Managing customers' IT capabilities in IT outsourcing over time: A system dynamic approach

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Abstract: The IT Outsourcing (ITO) literature shows a strong relationship between the IT capabilities of contracting organizations and the outcomes expected by ITO initiatives. IT capabilities of organizations that hire services in this area are evaluated through every stage of the ITO life cycle (from the decision to outsource IT to the delivery of services). However, there are still gaps to be filled by tools and models that help managers to decide which capabilities to develop and / or maintain internal to their organizations, in which quantity or magnitude and how such capabilities behave in a dynamic scenario of constant interaction between client's and vendor's IT teams. This paper proposes a model based on the concepts of dynamic capabilities and benefits management for evaluating and managing customers' IT capabilities that need to be applied to outsourcing relationships over time. This research is still under development and the results presented here are preliminary.

Keywords— IT Capability Management, IT Outsourcing, System Dynamics Modeling, Benefits Realization Management

I. INTRODUCTION

A. Context

In organizations where Information Technology (IT) plays a strategic role, adequate IT provisioning requires finding and leveraging appropriate IT resources and capabilities.

According to ITIL [1], IT resources and capabilities are types of assets used by the organizations to create value in the form of goods and services. Resources are direct inputs to production processes. Management, organization, people and knowledge are used to transform resources. Capabilities represent the ability of an organization to coordinate, manage and deploy resources to produce value. [1]

Organizations need to define the portfolio of IT services to be provided in order to create value for its business processes and the most rewarding strategy of providing these services in terms of results. When the organization doesn´t have the resources and internal IT capabilities for the provision of all services comprising the portfolio, for strategic reasons or not, it must look for external organizations able to fill the gap [2]. This practice is called Information Technology Outsourcing - ITO.

IT outsourcing is quite complex and has been studied by researchers and IT practitioners for over two decades. The ITO life cycle is presented in the literature with some minor differences, but in essence, it converges to the following stages [3]: (1) the decision to outsource; (2) the selection of suppliers; (3) contract negotiation and design; 4) the transition of services to the contracted supplier, 5) managing the contract and relationship; 6) evaluation of the outcomes and decision about continuing the relationship.

The capabilities of the organizations that hire IT services are evaluated in all ITO stages, from the decision to outsource up until the delivery of services (management phase of the contract and relationship).

The literature on ITO shows a strong relationship between the contracting organization's capabilities and the expected outcomes of outsourcing initiatives [3][4]. In his recent review of the literature on IT capabilities, Jorfi [5], identifies a positive relationship between IT capabilities and corporate strategic alignment. However, there are still gaps to be filled by tools and models that help managers decide which capabilities to develop and / or maintain internal to their organizations, in which quantity or magnitude and how such capabilities behave in a dynamic scenario of constant interaction between internal IT and vendor´s teams.

It is important to emphasize that, in the literature on ITO, the terms "ITO success", "expected outcomes", " IT/business strategic alignment" and "IT business value delivery" are presented in a subjective, informal and unstructured way. Little attention is paid to the use of structured approaches and formal verification of benefits brought by IT to business, mainly by investments in ITO initiatives over time [6].

B. Motivations for our work

The following are some issues that motivate the development of our research.

1) **The risk of loss of strategic capabilities -** The loss of internal technical skills is an important risk factor for organizations embarking on an ITO initiative [7][8]. The goal is not to lose control of IT, taking into account the scenario of importance and closeness that this area has in relation to the core business. This concern should be reflected in the various phases of the outsourcing cycle. However, there is no clarity on the part of managers on how to mitigate this risk in a rational and balanced way, without compromising the potential benefits that outsourcing can provide.

2) **Undefined focus on the explanation for the ITO success -** Little attention is given to the use of structured approaches

978-3-901882-50-0

and formal verification of benefits brought by IT to the business, especially in investments made on ITO initiatives over time.

3) **Little understanding about the interaction between IT capabilities of contractors and suppliers -** The IT capabilities of an organization are not static. They vary over time, influence and are influenced by the capabilities of the organizations with which it interacts. In an ITO relationship, the interaction between customer and supplier causes, on both sides, the emergence, development, weakening and even loss of technical skills related to IT. We must pay attention to the fact that capacities can interact with each other in a non-linear fashion, subject to delays and feedbacks of various magnitudes, as identified by the ITO literature [1].

The rest of the paper is organized as follows. Related work is discussed in Section II. Section III presents a description of the problem and the objectives of this research. The basic model entities are presented in Section IV. Section V presents the proposed model for evaluating IT capabilities. Finally, Section VI closes the paper with future steps of this research.

II. RELATED WORK

The lack of definitive and consolidated understanding of what constitutes an organization's IT capabilities and how they can be measured brings great possibilities for research. Feeny & Willcocks [9] identify which IT capabilities are essential for business success, called *core capabilities*, and which of those have potential for outsourcing. Through a configurationist vision, they present building blocks that constitute core capabilities as combinations of skills. In this same study, the authors include the dimension *time horizon* in the construct of IT capabilities to indicate how long a capability is needed and therefore until when it should be retained. The capabilities related to long-term goals should be properly marked and should be treated differently from capabilities linked to short-term goals. This work has influenced our research by identifying the core capabilities to be addressed by our model, the skill profiles that comprise them, the use of the temporal dimension of capabilities for retention and the motivation for their quantification.

Kermani [10] uses software simulation modeling in a software engineering context to find the best combination of verification and validation techniques with respect to specific time, quality and effort goals and to analyze the effect of the project staffing profile on its performance. This work has inspired us by showing how to represent and quantify workforce skills using system dynamics simulation. It also was a reference of how we can build a generic and re-usable model for our purposes.

The next important concept is the *management of benefits*, here used as the mechanism for measuring the results presented by IT to enhance their internal capabilities.

Peppard & Ward [11] conducted a study in IT Benefits Management (BM). It focused on defining a roadmap for the construction of the Benefits Dependency Network (BDN) artifact, which can be constructed in a problem-driven or innovation-driven fashion. The study done in [6] concludes that benefits management contributes to the success of an ITO relationship. This work presents the concepts and models of benefits management, among them, the process of Cranfield, which is preferred by having well-defined stages, aligned to the ITO lifecycle. A recent work [12] makes a review of BM methodologies, compares 17 of these methodologies with each other, according to well established criteria by researchers and practitioners. Based on this research, the Cranfield methodology is considered the most comprehensive and, after some improvements, it has become more objective and applicable to projects that are already underway. We incorporate a mix of practices and artifact structures originating from these three works in our model.

The work most correlated with our research is [13], more specifically with regard to the IT Capability Maturity Model Framework (IT-CMF). This model uses the maturity level approach to enhance the IT capabilities of organizations over time. IT-CMF consists of 33 critical capabilities, organized into 4 areas or macro capabilities and supports the management of IT-driven value creation. However, there are still many opportunities for the improvement of the framework, such as the assessment of supplier capacities, their interaction with client capabilities and the reciprocal influences of these interactions. Our work differs from the IT-CMF in that it is quantitative and captures time dynamics.

III. PROBLEM STATEMENT AND OBJECTIVES

In this section we present a description of the problem and the objectives to be reached by the proposed model.

A. Problem statement

Measuring the IT capabilities quantitatively in order to properly allocate resources to better achieve planned results (e.g. projects objectives) is still a challenging problem, specially with regard to human resource skills and the impact of tools and techniques used to support IT functions.

It is part of the current ITO research agenda to develop models and tools to support the process of Capacity Forecasting and Planning [13]. This process is very timely for organizations wishing to adopt or that already adopt ITO in order to produce capacity plans to better manage their core IT capabilities [9]. The need for capabilities can vary over time because these can no longer exert the same positive impact on benefits achievement, depending on how these benefits are scheduled.

Modeling the causal interaction of clients and providers´ capacities in ITO relationships over time driven by the benefits realization is a still an open ITO as well as BM research topic.

The problem is to find which changes in resource allocation configuration (capabilities) maximize the realization of planned benefits over time.

B. Objectives

Based on the identified problem, the main objective of this paper is to provide a model capable of evaluating the benefits

or results generated by the use of IT capabilities of ITO client organizations.

This model can be used by practitioners to decide which of their IT capabilities to retain, develop or to delegate to third parties.

IV. BASIC MODEL ENTITIES

A. Model Components

Inspired by models used in software engineering simulation [10], our model consist of a set of generic re-usable components which can be composed and customized to model a wide range of different IT capabilities with its respective IT functions (see table).

Component	Use
IT process structure	Used as the basis for modelling the activities (flows) that consume the IT resources through the IT capabilities.
Allocation policy	Models the organization-specific resource allocation heuristics used to build IT capabilities.
Calibration	Used to adjust the behavior of the model to the reality of organizations or environments in the actual usage scenario.

B. Model Views

To provide for better re-usability and maintenance, the model allows for multiple views (see table).

View	Content
IT process/ function	Models the specific behavior of the activities executed and input/output flows in an IT function.
Resources to Capability	Models the specifics of how the resources are allocated/organized in capabilities, delivering productivity to the activities.
Benefits verification	Models details of how the successfully delivered services are used to check if a planned benefit was achieved, using the chosen performance metrics.
Capabilities interaction	It models the reciprocal influences between client and provider IT capabilities.

V. THE PROPOSED MODEL

The main application of the proposed model is the management of IT capabilities in ITO contexts. The chosen IT capability considered here is Contract Management, because it intermediates all interactions between clients and ITO providers. This activity is classified in the literature as a core capability [9] and its flow is depicted in Figure 1.

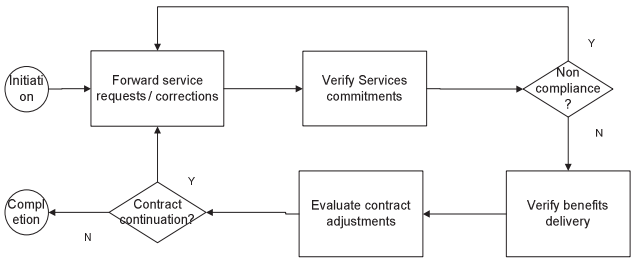

Fig. 1 - A generic process for contract monitoring (adapted from [14])

C. Model Variables

In addition to components presented in section IV, the following entities are also part of the model:

Resources (Input)

Workforce

Matrix $WF_{n \times m}$, where n is the number of employees and m is the number of IT activities executed in an organization for which IT staff can have skill. $WF_{i,j} \in [0,1]$ on a continuous scale is the skill level of the employee in performing activity j.

Material

Matrix $MR_{r \times m}$, where r is the number of material resources (software, workstations, servers, installations) involved in considered IT processes and m is the number of IT activities that can be performed in an organization.

Intangible

Matrix $IR_{s \times m}$, where s is the number of intangible resources involved in considered IT processes (organizational knowledge, contracts, documented routines, methodologies, etc.) and m is the number of IT activities that can be performed in an organization.

Allocated Capabilities (Mediator)

Matrix $AC_{m \times 3}$, where the lines represent the m possible IT activities that can be performed in an organization. The first column represents the number of employees allocated to the activities. The second column represents the average skill level of employees allocated to each activity. The third column represents the maximum flow rate of activities per person-day.

Demands (Input)

Matrix $D_{i \times 4}$, where the i line represents tasks belonging to projects that were prioritized and scheduled to the IT department. The first column represents the efforts being undertaken to implement the i-th task. The second column represents the minimum required skill level for the i-th task to be performed. The third column represents the minimum level of performance for the i-th task. The fourth column represents the point in time at which the task should be scheduled.

Note: The tasks that comprise the IT project must necessarily be members of the standardized IT processes registered in the model.

IT Standard Processes (Input)

Vector $ITSP_i$, i representing the activities that comprise a particular IT process.

Note: The definition of this entity aims to standardize tasks and activities to be included in the matrices of demand, workforce and allocated capacities. For this purpose, the practices described in the framework Sourcing Capability Model (eSCM) [15] are used as reference.

Benefits Delivery Plan (Input/output)
Matrix BDP_{ix4} , where the *i* lines represent the planned benefits to be achieved by the IT projects. The first column represents the probability of realization of the *i*-th benefit. The second column represents the expected time horizon for the realization of the *i*-th benefit. The third column represents the expected effect, depending on the chosen performance metric, of the realization of the *i*-th benefit. The fourth column represents the realized effect of the *i*-th benefit.

Delivered Services (Output)
Vector DS_2, where the first position represents the delivered performance level. The second position represents the effort effectively undertaken to deliver the service.

D. The Contract Monitoring Process View

We present below the implementation of one of the model´s views, representing the specific activities performed in the monitoring process of ITO contracts.

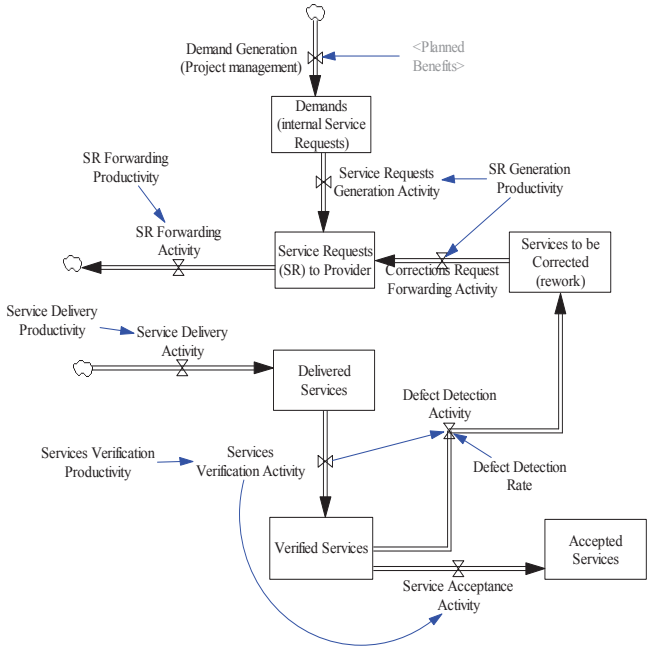

Fig. 2- The stock-flow diagram for the Contract Monitoring Process View.

Figure 2 illustrates a simplified snapshot of this view, with some of its variables hidden to improve readability and understandability of the diagram.

This part of the entire SD-based simulation model is responsible for simulating the effectiveness of the overall process of monitoring conformance of the demands generated by the BDP. The productivity rates of all process activities, represented by the model flows are calculated in the Resources-to-Capability view, based on the workforce allocated for the task, its respective average skill level and organization-specific calibration parameters.

VI. FURTHER RESEARCH

This research is still under development, so that the results presented here are partial. The model proposed here can be used in several ways to improve IT sourcing strategies, driven by the benefits delivery for the organization's business. The goal is to advance in future research, using the model to respond objectively questions such as: How many people are needed to deliver IT capabilities required to achieve the expected results for an organization? For how long? The next steps are: 1) implementation of remaining components and views presented in section IV; 2) the refinement of the model through validation cycles with CIOs, project leaders and contract managers. We plan to contact people belonging to public organizations, industries in the sugar sector and private providers of IT services that operate in the state of Alagoas, Brazil.

ACKNOWLEDGEMENT

The authors thanks to Reviewers for their comments.

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