simplified formula	Enterprise	Marketing	Order handling	Problem Handling
Ticket per subscr. / month	Indep.	0.2				X
No. of tickets	Dep.	No. of subscr. × Ticket per subscr. / month				X

#### D. Development of IT performance model

In addition to the business performance model, the IT performance model is developed by the technical roles. It is composed of a graph of IT asset metrics and IT service metrics. Thereby, a few IT asset metrics form the interface to the business performance model. Furthermore, some IT asset metrics are directly connected to the IT service metrics entailing a direct impact on the IT service costs. Similar to the business performance model, in the IT performance model the dependent and independent variables are defined, the initial values of the independent metrics are determined and the formulas to compute the dependent variables are described. If necessary, auxiliary metrics are created. Although, in general, the same types of IT metrics can be assigned to each business capability, the formula and value of these metrics may be different between the business capabilities. Selected IT metrics that were defined for the sample case are listed in TABLE III.

TABLE III. CASE – SELECTED IT METRICS

IT metrics		Business capabilities		
Name	Type	Marketing	Order Handling	Problem Handling
<i>IT assets</i>				
user capacity per day	Indep.	5 email campaigns	80 orders	40 tickets
No. of users	Dep.	No. of email campaigns ÷ user capacity	No. of orders ÷ user capacity	No. of tickets ÷ user capacity
No. of business apps	Indep.	2	1	1
Image capacity per business item	Indep.	1 : 10,000	1:5,000	1:2,500
No. of images per app (baseline)	Indep.	2	1	1
No. of images per app (extended)	Dep.	No. of email campaigns ÷ img. capacity	No. of orders ÷ img. capacity	No. of tickets ÷ img. Capacity
<i>IT services – End User Services</i>				
Avg. time per user / month	Indep.	3 min	3 min	2 min
Avg. costs per min.	Indep.	\$10.00		
Total time	Dep.	No. of users × Avg. time per user / month × 12		
Total IT service costs	Dep.	Total time × Avg. costs per min.		
<i>IT services – Server and Systems Operations</i>				
Avg. time per image / month	Indep.	1 min	10 min	2 min
Avg. costs per min.	Indep.	\$7.50		
Total time per year	Dep.	No. of images × Avg. time per image / month × 12		

IT metrics		Business capabilities		
Name	Type	Marketing	Order Handling	Problem Handling
Total IT service costs		Total time × Avg. costs per min.		

A key metric that has been identified for instance as driver for end user services is the number of users. While this metric is relevant for various business capabilities, its value creation formula differs among them. The metric is driven by the business capability specific business items (e.g., emails, orders, tickets), as well as the user capacity to process these business items.

Another key IT asset metric driving the IT service Server Systems and Operations is the number of images. In the sample case, the number of images are defined for a baseline, i.e., for a minimum number of business items, as well as for the processing of additional business items. In the latter case the number of images will grow linear. The formula to compute this metric value uses the total number of business items and the image capacity per business item.

Building on the experiences of previous IT sourcing projects, for each IT service the average time to process the business capability specific cost driver metric is defined. For instance, for the IT service End User Services it is defined how much time it takes to support one user per month, for the IT service Server and Systems Operations it is defined how much time it takes to manage one image per month.

#### E. Development of business scenarios

In a long term outsourcing project changing business conditions will require changes of the IT infrastructure causing IT service costs to develop accordingly. The business changes are difficult to predict as they can be caused by various events. To understand how the IT service costs might change it is therefore helpful to create potential business scenarios. A business scenario builds on the before defined initial values, as well as time series of independent business metrics that reflect the changing business conditions. In the example case, two business scenarios were created (see TABLE IV. ).

TABLE IV. CASE - BUSINESS SCENARIOS

Business metrics (in %)	years							
	1	2	3	4	5	6	7	...
<i>Scenario 1</i>								
Increase in revenue	10	10	10	10	10	10	10	..
Increase in order success rate	2	3	5	7	10	2	2	..
increase in campaign success rate	0	0	0	0	0	0	0	..
<i>Scenario 2</i>								
Increase in revenue	3	6	10	7	3	2	0	..
Increase in order success rate	1	1	1	1	1	1	1	..
increase in campaign success rate	2	5	8	10	11	12	13	..

In the first scenario, it was assumed that the company would be able to increase its revenue every year by 10%, due to the introduction of a new order management system an annual increase of the order success rate was expected. The email campaign success rate was assumed to remain the same over a time period of 10 years. The two dependent metrics, i.e., number of email campaigns and number of orders, were computed by the system.

In the second scenario, it is assumed that the revenue will increase in the first years and then stagnate in the following years. This increase is explainable with a growing campaign success rate due to a new campaign management system. The order success rate only increased marginally due to minimal changes in the order handling processes. Given these changes, the values of the dependent metrics number of email campaigns and number of orders were automatically adjusted by the system.

#### F. Development of cost scenarios - Results

Based on the initial values of the business and IT performance model, as well as the defined business scenarios the corresponding cost scenarios are computed by the system. Figure 3 illustrates the cost scenarios that were created for the above two business scenarios. The two charts show how the relative IT service costs of the three business capabilities differ between the two scenarios. Additionally, the total IT service costs (not illustrated in the charts below) vary between the two scenarios.

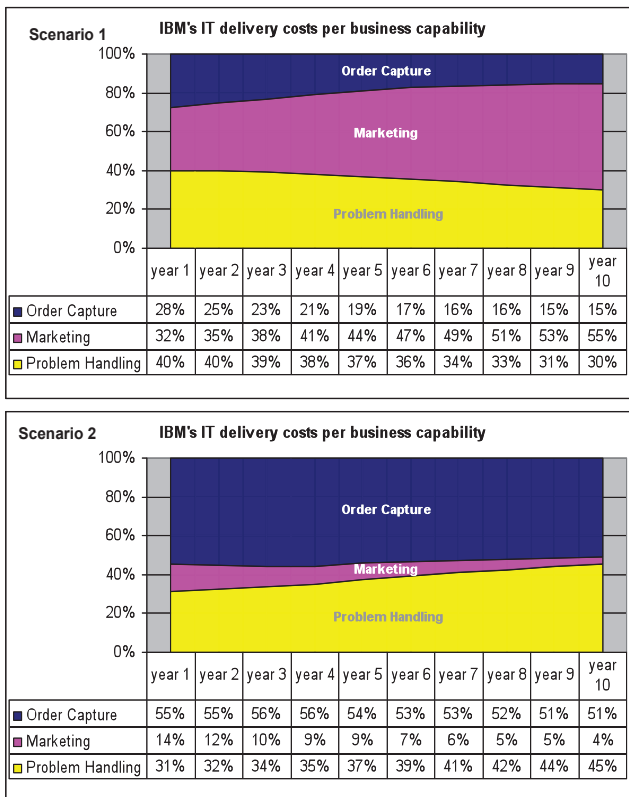


FIGURE 3. CASE – COST SCENARIOS OF BC ORDER HANDLING

In the first scenario, the increasing IT service costs for the business capability marketing is explainable with the constant annual increase in revenue which requires to be met a higher number of email campaigns and more marketing personnel processing these campaigns. In particular, the increasing number of marketing personnel, impacted the number of users for the marketing capability, and thus the need and costs for end user services. As the order success rate in this scenario increased the need for new employees decreased over time with the consequence that the number of users remained the same and therefore in particular the IT service costs for end user services stagnated. The costs for server and systems operations increased more significantly for marketing due to an increase in number of images for this capability.

In the second scenario, the fast increasing campaign success rate requires less marketing campaigns and thus less users working with the marketing applications. However, the number of users for order handling and thus the costs of end user services is highly impacted. The higher IT service costs for order handling is furthermore explainable with the increased number of images needed for this particular business capability, as well as the higher average costs per image for the IT service server systems and operations.

#### V. DISCUSSION AND CONCLUSIONS

This paper proposes the Value Cost Impact Analysis approach to enable an organization or an IT service provider to estimate the IT cost impact of future business developments. Using typical metrics associated with business architecture and IT resources as well as service cost metrics for particular industries this approach overcomes the need to very detailed, custom modeling for each particular company use case and provides a “good enough” estimation of IT cost impact and the corresponding risk assessment. The approach does not require detailed estimation of configuration-level changes to the infrastructure, which would make the creation of different planning scenarios prohibitively expensive. The approach has been implemented in the context of the telecommunications industry based on a model created in collaboration with industry and IT experts on an MS Excel platform.

While no detailed measurements have been taken yet from a large enough number of cases modeling different companies, the use case shown in the paper demonstrates the advantage over methods previously employed such as the modeling of detailed configuration scenarios for business development scenarios or uniform extrapolation of business metrics changes to IT cost metrics. Further experience with the approach will enable us to assess the precision of the approach.

While related work considers specific aspects of relationships of business-related metrics with IT metrics, e.g., Mayerl et al. [13], the approach proposed in this paper, considering business metrics as independent variables and relating them to IT metrics through business architecture has not been proposed in this form.

Planned future work includes the application of the approach to different industries and the implementation of a more formal tool with a corresponding knowledge base for industry models. Once deployed on a larger scale, actual



business developments and their cost impact on IT will help to gradually improve the cost impact models over time.

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#### REFERENCES

- [1] H. Anderson, R.G. Ross, The Business Motivation Model - Business Governance in a Volatile World - Release 1.3.
- [2] R. Birke, L. Y. Chen, E. Smirni, Data Centers in the Wild: A Large Performance Study, IBM Research Report RZ 3820, Zurich, 2012.
- [3] M. Buo, R. Chang, L. Luan, C. Ward, J. Wolf, P. Yu, Utility computing SLA management based upon business objectives. *IBM Systems Journal*, 43(1), 159-178, 2004.
- [4] R. Buyya, C. S. Yeo, and S. Venugopal. Market-oriented cloud computing: Vision, hype, and reality for delivering it services as computing utilities. In *High Performance Computing and Communications, 2008. HPC<sup>2</sup>08. 10th IEEE International Conference on*, pp. 5-13. IEEE, 2008.
- [5] L. Cherbakov, G. Galambos, R. Harishankar, S. Kalyana, G. Rackham, Impact of service orientation at the business level, *IBM Systems Journal*, Volume: 44 , Issue: 4 , Page(s): 653 – 668, 2005.
- [6] Distributed Management Task Force, Base Metrics Profile. Document Number: DSP1053, 2009.
- [7] Distributed Management Task Force, Software Identification and Entitlement Usage. Document Number: DSP-IS0301, 2012.
- [8] S. Glissmann, J. Sanz, Business Architectures for the Design of Enterprise Service Systems, *Handbook of Service Science*, pp 251-282, 2010.
- [9] J. Huschens, M. Rumpold-Preining, IBM Insurance Application Architecture (IAA) — An overview of the Insurance Business Architecture, *Handbook on Architectures of Information Systems, International Handbooks on Information Systems*, pp 669-692, 2006.
- [10] IT Governance Institute, Cobit 4.1, 2007.
- [11] M. B. Kelly, Report: The TeleManagement Forum's Enhanced Telecom Operations Map (eTOM), *Journal of Network and Systems Management*, Volume 11, Issue 1, pp 109-119, March 2003.
- [12] R. Linan, The Smart Insurance Enterprise System (SIES). Capgemini Financial Services , 2007.
- [13] C. Mayerl, K. Huner J. Gaspar C. Momm S. Abeck, Definition of Metric Dependencies for Monitoring the Impact of Quality of Services on Quality of Processes, *Proceedings of BDIM 2007, 2nd IEEE/IFIP International Workshop on Business-Driven IT Management*, May 2007.
- [14] Jorge Sanz, Joseph Kramer, Business Architecture for Banking - as described by four scenarios, *Proceedings of the 14th IEEE Conference on Business Informatics*, 2012.
- [15] R. A. Steinberg, ITIL Service Operation. The Stationery Office, The Cabinet Office of the UK, 2011.
- [16] The Open Architecture Group, Open Group Standard - ArchiMate® 2.0 Specification, 2011.
- [17] The Open Architecture Group, TOGAF – Version 9.1, Van Haren Publishing, 2011.
- [18] Object Management Group, “Business Architecture Working Group (BAWG)”, Available at: <http://www.omgwiki.org/bawg/doku.php>, January 2013.
- [19] TM Forum, Business Process Framework (eTOM), 2012.