Demo-based Cost Model

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Abstract: The complexity of organizations has become difficult to manage and organizations have lost the traceability between their essential transactions and the respective implementation costs. Most organizations do not have a coherent, comprehensive and consistent vision of the costs directly or indirectly related to the organization essential operations. This essential operations are based on networks of subjects that interact in order to coordinate and perform work, contributing for global performance. The lack of understanding of where costs occur leads to difficulties when taking decisions, limiting what can be achieved in a planned way, reason for the need of a properly cost analyses. A solution could contribute to a better understanding of where costs occur, providing managers with more information to support their decisions, so they can improve organizations in order to be more profitable. In our research we propose a DEMO-based Cost Model to address this problem, which intends to reduce the complexity of analysing costs, mapping the implementation costs with the essence of organizations. Our proposal allows analysing costs from different perspectives, by act, actor role, transaction and business process. The demonstration was applied to Invoice Management of a research and development unit. This research was conducted using DSRM.

1 INTRODUCTION

Over time organizations become increasingly complex and managing that complexity is a growing challenge. Organizations complexity has been described as the organized complexity: too organized for statistics and too complex for analysis (Weinberg, 2001). Since costs in organizations have become too complex for analysis, organized complexity also applies to costs (Wileman, 2008).

Complexity seems to be a common background of enterprise problems (Association of Chartered Certified Accountants & Institute of Management n.d.). In a complex system, elements can interact with others, moving into more elaborated structures and increasing the number of the transactions. As a consequence organizations also incur in more costs that are hard to identify (Ray, 2013).

Costs are associated to the enterprise operations and its processes. Costs are not only inherent of enterprise operation but also of complexity, mergers, search for growth, acquisitions, or other factors. One of the top challenges nowadays, as revealed by several surveys, is to identify cost reductions (Association of Chartered Certified Accountants & Institute of Management n.d.). However the complexity of organizations has become unmanageable (Schapper et al., 2005) and organizations have lost the traceability between the organization essence and the respective implementation costs, meaning that most organizations do not have a coherent, comprehensive and consistent vision of the costs related to the essential operations (Dietz, 2006). Organization operations are performed by networks of subjects that contribute to global performance, interacting with others to coordinate and perform work (Cross and Parker, 2004). A solution to approach this problem should reduce the analysis complexity, focus on the system and ignore the subsystems, to separate enterprise essence from the implementation.

Our research focused on DEMO to overcome the complexity of modelling organizations, allowing us to separate the way organization are implemented from its ontological essence, reducing the analysis complexity. We also used Time-Driven Activity Based Costing (TDABC) to allow reflecting the complexity and variability of business processes with time equations. TDABC is more simpler, less costly and faster to implement than Activity Based

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Costing (ABC) which adds more complexity, needs large data estimates calculations, and not considers the subjective time consumption of resources.

Therefore we propose a method based on DEMO Methodology (Dietz, 2006) and on TDABC theory (Kaplan and Anderson, 2007). This research was conducted using the Design Science Research Methodology, a framework commonly accepted to produce of Design Science Research in Information Systems.

The main contribution to solve the identified problem is the understanding of where costs occur relating the essential operations to their implementation costs, and areas of responsibility. This would provide information for managers to support their managing decisions, making organizations more profitable (Pesonen, 2001).

The remaining paper is structured as follows, in Section 2 we present the related work. In Section 3 we explain our proposal. A demonstration of the proposed artifact is shown in Section 4. In section 5 a conclusion, the achievements and the future work are presented. In appendix we present the auxiliary calculations tables (Appendix B).

2 RELATED WORK

In this section we detail the work that has been done in this domain of investigation. We will describe Enterprise Ontology and TDABC in Sections 2.1 and 2.2.

2.1 Enterprise Ontology

Enterprise Ontology (EO) is a comprehensive theory that supports DEMO methodology and allows overcoming organizations complexity.

This last is composed by methods and techniques based on EO theory, so that organizations conceptual model can be constructed showing only the essence of the operations in way that is coherent, comprehensive, consistent and concise (Dietz 2006).

EO is defined as the structure behind the observable surface, the realization and implementation independent essence of an organization.

Competing methodologies do not guarantee to produce implementation independent models, and in addition the aspect models are not totally linked to each other.

2.1.1 Theory

The PSI-Theory is the theory that supports the notion of Enterprise Ontology. It is based on four axioms (operation, transaction, composition, distinction) and one theorem (organization theorem).

Operation axiom explains that operations are a set of actor roles activities, either roles of authority or responsibility, fulfilled by subjects, which perform production acts or coordination acts. Their results are production facts - goods and/or services - and coordination facts - commitments with others.

2.1.2 Methodology

DEMO methodology consists of four aspect models with particular diagrams, lists and tables:

- The Construction Model (CM) specifies the identified transaction types and the associated actor roles, as well the information links between actor roles and the information bank. The composition, structure and environment of organizations can be specified by the CM using two models: 1) The Interaction Model (IAM) that shows active influences between actor roles, i.e. the execution of transactions; 2) The Interstriction Model (ISM) showing the passive influences between actor roles;
- The Process Model (PM) contains the specific transaction pattern of the transaction type, also the causal and conditional relationships between transactions. Those relationships determine the transaction patterns and the possible trajectories in the Coordination-world (transition space and state space);
- The Action Model (AM) specifies action rules as guidelines for actors deal with their agenda. Action rules guide how the performing actor role should respond to the reached status;
- The State Model (SM) identifies the state space of P-world: object classes and fact types, the result types, and ontological coexistence rules. SM is ideal to start developing and maintaining the data dictionary of an organization, facilitating the identification of business components (software components), based on the fact types around categories.

These models are illustrated in Figure 1 and constitute the complete ontological model of the organization. To produce the aspect models we use the logical sequence anticlockwise, starting with interaction model (IAM).

As business architectures approaches areas such as management science, business administration, logistics and informatics, they are unable to provide integrated understandings of actors, communication,

production and their realizing technologies (Mulder and Dietz n.d.).

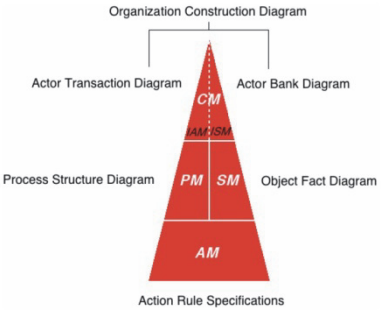

Figure 1: DEMO ontological aspects models and diagrams (Dietz, 2006).

Regarding this concerns, Enterprise Ontology offers a new kind of understanding, brought by the approach of Design & Engineering Methodology for Organizations.

2.2 Tdabc

Time-driven activity-based costing is an alternative approach to ABC model estimation, addressing its limitations being: simpler, faster to implement, and less costly.

TDABC allows overcoming transaction complexity, by using time equations and time consumption of process in the departments, basing the cost driver rates on the practical capacity of supplied resources (Kaplan & Anderson 2007).

This new approach considers the number of times that an activity is performed (number of production runs, setups, number of shipments, purchase orders, and number of customer orders) and resources effort that is required to perform activities (setups that might be more complex or difficult to do than others, time and effort spent).

In ABC, transactions heterogeneity is handled in two ways: 1) Expanding the number of activities (simple orders, average orders, and complex orders). 2) Using duration drivers to estimate the required time to perform the task (example are the material handling time, setup hours, direct labour hours and machine hours).

The simplicity of Time Driven Activity-Based Costing is essentially to measure and manage the capacity of organization, requiring only two estimates: 1) The unit cost of supplying capacity, and 2) The consumption of capacity (unit times) by the activities the organization performs for products, services, and customers.

2.2.1 Estimating Unit Cost

For estimating the cost of supplying capacity, various groups of resources that perform activities must be identified (activities performed in administration, front-line employees, their supervisors and the support resources).

There are two possible ways of measuring practical capacity. One is to estimate practical capacity as a percentage of theoretical capacity, including personnel time for breaks, arrival and departure, communication and reading unrelated to work, machine time for downtime due to maintenance, repair, and scheduling fluctuations.

The other way is to measure practical capacity, obtaining historical time of activities and taking in consideration fluctuations that can occur in certain periods (due to excessive delays, poor quality, overtime, or stressed employees). This number is then used as the estimate for capacity of resources that perform that activity.

After estimating the 1) cost of supplied capacity of each resource and 2) the practical capacity, the analyst can calculate the unit cost using Eq. 1:

$$\text{Unit Cost} = (\text{Cost of capacity Supplied}) / (\text{Pratical Capacity supplied}) \quad (1)$$

The numerator includes direct or indirect expenses attributed to the unit and the denominator is the available capacity time.

2.2.2 Estimating Unit Time

TDABC requires an estimation of the time an activity takes to be performed. The procedure uses an estimate of time, replacing the ABC process of interviewing people. The time estimates can be obtained either by direct observation or by interviews, rough accuracy is sufficient.

An analysis to the results obtained by the model can reveal the costs of both resource capacity used and resource capacity unused. Rather than reducing unused capacity in the present, managers can choose to reserve that capacity to grow in the future.

Managers can forecast how much the business can handle with the existing capacity and if capacity shortages might happen.

2.2.3 Time Equations

Business processes activities have different durations, being similar to requests, complains, or performing other transactional activity. Companies most of the times can predict the drivers that turn transactions into simpler or more complex ones

(Kaplan and Anderson, 2007).

For example, to dispatch a letter in the post office the operation may take 2 minutes, but if the item requires a special delivery then an additional 4 minutes might be required, also if the item has more weight another 2 minutes is required to weigh in the balance.

Instead of defining separate activities to each procedure, the time-driven approach uses a simple equation, Eq. 2:

$$\text{Dispatch Time} = \quad (2)$$
$$= 2 + 4 \text{ (if special delivery required)}$$
$$+ 2 \text{ (if additional weight)}$$

TDABC approach is a powerful framework and is useful to apply in our proposal because: 1) it is more accurate and can operate with fewer equations than the number of activities in traditional ABC systems, allowing a variety and complexity in products, orders, and customers; 2) it gives information about the unit cost and unit times, as consequence the knowledge about possible improvements in efficiency (Kaplan and Anderson, 2007).

With TDABC a time equation model can be obtained, reflecting any business processes complexity and variability. The complexity in processes can be surpassed by modelling departments as one process, in one time equation.

Time equations can also be expanded to add more terms including variations of different types of transactions, reflecting the actual activities during each period (Kaplan and Anderson, 2007).

In our proposal time-equations can allow us to calculate the costs of activities, based not only on the used resources but also on the time consumed.

3 PROPOSAL

This section corresponds to objectives definition for solution, design and development steps of DSRM.

3.1 Objectives of the Solution

The objectives for a solution have two major concerns: first the need to obtain an artefact that allows modelling an organization in a comprehensive, consistent and concise way; second the artefact should allow identifying and relating the implementation costs with organization's essential operations.

3.2 Proposed Method

We propose an artefact that uses contributions from both TDABC and DEMO methodology. We choose to use DEMO since it was conceived to overcome complexity.

This methodology allow us to separate the way organization is implemented from its ontological essence, reducing the analysis complexity and allow to be more focus on the system of interest (Dietz, 2006).

Organizations consist of people, interacting in order to coordinate and perform work. The duration of their activities should also be included when modelling organization costs. To consider this aspect we propose to use TDABC time equations, adapting them to reflect not only the duration of essential activities but also their dependencies.

In Fig. 1 we introduce the proposed method with a diagram, showing two phases each with several steps. The first phase consists on DEMO Methodology and the second phase is based on TDABC theory.

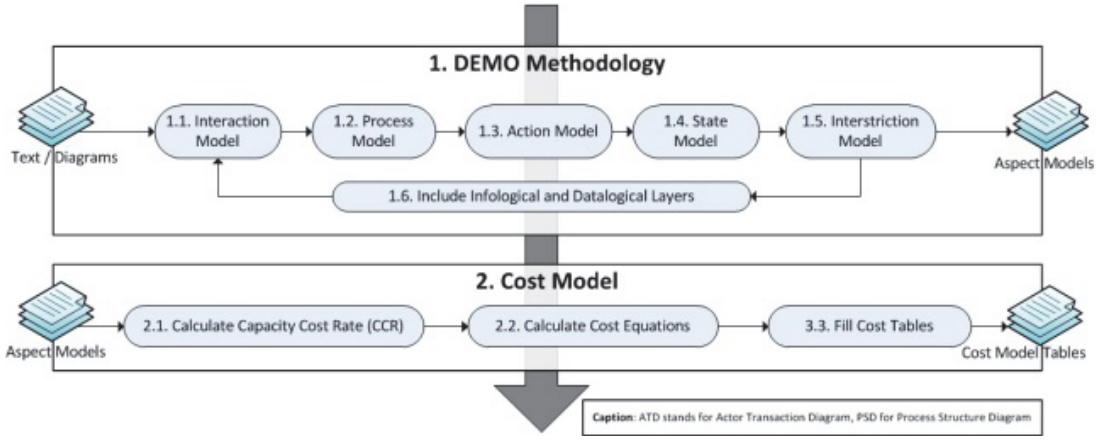

Figure 1: Steps of the proposed method.

3.2.1 Demo Methodology

The first phase is based on DEMO Methodology and is composed of six steps as shown in Fig. 1. Each step consists on modelling the aspect models (Dietz, 2006), we propose to consider not only the ontological transactions but also the infological and datalogical transactions, identifying them with the respective colours (accordingly to the distinction axiom) and a letter "I" and "D" before the designation of infological and datalogical transactions respectively.

With the Process Structure Diagram (PSD), the Actor Transaction Diagram and Result Structure Chart, in particular, we can understand which dependencies exist between acts and continue to the second phase.

3.2.2 Cost Model

The second phase is based on TDABC theory (Kaplan and Anderson, 2007). Having as output the diagrams of first phase we can proceed to the steps of Cost Model.

Capacity Cost Rate. The first step of this phase is to calculate Capacity Cost Rate (CCR) for each Actor Role using Eq. 3. The variable (x) belongs to Actor domain and (y) belongs to Actor Role domain.

$$\text{CCR}(x,y) = (\text{Expenses Attributable to (x) who fulfill (y))} \,/\, (\text{Available Capacity of (x) who fulfills (y)}) \quad (3)$$

The Eq. 3 gives actor role cost for unit of time, the numerator includes expenses related to the time period in consideration.

Some examples of Portuguese organization expenses that can be divided in two categories are personnel expenses (salary, social security, holiday's subsidy, Christmas subsidy, sickness subsidy, meal subsidy, taxes) and operation expenses (space rent, electricity, water, equipment, services, training, and taxes). The denominator is calculated as the available capacity of resource.

We start with the number of days in one year, then we subtract non-working days (to get the number of working days in a month) and finally we multiply this last value with the available hours per day of work. Available hours per day of work are obtained by subtracting to daily work hours the non-work times. Some examples of non-work days/times are holidays, breaks, vacations, expected personal/sick leave, and training.

Cost Equations. The second step of Cost Model phase is to calculate cost equations, starting by act cost equation, Eq. 4.

$$\text{Act\_cost} = \text{CCR\_ActorRole} + \text{estimated\_time} + \text{number\_ocurrences} + \text{specific\_cost} + \text{dependencies\_cost} \quad (4)$$

Eq. 4 is calculated having as basis several parameters:

- CCR_ActorRole is the capacity cost rate calculated previously;
- estimated_time the average estimation time of act;
- number_ocurrences as the number of times act was performed;
- specific_cost are the act costs not included in CCR (x,y) numerator expenses. Taking an example of a pharmacy, when a medicine is dispensed, the specific costs is the medicine cost;
- dependencies_cost are costs of other acts costs that must be performed before, dependencies can be captured following the conditional lines in PSD diagram.

After calculating Acts Cost we calculate transaction cost using Eq. 5. Transaction_cost which is the sum of both Executor_(cost) and Initiator_Cost.

Table 1: Table model to represent Transaction Costs.

$\text{Transaction}_{\text{cost}}$	rq	dc	qt	pm	ex	st	rj	sp	ac	Txsum
$\text{Initiator}_{\text{ActorRole}}$	€a	€b	€c	€d	€e	€f	€g	€h	€i	€j
$\text{Executor}_{\text{ActorRole}}$	€k	€l	€m	€n	€o	€p	€q	€r	€s	€t

Table 2: Table model to represent Business Process Costs.

	A01	A02	(…)	A0M	Sum
T1	€c11	€c12	€ (…)	€c1M	€c1
T2	€c21	€c22	€ (…)	€c2M	€c2
(…)	€ (…)	€ (…)	€ (…)	€ (…)	€ (…)
TN	€cN1	€cN2	€ (…)	€cNM	€cN
Sum	€c01	€c02	€ (…)	€c0M	$€\text{BP}_{\text{Cost}}$

We consider participations from Initiator acts times in some Executor acts time, meaning that in some business processes we might want to assume that initiator and executor have both the same act time duration.

For example in a Pharmacy when a client makes a request that is being heard by the pharmacist, the duration of the request will be the same for initiator and executor, so we will differentiate this as it can be seen represented in cost tables (Table 1).

$$\begin{aligned}\text{Transaction\_cost} &= \\ = \text{Initiator\_Cost} + \text{Executor\_(cost)} &= \\ = (\text{Sum of Initiator Acts\_cost}) &\\ + (\text{Sum of Executor Acts\_cost}) &\end{aligned} \quad (5)$$

The Business Process Cost BP_cost can be obtained with Eq. 6 for ontological transactions T1 to TN.

Here we only consider ontological transactions that have their result at the end of the result structure chart, since we don't want to include costs that already were considered, due to dependencies (Eq. 4).

$$BP\_cost = T1cost + T2cost + ...+ TNcost \quad (6)$$

Cost Tables. The third step of phase two is to fill cost tables. In Table 1 we represent the Transaction Costs, which we only consider transactions that are parameters of Eq. 6. Here two rows represent Initiator and Executor Actor Role, their acts are in columns and each cell will have the correspondent Act Cost (calculated using Eq. 4).

In Table 2 we represent Business Process Costs, but only those that are parameters of Eq. 6. Here we can represent also how each Transaction Cost is related to each Actor Role responsibility area, understanding the implementation cost for the organization when providing a service or product.

DEMO models show actor roles and their area of responsibility (represented in Fig. 4 with a grey colour rectangle). Since the limit of actor roles responsibility areas is well defined, we can trace costs between actor roles and their acts. The advantage of associating costs to actor roles is the overview about specific roles costs, understanding which ones are more costly.

The Cost Model is the last phase of the proposed method. With this method we have a direct correspondence between ontological acts costs and their implementation costs. Then analysis can be made, concerning which transactions are more costly, who is responsible for them, or even make other conclusions about the organization costs.

4 DEMONSTRATION

This section corresponds to the Demonstration step of Design Science Research Method. The application of the artefact is presented using Invoice Management of a Portuguese research group.

4.1 Modelling Phase

The research group is a Portuguese private group composed by thirty persons, dedicated to the research, innovation and development of new solutions to problems in the IT Governance and digital services areas. The invoice department is a shared service company that provides financial services to the research group, including invoice management.

Next we describe the invoice management process, making DEMO analysis. In red we colour Performa items, green Informa items, and for Forma items. Brackets enclose parts of text, namely "[" and "]" indicate an actor role, "(" and ")" indicate a C-act/result, and the brackets "<" and ">" indicate a P-act/result.

> *The process is conducted by e-mail. It starts when the [chief of the research and development unit] needs to (send an invoice) to a [customer]. He then (e-mails) [someone at the invoice department], belonging to the shared services company that provides financial services. This e-mail contains information about the date, value, address or description that should be present in the invoice. After receiving the e-mail, the [invoice department] <has to create the invoice> and <send> it to the [customer], adding in carbon copy (CC) the chief of the research and development unit. When the invoice is paid, the research group leader receives an e-mail*

In Table 3 we present all identified transactions, their result, and then we colour them accordingly to each transaction type. Note that transactions that are not ontological are identified as DT or IT, meaning that they are datalogical transaction or infological transaction, the same for transactions results.

Table 3: Transaction Result Table (TRT) with transaction types and result types.

Transaction	Result Type
T01 service payment	R01 service P has been paid
DT02 invoice sending	DR02 invoice I has been sent on date D
DT03 invoice creation	DR03 invoice I has been created on date D
IT04 additional information obtainment	IR04 additional information for invoice I has been obtained

The Result Structure Analysis allows us to identify dependencies and in this case three dependencies are identified.

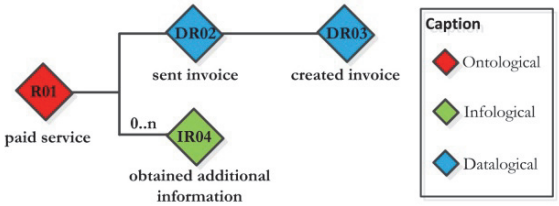

Figure 2: Result structure chart.

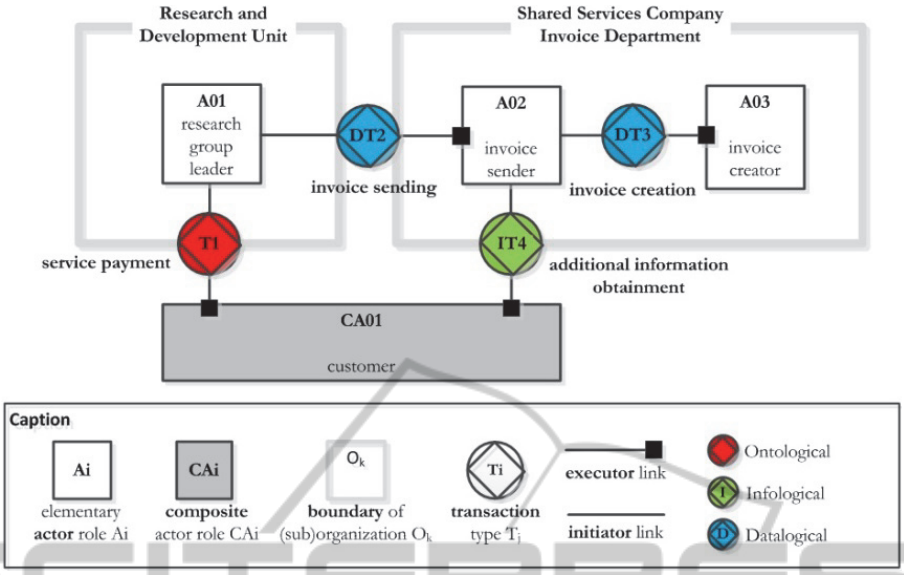

Figure 3: Actor Transaction Diagram (ATD).

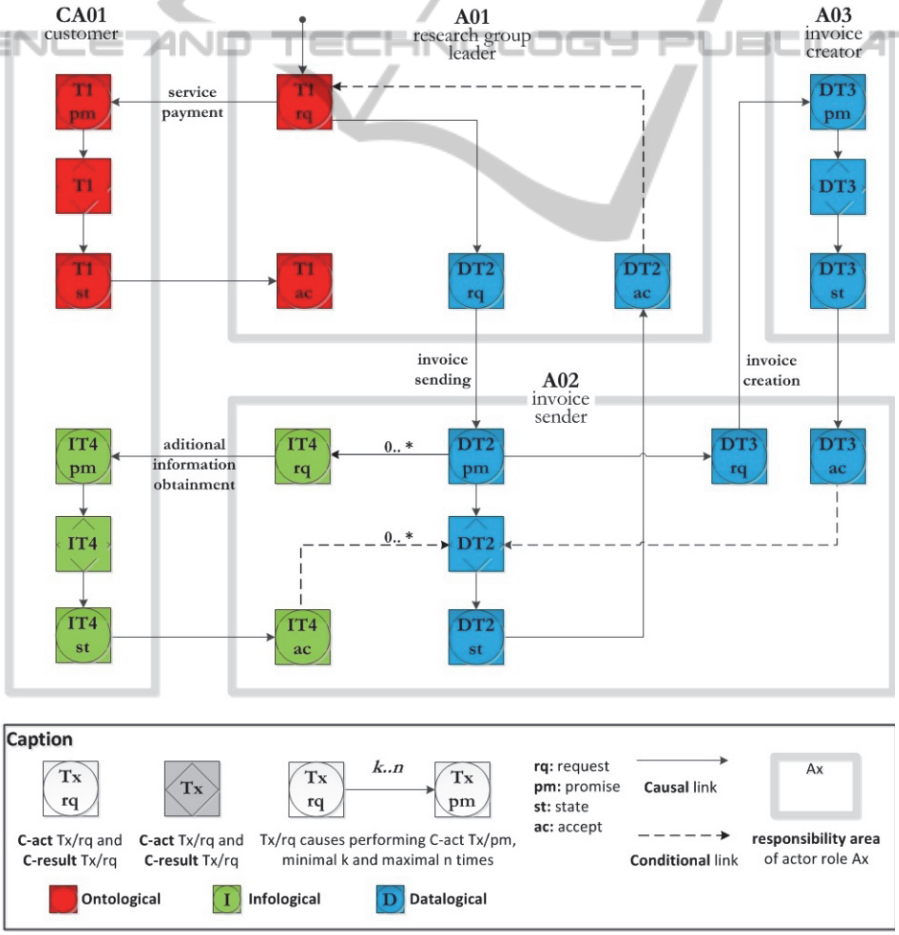

Figure 4: Process Structure Diagram (PSD).

In Fig. 2 we can see the first dependency is that in order to pay for the service, an invoice has to be sent first, but for that it has to be created (second dependency).

The third dependency is the result of additional information to pay the service. Since this dependency is optional, the minimum number is zero and the maximum number is variable.

4.1.1 Interaction Model

The interaction model is presented next, where transactions are coloured accordingly to the distinction axiom.

In Fig. 3 the actor role A01 (research group leader) represents the person who want the service to be paid (Transaction T1) by the customer, represented by the actor role CA01. The actor roles A02 and A03 represent the person who works in the Invoice Department, responsible for sending (transaction DT2) and creating the invoice (transaction DT3). Actor role A02 can also request to customer additional information (transaction IT4).

4.1.2 Process Model

In figure 4 we present the Process Structure Diagram (PSD) for invoice management.

In PSD we colour the acts accordingly to the distinction axiom. Transaction T1 represents a request for service payment, by the Research Group Leader to customer. Transaction DT2 is initiated and leads to a request for invoice sending, by the Research Group Leader to the invoice sender. If more information was needed, IT4 request would be initiated by the invoice sender and executed by customer, this demonstration consider that IT4 do not happen. In Transaction DT3 there is a request for invoice creation, by the invoice sender to invoice creator.

We could continue to present the other diagrams, but ATD and PSD are enough for this demonstration, since they have all the information we need to proceed to the Cost Model phase.

4.2 Cost Model

The second phase of the demonstration continues with Cost Model, which is composed by three steps: 1) Calculate Capacity Cost Rate; 2) Calculate Cost Equations; 3) Fill Cost Tables.

4.2.1 Capacity Cost Rate

Based on the PSD of Fig. 4 we construct Table 4 to show CCR for Actor Roles, using Eq. 3 in which the expenses and available capacity indicated are only estimates (considered to be four times more than the cost of a salary).

Table 4: Capacity cost rate calculation.

Actor Role	Expenses Attributable by month	Available Capacity in minutes	CCR €/min
CA01 Customer	€ 6000	9000 minutes	0.67
A01 Research Group Leader	€ 8000	9000 minutes	0.89
A02 invoice Sender	€ 4000	9000 minutes	0.44
A03 Invoice Creator	€ 4000	9000 minutes	0.44

4.2.2 Cost Equations

In this step we calculate the cost equations, which calculations are in attachment (see Appendix).

Table 5: Transaction T1 Costs.

$T1_{cost}$	rq	dc	qt	pm	ex	st	rj	sp	ac	€24.44
A01 Research Group Leader	€16	-	€0	-	-	-	€0	-	€1.78	€17.78
CA01 Customer	€0	€0	-	€1.33	€4	€1.33	€0	€0	€0	€6.67

Table 6: Unitary Transaction Cost for each Actor Role.

	CA01	A01	A02	A03	Sum
T1	€6.67	€6.22	€0.00	€0.00	€12.89
DT2	€0.00	€4.44	€3.56	€0.00	€8.00
DT3	€0.00	€0.00	€1.33	€2.22	€3.56
IT4	€0.00	€0.00	€0.00	€0.00	€0.00
Sum	€6.67	€10.67	€4.89	€2.22	€24.44

Since Transaction IT4, corresponding to additional information obtainment, was not initiated the cost equations for this transaction were not presented.

4.2.3 Cost Tables

Next we fill the first cost table to calculate each act cost. Notice that we only have one transaction represented in Table 5, since there is only one transaction that has result at the end of result structure chart.

The reasoning to obtain implementation costs of T1rq was:

$$T1rq\_cost = T1rq\_(unit.cost) + DT2\_cost + DT3\_cost = €4.44 + €8.00 + €3.56 = €16.00 \quad (7)$$

We do not present a similar table to Table 2 to represent this Business Process Costs, since there is only one ontological transaction. However, we choose to represent in Table 6 the cost of each unitary transaction (without its implementation cost) for each actor role.

In Table 6 we can observe that Business Process Cost is €24.44, but if we exclude CA01 cost, the client participation on costs, we can calculate organization invoice management cost: €24.44 - €6.67 = €17.78.

5 EVALUATION

This evaluation assesses the demonstration we made at Invoice Department. We have collected feedback from practitioners, applied the Moody & Shanks Framework and used the Österle principles.

5.1 Evaluation Strategy

In this subsection we identify what is actually evaluated, how it is evaluated and when the evaluation takes place. To do so we illustrate the answers in three questions proposed by the framework (Pries-Heje 2004):

- What is actually evaluated? The artifact to be evaluated is the method proposed, Section 3.2;
- How is it evaluated? We used feedback gathered, the Moody & Shanks and the Österle Principles to evaluate the DEMO-based Cost Model. This represents a naturalistic evaluation, it was conducted in a real organization, using a real artefact;
- When was it evaluated? It was evaluated ex post, after the design artefact was developed.

To evaluate the proposed artifact, using the eight quality factors of the Moody & Shanks Framework, the following results are presented:

- Completeness: our focus is on one specific part of the organization, however we consider that the Transaction Result Table and the Actor Transaction Diagram can represent consistently the description of the Invoice and Research Departments;
- Integrity: we have identified dependencies between the transactions which are illustrated in the Process Structure Diagram (PSD), and expressed the organization business process;
- Flexibility: this aspect of quality decreases with the increase of the number of transactions, actor roles and dependencies;
- Understandability: the models at the beginning are difficult to understand because the stakeholders must know DEMO in order to model the organization with the models proposed in this methodology;
- Correctness: DEMO and TDABC have strong theoretical foundation, that allows to model correctly organizations and trace the implementation costs of essential operations;
- Simplicity: DEMO and TDABC allow to overcome the complexity of organizations;

- Integration: with the description of the organization we have enough information to construct the Transaction Result Table (TRT), the Result Structure Chart and to model the organization. We think that these models are consistent with organizations reality and allow to model the organization in a consistent way, by easily integrating DEMO and TDABC;
- Implementability: this artifact can be implemented since DEMO allows to model the organizations implementation operations details and focuses on organization essence.

As results of applying Moody & Shanks Framework, the negative aspects were Flexibility and Understandability, the other aspects have a positive result.

5.2 Österle Principles

We present the evaluation of the proposed artifact, based on the feedback received from academics and practitioners. This research was presented at a workshop, attended by experts who gave some positive feedback of our proposal, allowing us to answer the Österle principles:

- Abstraction: this artifact can be applied to different organizations and operations, considering the ontological, infological and datalogical layers. Organizations operations can be identified through interviews, documents and from a given description;
- Originality: the proposed artifact has the novelty of combining DEMO and TDABC. This new approach allows to aggregate implementation details into actor roles, regarding time equations in transaction acts;
- Justification: the artifact is justified by the ”Theorical Background” of DEMO and TDABC, with a strong conceptual foundation allowing to eliminate all the inconsistencies and limitations occurring in other solutions. Also, our artifact was validated by the positive feedback gathered when communicating our findings to practitioners, as explained before;
- Benefit: the DEMO-based Cost Model allows to identify and trace the costs of implementing the organizations essential operations in a fast and easy way. The feasibility of aggregating costs especially between actor roles and their responsibility in acts, transactions and business process cost, gives an important contribution to solving the identified problem.

6 CONCLUSIONS

Managing organizations is a growing challenge due to their complexity. The traceability between the organization essence and the respective implementation costs has been lost. Most organizations do not have a coherent, comprehensive and consistent vision of the costs related to the essential operations (Dietz, 2006).

In this research we have presented a DEMO-based cost model solution. We expect that this solution can give a contribution to the understanding of essential operations costs, relating them to their implementation costs and areas of responsibility. So far we found several aspects: it is possible to have a traceability between the enterprise essence, the implementation costs and responsibility areas costs; an association is possible between TDABC terms and DEMO terms; a composite cost structure can be constructed in DEMO, relating acts cost, transactions cost and business process cost.

The research was conducted using the Design Science Research Methodology. The evaluation of our proposal uses several methods as the Moody and Shanks Quality Management Framework, the Österle et al. principles and communication to scientific community. As future work, we intend to apply and validate our proposal in several organizations in the next months. Also we intend to submit papers, communicating our findings to the scientific community and other interested audience.

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APPENDIX

T1	A01 Research Group Leader		Actor Role CCR:	0,89 / min		CA01 Customer		Actor Role CCR:	0,67 / min	
Act	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost
rq	5	1	0,00 €	0,00 €	4,44 €	0	0	0,00 €	0,00 €	0,00 €
dc	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
qt	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
pm	-	-	-	-	-	2	1	0,00 €	0,00 €	1,33 €
ex	-	-	-	-	-	6	1	0,00 €	0,00 €	4,00 €
st	-	-	-	-	-	2	1	0,00 €	0,00 €	1,33 €
rj	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
sp	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
ac	2	1	0,00 €	0,00 €	1,78 €	0	0	0,00 €	0,00 €	0,00 €
Total				0,00 €	6,22 €				0,00 €	6,67 €
Total Transaction Cost										12,89 €

DT2	A01 Research Group Leader		Actor Role CCR:	0,89 / min		A02 Invoice Sender		Actor Role CCR:	0,44 / min	
Act	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost
rq	3	1	0,00 €	0,00 €	2,67 €	0	0	0,00 €	0,00 €	0,00 €
dc	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
qt	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
pm	-	-	-	-	-	0	1	0,00 €	0,00 €	0,00 €
ex	-	-	-	-	-	5	1	0,00 €	0,00 €	2,22 €
st	-	-	-	-	-	3	1	0,00 €	0,00 €	1,33 €
rj	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
sp	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
ac	2	1	0,00 €	0,00 €	1,78 €	0	0	0,00 €	0,00 €	0,00 €
Total				0,00 €	4,44 €				0,00 €	3,56 €
Total Transaction Cost										8,00 €

DT3	A02 Invoice Sender		Actor Role CCR:	0,44 / min		A03 Invoice Creator		Actor Role CCR:	0,44 / min	
Act	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost	Estimated Time	Number Occurence	Specific Cost	Dependencies Cost	Total Cost
rq	2	1	0,00 €	0,00 €	0,89 €	0	0	0,00 €	0,00 €	0,00 €
dc	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
qt	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
pm	-	-	-	-	-	1	1	0,00 €	0,00 €	0,44 €
ex	-	-	-	-	-	3	1	0,00 €	0,00 €	1,33 €
st	-	-	-	-	-	1	1	0,00 €	0,00 €	0,44 €
rj	0	0	0,00 €	0,00 €	0,00 €	-	-	-	-	-
sp	-	-	-	-	-	0	0	0,00 €	0,00 €	0,00 €
ac	1	1	0,00 €	0,00 €	0,44 €	0	0	0,00 €	0,00 €	0,00 €
Total				0,00 €	1,33 €				0,00 €	2,22 €
Total Transaction Cost										3,56 €