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Methodology of synchronization among strategy and operation. A standards-based modeling approach

Metodología de sincronización entre la estrategia y la operación. Un enfoque de modelado basado en estándares

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ABSTRACT

Enterprise Architecture (EA) has gained importance in recent years, mainly for its concept of "alignment" between the strategic and operational levels of organizations. Such alignment occurs when Information Technology (IT) is applied correctly and timely, working in synergy and harmony with strategy and the operation to achieve mutually their own goals and satisfy the organizational needs.

Both the strategic and operational levels have standards that help model elements necessary to obtain desired results. In this sense, BMM and BPMN were selected because both have the support of OMG and they are fairly well known for modelling the strategic level and operational level, respectively. In addition, i* modeling goal can be used for reducing the gap between these two standards. This proposal may help both the high-level design of the information system and to the appropriate identification of the business processes that will support it.

This paper presents a methodology for aligning strategy and the operation based on standards and heuristics. We have made a classification for elements of the models and, for some specific cases, an extension of the heuristics associated between them. This allows us to propose methodology, which uses above-mentioned standards and combines mappings, transformations and actions to be considered in the alignment process.

Keywords: Enterprise architecture, strategic alignment, intentional modeling, goal models, goal orientation, BMM, i*, BPMN, BPM.

RESUMEN

La Arquitectura Empresarial (EA) ha ganado importancia en los últimos años, principalmente por su concepto de "alineación" entre los niveles estratégico y operacional de las organizaciones. Dicha alineación ocurre cuando la Tecnología de la Información (TI) se aplica correcta y oportunamente, trabajando en sinergia y armonía con la estrategia y la operación, logrando mutuamente sus propias metas, y alcanzando las necesidades de la organización.

Tanto los niveles estratégicos como los operativos tienen estándares que ayudan a modelar los elementos necesarios para obtener los resultados deseados. En este sentido, el BMM y el BPMN fueron seleccionados debido a que tienen el soporte de la OMG y son bastante conocidos para modelar la estrategia y la operación respectivamente; además, el modelado de objetivos i* puede ser utilizado para reducir la brecha entre los dos estándares. Esta propuesta podrá ayudar tanto al diseño de alto nivel del sistema de información como a la identificación apropiada de los procesos de negocio que lo soportarán.

Este artículo presenta una metodología para alinear la estrategia y la operación basada en estándares y heurísticas. Hemos realizado una clasificación de los elementos de los modelos y, en algunos casos específicos, una extensión de las heurísticas asociadas entre ellos. Esto nos permite proponer una metodología que utiliza los estándares antes mencionados y que combina mapeos, transformaciones y acciones a considerar en el proceso de alineación.

Palabras clave: Alineación estratégica, modelado intencional, modelado de objetivos, arquitectura empresarial, orientación a metas, BMM, i*, BPMN, BPM.

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Introduction

Often, companies of any size and economic capacity define from its beginnings the visionary and basic concepts necessaries for its constitution; during this process, companies include motivational elements such as vision, mission and projection of objectives. As time passes and in a natural process, organizations´ strategy and processes tend to lose synchrony. This is mainly caused by a market´s active dynamic or the organizations own management of the business' context, which in turn produces a continuous evolution of its processes.

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Consequently, finding diverse alternatives to achieve a greater alignment between strategy and business processes constitutes a challenge and a priority for the development of the strategic and operative components within the framework of an enterprise architecture - EA (Goethals *et al*., 2006; Lankhorst *et al*., 2005).

Our proposal complements in several aspects some previous and independent work in the domain of alignment between strategic and operational models (Alves *et al,* 2013; Bleistein *et al*., 2006; Cravero 2012; Koliadis *et al*., 2006). We have contributed to the state of art in the paradigm of the strategic - operational alignment. We defined an integral methodology that will allow the tasks of modeling and bi-directional alignment among different levels of abstraction to be optimized in a practical manner.

In the beginning, organizations use BMM (OMG: BMM, 2015) to define the organizational strategy (motivation) and BPMN (OMG: BPMN, 2013) to model business operations. The correspondence between the two models is not evident and sometimes "ad hoc" methods that don't allow reutilization or generalization are used. In this context, in order to reduce the natural gap between the motivation and the operational abstraction levels, a modeling agent-goal paradigm called i* (Yu, 1995) is used. To establish a bidirectional correspondence between these models, we have classified, unified and contributed transformation heuristics between the goals model and the operational one by complementing some previous works (Bleistein *et al*., 2006; Alves *et al*., 2013).

Furthermore we developed transformation heuristics between the BMM and i* models, transformation heuristics between the i* and BPMN models, and some additional and specific mapping heuristics between the strategic model and the goal model. Some specific theories of transformation among the strategy and the operation were formed. In addition, we developed some support artifacts (Matrix mapping between constructs, Overview of the Matrix log of alignment) for tracing and controlling the alignment between these models.

Research Context

We have based our work on strategic - operational alignment paradigms, which are current and adopted in most organizations that focus its efforts in the area of the EA. Among them, we can mention the *strategy orientated paradigm*, that contains modeling oriented by goals and agents (Yu, 1997) and whose goal-oriented and agent-oriented approach have been important in the field of requirement engineering (RE). Therefore, frameworks that share this concept such as NFR (Chung *et al*., 2000), KAOS (Bodhuin *et al*., 2004) and GRL (Amyot & Mussbacher, 2002; GRL, 2016) have demonstrated significant advantages in organizational impact during strategy modeling.

One of the framework derived from strategy-oriented paradigm is called i* (Yu, 1995), which allows modeling organizational goals and the relationship between the ones that are responsible for the organization, adopting an approach of the intentional domain y socio-technical. i* is normally used to model and understand the internal relationships and the external environment of an organization. This includes actors, goals and responsibilities of dependencies and alternatives (Horkoff and Yu, 2009). i*'s methodology includes: the Strategic Dependence model (SD), which describes how stakeholders depend on each other inside an organizational context; the Strategic Rational model (SR), which mainly describes stakeholder's interests and concerns by means of intentional elements such as goals, soft goals, tasks and resources, as well as particular dependencies with other elements inside the organizational context (Yu, 1995).

On the other hand, there are interesting works such as Yu *et al*. (2006); Cravero *et al*. (2009); and Cravero, (2012) illustrating the potential use of BMM together with i* supporting intentional modeling and Enterprise Architecture (EA) analysis under different perspectives.

The Business Motivation Model (BMM) focuses primarily on modeling intentionality thus providing a framework for developing, communicating and managing business plans in an organized way (BGR, 2016). This structured meta-model introduces elements and intentional interrelationships, this includes: the *ends*, describing the aspirations of the company, the *means* defining plans the company utilizes to achieve those ends and the *tactics and strategies* to be implemented to fulfill those purposes. The model includes so called *influencers*, those elements that can positively or negatively impact the organization's operation, means and ends (Collazos & Duarte, 2016).

Additionally, BMM model has referenced four relevant concepts: *Asset, Organization Unit, Business Process, and Business Rule*; which have roles in BMM structure but actually belong in other standards OMG, where they are defined. Also, for construction of BMM model, techniques such as VMOST (Bleistein *et al*., 2006) and VMOST Extended (Collazos & Duarte, 2016), can be considered as semi-structured tools to define the business strategy.

Another one of the paradigms that we address in this work, related with the *strategic - operational alignment*, aims to reduce the natural gap in the level of abstraction that exists between the strategic model and the operative model of business processes. Under this concept, in addition to strategic modeling, efficient operations design and modeling of business processes with its corresponding implementations are also treated as significant. It is here where the BMPN modeling standard serves as a common language, easy to interpret, for modeling business processes in a graphical manner.

In relation with this work, the literature presents specific cases such as those as described by (Bleistein *et al*., 2006; 2006 (b)), in which the strategy of an organization is represented through the i* goals and BMM models, distinguishing the business level above the information technology (IT) level with the objectives level, and establishing the correspondences between them. This approach differs from our work on the goals and in the omission of a context focused on strategic and operative alignment using BPMN to define the operational business model.

Although, the literature shows us some proposals that try to independently integrate strategy with the goal model (Cravero *et al*., 2009; Cravero, 2012), and others based in i*'s goal model and BPMN (Alves *et al*., 2013; Koliadis *et al*, 2006), we consider that our proposal is more complete and structured since we've supplemented it with new heuristics that can enables the passage between the different levels of abstraction and the introduction of new artifacts that make the alignment process more practical.

Methodological Alignment Proposal

Some authors like Reich *et al*., (1996); Luftman, (2000); Theve-net, (2006) state that an "alignment" takes place when information technologies (IT) are being applied correctly and opportunely, working in synergy and harmony with strategy and operations to achieve IT's own goals, and satisfy the organizational needs.

Our approach based on heuristics (Reeves, 1996) and (Manie-ga, 2010) complement some previous works based in this concept (Koliadis *et al.*, 2006; Alves *et al.*, 2013); here we have focused on classifying the elements of the models extending some of the heuristics. This allow us to propose a methodology that applies an integral vision of mappings, transformations and actions to bear in mind in the alignment process using BMM, i*'s goal model and BPMN.

Below, we present the heuristic proposed to bear in mind in the alignment process between the different levels of abstraction, obtaining concrete guidance for processing and aligning each model's elements.

Heuristic of Transformation between models BMM and i*: Table 1 shows the key heuristics, in the identification of the goal model i* from the elements of the model BMM and vice versa.

The alignment, in principle, can mostly be deduced by the analyst (Horkoff, 2006). This transformation allows to reduce the gap that exists between the abstracts levels strategic and operational. Here our additional contribution by heuristics: 6 (b), 7-12.

Table1. Transformation heuristics between BMM and i* models

Model Element		# Heuristic.		Description
BMM	**I***			
Vision	Softgoal	1		Determined as the overall objective realized in the organizational unit in question (organization or area), Must be in a general sense abstract and implicit in the model (SR) and fully coherent with the *Softgoals* defined
Mission		2		There may be bi-directional transformation as follows:
	Softgoal		(a)	It must be coherent with the mission of the organizational unit, and must be represented abstractly, based on objective elements deduced as strategies
	Task		(b)	In a model with a low level of detail it can be represented as a task element i*, which uses task decomposition links with regard to the tasks defined as strategies
Strategy	Objective	3		Strategies BMM can be represented by *Objetives* i* also named hard goals
Objective	Objective	4		An objective, which is part of the desired result in BMM, can be represented by a hard goal in i*
Goal	Softgoal	5		Each actor present in the scope transforms into a participant in the BPMN model
Tactic	Task		(a)	A tactic can be translated into a task i*
	Resource		(b)	A resource can include a tactic according to human judgment
Directive (Policy Rule)		6		Using human judgment, a policy type directive and business rule can be aligned as follows
	Softgoal		(a)	A BMM directive may be represented with a *Softgoal* or vice versa by human judgment
	Artefact		(b)	If the narrative of the directive includes some *Artifact* (resource, device, group, data), it can be transformed into a *resource* element
Influencer		7		An *Influencer* (Internal or external) identified in the narrative or model may be analyzed as follows
	Actor		(a)	If it is identified as an *Actor, Position, Agent or Role*, can be transformed into its corresponding element, according your narrative and human judgment
	Artefact		(b)	If the narrative is associated with a resource element it can be transformed with the corresponding type using human judgment

Model Element		# Heuristic.		Description
BMM	**I***			
Influencer	Softgoal (Dependum)	7	(c)	The narrative can through human judgment, give a *Dependum* element between the actors involved, so that your influence on the model is evident
Organization Unit		8		A Placeholder *Organization Unit* identified in the narrative or model may be analyzed as follows:
	(infers title)		(a)	Defines the name of the entire organization or an area in which the model (SR) i* in question is focused, or vice versa. This name infers in the title or name of the defined model
	Actor		(b)	An *Organization Unit* may be represented with an *Actor* i* or vice versa, according to detail of model. This can be inferred and decomposed into multiple actors and types through human judgment
Business Process	Task	9		A Placeholder Business Process may be represented with a Task (Root)
Business Rule	Softgoal	10		A Placeholder Business Rule may be represented with a Softgoal associated whit the root task in i* model
Asset	Resource	11		A Placeholder Asset may be represented with a Resource i*
Mission, Vision, Goal, Objective, Directive	(*Softgoal, Goal, Task*)	12		A relationship between model elements through links should be analyzed in detail, depending on the judgment made by the analyst, may have the following cases:
	Contributions Links		(a)	A *Contribution link* is defined when one or more goals fail to meet the fulfillment of a *Softgoal*. According to the type of concept is defined dependence *Softgoal* and can be classified as *a Mission, Vision, Goal or Directive* BMM, given by the human analysis made
	Means-End Links		(b)	It is defined a *Means-Ends Link* from the relationship between a *Task* and *Goal* i*. This relationship is evident in the BMM model with respect to their corresponding *Tactic* or *Mission* elements (for Task i*) associated with their respective *Objective* element (equivalent to Goal i*)
	Decomposition Links		(c)	When the satisfaction of a goal or task is accomplished by the total of his sons elements (*Subgoal, Subtask, Resource, Softgoal*), it is defined a decomposition links relationship of type logical 'AND'. Also transformation to their corresponding elements BMM it is given between a *Tactic* or *Mission* (Task i *) that is achieved by the total of the related elements (Vision, Goal, Objective, Directive) as appropriate to human judgment
			(d)	When the satisfaction of a goal or task is accomplished by any of his sons elements, it is defined a decomposition links relationship of type logical 'OR'. Also transformation to their corresponding elements BMM it is given between a *Tactic* or *Mission* (*Task* i*) that is achieved by any of the related elements (Vision, Goal, Objective, Directive) as appropriate to human judgment.

Source: Authors based on (Bleistein et al., 2006; Cravero et al., 2013).

Heuristics Mapping between the models i* and BPMN In comparisons analysis and mappings of elements between strategic and operational models, numerous proposals have evolved (Alves *et al.,* 2013; Fuxman *et al.,* 2004; Giorgini *et al.,* 2004; Koliadis *et al.*, 2006). Those proposals described the possible ways to align goal and operational models systematically. During this mapping procedure, it is important to specify the routines and define their scope (Koliadis *et al.*, 2006; Yu, 1995). Heuristics adopted and in this work have been consolidated, classified and extended, allowing the determination of existing consistencies between models i* and BPMN, as expressed in Table 2. Here our additional contribution by heuristics: 11(b, c).

Table 2. Transformation heuristics between i* & BPMN models

Model Element		# Heuristic.		Description
I*	**BPMN**			
Model SR	Model BPMN	1		Specify routines and define its scope, creating a BPMN model for each routine
Stakeholder	Swimlane	2		Each present actor in the scope model, becomes a participant in the model BPMN:
	Lane		(a)	Actors who do not belong to the same organization (at functional context) transformed into different BPMN Lanes
	Pool		(b)	Actors who belong to the same organization (at functional context), are transformed into different pools in the same Lane
Task	Activity (Task)	3		The internal tasks of the present actors in a scope are included, as an activity, into the lane/pool of the corresponding participant in the BPMN model
Subtask	Swimlane	4		If the task within the scope is decomposed, its subtasks must be analyzed as follows:
			(a)	If the *Subtasks* must be performed in parallel, they become activities parallel in the *Lane/ Pool* of the corresponding *Actor*
	Secuence Flow		(b)	If the *Subtasks* must be performed in sequence, they become activities linked through *Sequence flows*
Task Dependum	Activity/ Link flow message	5		A *Task Dependency* is included as an activity in the corresponding lane to the D*ependee* actor, and a message flow links from the present activity in the lane corresponding to the *Depender* actor
Goal (Hard)	End Event	6		A goal become an end event:

Model Element		# Heuristic.		Description
I*	BPMN			
Goal (Hard) Dependum	End Event		(a)	If the *Goal* is a dependency, the end event could be included in the lane corresponding to the *Depender* actor, according to human judgment made by the analyst
Goal (Hard)	End Event		(b)	If the goal is an internal element of an actor, the end event is included in the *Lane/Pool* of the corresponding actor, according to human judgment made by the analyst
Root Task	Start Event	7		The *root Task*, related to the chosen routine, becomes the initial event that triggers the process
ResourceDependum	Artefact / Flow message	8		A *Dependum Resource* becomes an artifact produced by the present activity in the participant that represents the *Dependee* actor. Two flows of messages have to be added among the activities related to the assigned participants for the *Depender* and *Dependee* actors. These flows of messages have to be placed in opposite directions
Task	Sub process	9		When the task is decomposed into more than one level, it will be transformed into a sub-process
Subtask	ActivitySequence	10		A sequence of activities in the BPMN model must be analyzed, and depending on the analyst's judgment, they could become sub-tasks of the same decomposed task or tasks without a father or sons
Softgoal		11		According to human judgment, a *Softgoal* can be aligned as follows:
	Infer activities		(a)	Softgoals are not modeled in BPMN, but they can be inferred by searching and definition of quality attributes associated to the activities performed by the participants
	Artefact		(b)	If the *Softgoal* narrative includes any *Artefact* (resource, annotation, group, data), it can be transformed into a *Resource* element
			(c)	By not modeling *Softgoals* they can also be defined Artifacts of type *Annotation* so that it conceptually enriches the intention of the diagrammed process

Source: Authors, based on (Koliadis et al., 2006; Alves et al., 2013).

Other Heuristics of i*Transformation towards BMM. During this proposal development, the proposal of some additional heuristics have been considered that might be taken into account during the transformation process, specifically, from the i* model towards BMM. This will allow the one modeling to cut time in strategic synchronization, optimize the alignment procedure of the motivational model with the objective model, besides enriching mutual, syntactically and semantically its elements. This corresponds to Table 3.

Table 3. Other Transformation Heuristics between i* & BMM models

#	Description of Heuristics
1	Tactics are actions that use resources to achieve an objective, in this sense, a resource in the BMM model must be deducted by the analyst's judgment and based on the formulated tactic; therefore, a resource cannot be literally expressed as a tactic in the model
2	In the construction of modeling alternative (SD) i*, efforts are needed to not remove objectives or goals previously defined, unless they are modified with the analyst's argument and criteria. Maintaining enough Softgoals will enrich the BMM model syntactically and semantically
3	All resources -defined in the model (SD) i*- must be related to at least one tactic, if orphans tactics resources exists after the transformation process, it is necessary, by using human judgment, to define the new tactic given the criteria and the strategic need applicable
4	In case that an element (SD) i*'s syntax is modified it necessarily implies that a change of type is necessary on its corresponding BMM element in a transformation process, eliminating the BMM element and the addition of a new one, depending on the applicable type, should be considered, all this to human judgment by the one modeling (e.g. Change an *Objective* by a *Goal*)

Source: Authors

Support artifacts in the alignment

According to the views expressed by Karunakaran & Purao (2012), artifacts such as templates represent certain processes' materials, which can facilitate their execution. This motivated us to build some concrete artifacts like matrices and templates as a guide for the alignment procedure and synchronization of the strategic and operational models. This approach, as a constructor under the design science paradigm (March and Smith, 1995) also has been adopted in others proposals (Collazos & Duarte, 2016).

Matrix mapping between constructs and its elements During the alignment procedure between BMM, i* and BPMN, the need to optimize the way referencing their basic elements between each other arises. Thus, we have designed a transposed matrix (At) of symmetrical type (*nxn*) (Grone *et al*., 1987), applying concepts of Toeplitz and Hankel matrices (Ikramov & Chugunov, 2016), that allows the mapping between the models and their basic elements wherein, for each one and doing its transposition, will always give us the same result guaranteeing that the search and alignment with any order (descending, ascending, vertical or horizontal, from the BMM towards i* and BPMN or vice versa), will always coincide independently from the criterion of orientation applied.

Figure 1 shows the matrix in question, showing, highlighted in red, how, for instance, the element i* **Goal** can be mapped with the element BMM **Objective** or **Strategies (horizontal or vertical view)**. Likewise, it shows how it can be aligned with the BPMN **Event End** element. This logic is applied reversely among any of the elements of the models involved. . In the present document (for space reasons), the narrative of some detected equivalences between BMM and BPMN models is not defined into a heuristics' table, some of them through human judgment applied, however, in the alignment matrix of Figure 1, their respective co-relations can be directly identified, which are fully aligned with their corresponding associations to the i* model.

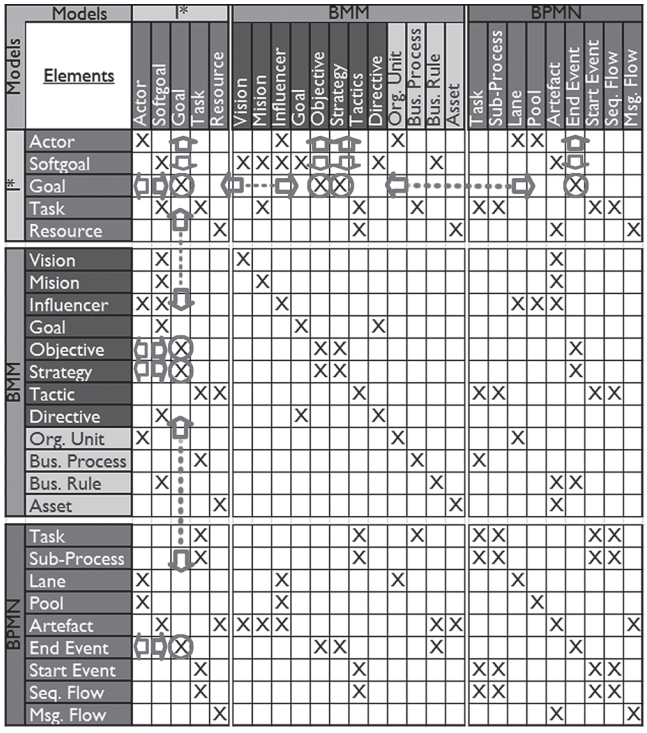

Figure 1. Matrix mapping between constructs.
Source: Authors

Matrix log of alignment between elements*:* The evidence presented by the literature is adopted for the strategic-operational alignment, intuit the application of analytical and manuals procedures, which are based on subjective reasoning in the use of mapping mechanisms among the elements of the aligned models. This can be very handy in models whose size are small or relatively moderate, but to implement the strategic and operational mapping in an integrated and directly way, in models with medium or larger sizes, can result in a very complex process for the one modeling. Moreover, the process is more complex when software tools that support the concept and process of transformation are not available, even more so with the absence of traceability of the operations executed.

This is why we contribute by defining a concrete artifact as a template that allows traceability to be objectively retained and alignment between elements of the involved models; this will allow us to textually keep the traceability applied (sequence) and the executed actions (add, update, delete) for every instance of the element aligned in the procedure, while providing practicality during the transformation routine in a bidirectional way.

The proposed matrix works jointly with the **matrix alignment constructs** mentioned in the preceding block. It is composed of several sections: there is the item number (# Item) identifying numerically every transformation operation realized to a specific element and its corresponding element to align. There is also specific sections for BMM, i* and BPMN and their corresponding basic elements (Elements) that can be correlated in a transformation procedures, this, accompanied by the instance name (Instance Name) of the element that applies in a particular way. In addition, it comprises a numerically column for keeping the reference (# Ref.) of each punctual change of the model (SD/SR) resulting in i* or BMM according to the direction of transformation.

It also has a column responsible for defining each operation (item) the action (Action) to be performed by a particular model (Model that executes the **"**Action**"**) among which are: **Add, Update or Delete**. The use of this matrix corresponds to a manual procedure and to an objective analysis by the one modeling. Figure 2 shows the procedure described above.

Running Example

The model of alignment has been evaluated by a systematic method, as is evidenced in (Collazos, 2016). In this section we present a simple example to facilitate understanding of the integral procedure of alignment proposed. Accordingly, we have selected a basic example defined in the official documentation of the BMM motivational standard related to a Pizza Company. Initially, each motivational statement was classified in its respective element, sub-element and associated description according to the BMM model and applying the VMOST and VMOST Extended techniques. The strategic model of pizza Company is shown in Table 4.

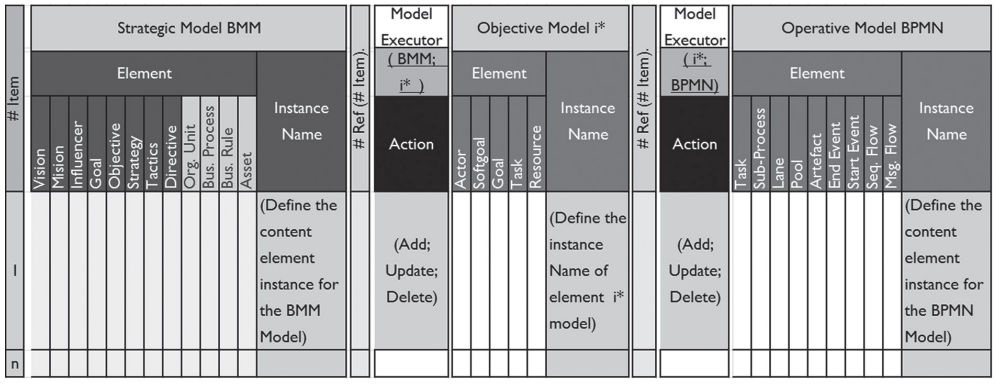

Figure 2. Overview of the Matrix log of alignment.
Source: Authors

Table 4. BMM Case for Pizza Company

Element	Sub-Element	Description
Organization Unit	--	Pizza Company
Business Process	--	Make pizzas
Business Rule	--	Making pizzas should have mutual benefits (customers / company)
Vision	--	Be the city's favorite pizza place
Mission	--	Provide pizza to customers city-wide
Goal		To keep customers satisfied
|_	Objective	To deliver pizzas in an expedient amount of time
|_	Objective	By January 1, 2007, 95% on-time pizza delivery
Strategy		Deliver pizzas to the location of the custo-mer's choice
|_	Tactic	Hire drivers with their own vehicles to deliver pizzas
Business Policy		Safety in the kitchen, and in the streets, comes first
|_	Business Rule	Pizzas must be delivered within one hour
|_	Business Rule	Pizzas may not be delivered beyond a radius of 30 miles
External Influencer	--	Instructions and current trade regulations
Assessment	Opportunity	The bankruptcy of Pizza Company's major competitor in Region-Y is assessed to be an Opportunity in its Goal "To increase market share

Source: Authors

The alignment in this case is of descending type, causing the process from the Strategic model towards the Operational model (*BMM* ⟶ *i** ⟶ *BPMN*). Once classified the types and instances names in the identified BMM model, they are defined according to the section of BMM elements of the *Matrix log of alignment*. This will be the starting point for applying the correspondences between the elements of the motivational BMM model and the objective i* model, applying for each operation (# item) its correlation as appropriate. For that purpose, we rely on the *Matrix mapping between constructs* previously discussed, as well as its base and the heuristics of alignment between BMM and i*, described in Table 1.

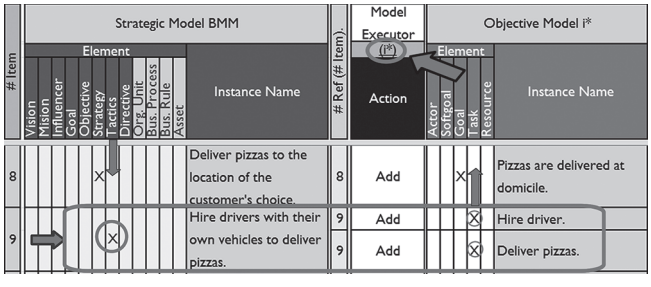

Figure 3. Excerpt from the application of Matrix log in the example of the Pizza Company.
Source: Authors

Continuing with the example above, Figure 3 describes (see the elements highlighted with red) that in the operation 9 (# item 9), an element exists of type *Tactics*, whose transformation originates an *Action* to *Add* a *Task* of the model i* and which *Names of Instance* is transcribed as "Hire driver" and "Deliver pizzas". The reference number (# Ref. 9) indicates that this new operation on i* model (To add new task), comes from the operation described initially in item # 9.

We have omitted the i* (SD) resulting model for space reasons; nevertheless in Figure 4, we show the corresponding (SR) i* model for the current case of the Pizza Company.

The figure demonstrates, for example, how the element Task in (SR) i* with *Name of instance* "Hire driver" (highlighted with red) (# Ref. 9) in Figure 4, and explained with more detail in the preceding paragraph, is the result of the transformation from the BMM element originated in its operational item (#9), and that corresponds to tactic "Hire drivers with their own vehicles to deliver pizzas" defined with a red circle in the Figure 3.

In addition, we can see how, for instance, # item 8 in Figure 3 describes a strategy with instance name "Deliver pizzas to the location of the customer's choice", and that also by applying the *matrix mapping between constructs* (Figure 1), we find a direct relation with an element i* of type *Goal*, which in turn, by human judgment, has been defined the *instance name* i*: "Pizzas are delivery at domicile". The preceding is evidenced in the Figure 4, # Ref 8.

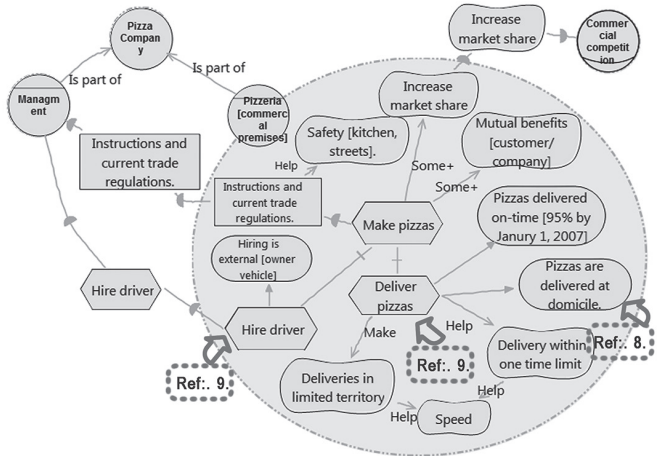

Figure 4. Model (SR) i* resulting from the sample case.
Source: Authors

The same alignment process is applied in the transformation of the Goal I* model to the Operational BPMN model. For instance, (highlighting some instances in red) Figure 5 displays, according to the above, how the Tasks (SR) i* "Hire driver" and "Deliver pizzas", can be transformed to a *Task* element in BPMN and on human judgment has retained the same instance name. This operation has taken as a reference the existing correlation according to the established definition in the *Matrix mapping between constructs*.

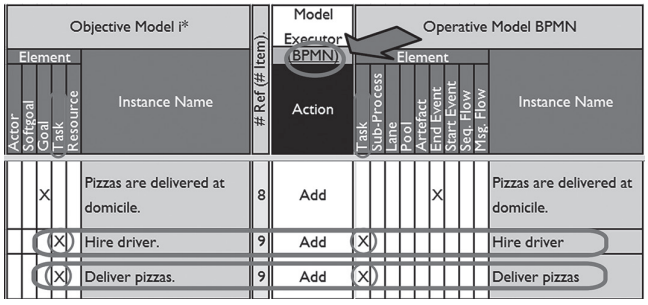

Figure 5. Matrix mapping between constructs.
Source: Authors

After defining the matrix log for the case of the Pizza Company, it is possible to finish with the process of descending alignment and define the corresponding BPMN model. In this case, we apply the transformation heuristic between the i* and BPMN models, as shown in Table 2.

Figure 6 shows the basic BPMN model and the outcome of the transformation process. For instance, it is clear how *Tasks* "Deliver Pizzas" and "Hire driver" were transformed by applying heuristic # 3, both. Similarly it is evident how it is possible to describe in the operative model the corresponding *Softgoal*, in this case, defined in annotations and by human judgment, applying for these cases the new heuristics # 11(b).

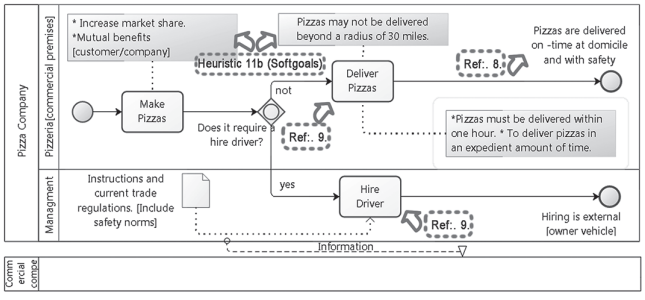

Figure 6. BPMN model aligned with the defined strategy.
Source: Authors

Conclusions

Providing support for organizational analysis by business and motivational modeling, which includes strategic and operational alignment methods, arises as a necessity for any organization ready to optimize their processes in a BPM's context. In this work, our particular contribution has been to provide an approach of organizational alignment based on heuristic techniques. We have also contributed in the classification, definition and extension of bidirectional heuristic mapping among the motivational BMM models, objective i* and operational BPMN. Similarly, another contribution that we have made is related to the construction of new matrix type artifacts, which improve the practicality and traceability of the implemented strategic-operational procedures of alignment (Figures 1 and 2). Moreover, an additional contribution relates to the description, with an example of a practical and simple application is presented in such a way that it facilitates comprehending the approach that we have proposed. The suggested methodology is a support tool that helps both, the Information System designer and the business expert in the alignment between the strategy and the business processes required to accomplish the established motivation.

The alignment approach proposed here has been implemented already in previous works as evidenced in (Collazos, 2016; Collazos & Duarte, 2016) where in a specific case study of a technology company they have been able to do an objective strategic-operational alignment in a bidirectional way, aiding themselves with this fundamental tool for implementing a method for the evaluation of the efficiency of the organizational strategy, demonstrating that the proposed approach covers an integral methodology between strategy and operations, addressing all the levels of abstraction modeling in an EA context.

As future work, efforts can be invested in automating the alignment approach by implementing a tool that can apply the alignment in a systematic and assisted way, especially for models of greater dimensions. It is also very useful to identify specific and productive contexts, where they can validate and provide feedback on this approach that would enhance the effectiveness of the proposal.

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