Aligning Business and System Functionality Through Model Matching

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RÉSUMÉ

Aligner les fonctionnalités du système d'information à la stratégie de l'organisation est crucial. La position développée dans cet article est qu'une partie des problèmes d'alignement est due à la discordance existant entre les modes de pensée et d'expression des managers et ceux des informaticiens. L'article propose de réduire le problème en trouvant un terrain d'entente commun qui est celui de l'expression des intentions managériales par des graphes de buts et des finalités fonctionnelles du système par le même arbre de buts. L'article présente le modèle de la carte (Map) et illustre son usage pour décrire le module MM (Material Management) de SAP par un arbre de buts et de stratégies pour les atteindre. On montre comment cette expression commune peut aider à réaliser l'alignement.

Mots-clés : Alignement, Modélisation des processus métier, Modélisation des fonctionnalités du système logiciel, Modélisation dirigée par les buts.

ABSTRACT

The dependence between organizations and IT leads to better understand the necessary alignment between business models (BM) and associated system functionality models (SFM). The baseline of this paper is that there is a "conceptual mismatch" between languages expressing BM and SFM that should be reduced. For this purpose, we propose to raise the level of SFM from a functional description to a goal-oriented one. We propose to represent goals together with the strategies to achieve them in a directed graph called map. The paper presents the concept of a map and illustrates it with the SAP-MM map. The BM/SFM relationship is then discussed and the alignment problem is highlighted in the case of an ERP system installation.

Key-words: Alignment, Business modeling, System modeling, Goal driven modeling.

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1. INTRODUCTION

It is widely recognised and acknowledged that as organisations become more and more dependent on their Information Systems (IS), they must strive to achieve a closer relationship between the system functionality and their business.

However, although aligning the *Business* and the *System Functionality* are beneficial in theory, companies report low success rates in attaining it in practice (Eatock, 2000), (Reich, 1996). According to (Gliaglis, 2001) one of the reason is that business analysts and IS professionals have traditionally had distinct roles within organizations, each equipped with their own tools, techniques, skills and even terminology. The conclusions we draw from the participation of our group in projects dealing with business change management (Nurcan, 2003), installation of ERP systems (BenAchour, 2000), and integration due to company merge/take-over (Rolland, 2003) are on the same line.

Our analysis of the situation is that there is one recurrent problem, namely the *conceptual mismatch* (Arsanjani, 2001) between the *IS experts* and *organization stakeholders* because the alignment process focuses on the functionality of the Information System. This is particularly true in the case of ERP system installation that we consider in this paper. In Figure 1 we show this at the lower level by the relationship between *enterprise business processes* and the *functions of the ERP enterprise model.* At this level the alignment to organisational needs is difficult to achieve because (a) the amount of detail to be handled is very large and mastering it gets very difficult and (b) organisations think in terms of their goals and objectives and not in terms of ERP functions, data that is to be maintained/supplied and the actions that are carried out. The latter results in a mismatch between organizational needs and their resolution in the ERP system.

Our position is that it is necessary to *minimise this mismatch.* To obviate

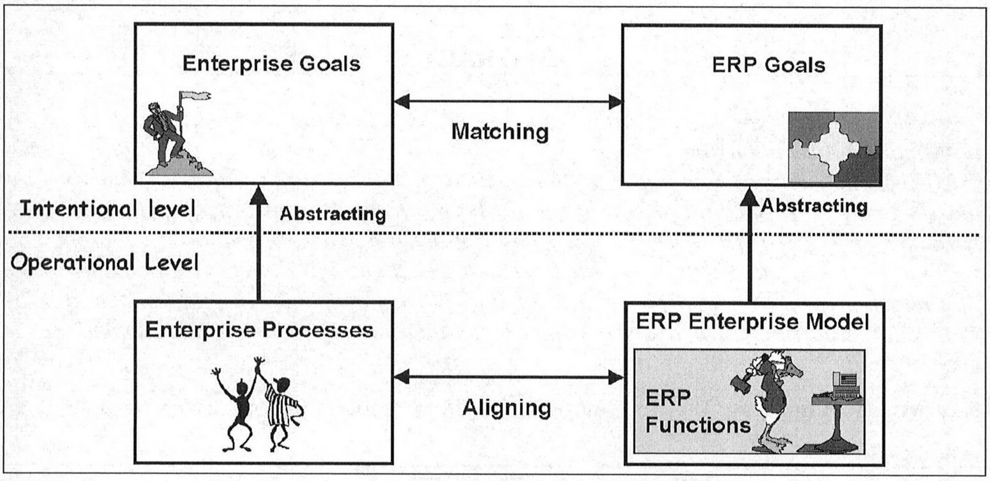

Figure 1: Levels of description.

the aforementioned difficulties we propose that the expression of the functionality of an ERP system should be done in a *goal driven manner.* Goal-oriented approaches have been found useful in both requirements engineering (Potts, 1994), (Bubenko, 1994), (Cockburn, 1995), (Rolland, 1998) and BPR (Lee, 1993), (Anton, 1994), (Yu, 1994), (Ould, 1995), (Hsiao, 1998). In the former they have proved useful in aligning system functions to organisational requirements whereas in the latter, goals drive the re-engineering of business processes; thus, they can help in resolving problem (b) above. By avoiding unnecessary details, goal-oriented approaches help in focusing attention on what is to be achieved and the strategies required to achieve them, thus contributing to the resolution of problem (a).

Our proposal is that the alignment should be done at the higher level of *enterprise business goals.* As shown in Fig. 1, this means that we should develop the notion of *ERP system goals.* An ERP system goal expresses the task that a function carries out and abstracts away from the performance of this task. In so doing, it emphasises the purpose of the system function, its goal. This helps in selecting the ERP system function that meets the organisation's goals.

Goal modelling constructs AND/OR goal hierarchies where AND represents goal decomposition and OR represents alternative ways of achieving a higher goal. Both constructs are relevant for ERP system goals. The former helps us in reasoning about tasks at different levels of abstraction. The latter gives us the notion of the strategy for goal achievement. This is useful because ERP strategies will make explicit the different ways in which an organisation can perform a task and thus, help in the selection of the appropriate ERP function variant during ERP installation.

We conclude that the alignment problem would be mitigated by the development of a *representation system based on goals and strategies.* In this system called *Map*, the tasks performed by functions would be goals and the different ways in which tasks are performed would be goal-achievement strategies. We propose to use the notion of a *map* to represent ERP/IS goals/strategies. A map is a directed labelled graph, with nodes as *intentions* and *strategies* as edges. An edge entering a node identifies a strategy that can be used for achieving the intention of the node. The map therefore, shows which intentions can be achieved by which strategies once a preceding intention has been achieved. Evidently, the map is capable of expressing organisational goals and their achievement. In this paper we show how it can form the bridge between the high level expression of goals/goal-achievement achievement and the low level functional view of an ERP system.

The remainder of this paper is organised as follows. In section 2, the MAP representation system is introduced. We discuss in section 3, how the business of Material Management (MM) is represented as a map that provides both a business view of MM and a the SAP R/3 system view of MM. In section 4 we show how the map can support reasoning about different possible alignments. In section 5 we consider the problem of establishing the alignment and illustrate its application in a real project at SNCF. Finally, in section 6 we draw some conclusions.

2. THE MAP REPRESENTATION FORMALISM

In this section we introduce the *key concepts* of a map and their relationships and bring out their relevance to model the business in an intentional perspective. We thus, sum up the properties of maps and compare the MAP representation system with other modelling techniques.

2.1. Key concepts of a Map

A *map* provides an intentional representation of a business process based on a non-deterministic ordering of intentions and strategies. The key concepts of the map and their inter-relationships are shown in the map meta-model of Fig. 2, which is drawn using UML notations.

As shown in the figure, a *map* is composed of several sections. A section is an aggregation of two kinds of intentions, *source* and *target*, linked together by a *strategy*.

An *intention* is a goal, 'an optative' statement (Jackson, 1995) that expresses what is wanted i.e. a state that is expected to be reached or maintained. *Make Room Booking* is an intention to make a reservation for rooms in a hotel. The achievement of this intention leaves the system in the state, *Booking made*. Each map has two special intentions, *Start* and *Stop*, associated with the initial and final states respectively.

A *strategy* is an approach, a manner, a means to achieve an intention. Let us assume that bookings can be made *on the Internet*. This is a means of achieving the *Make Room Booking* intention, and is a strategy. *By visiting a travel agency* is another strategy to achieve the same intention.

A *section* is an aggregation of the source intention, the target intention, and a strategy. As shown in Fig. 2 it is a triplet <I_{source}, I_{target}, $S_{source\text{-}target}$>. A section expresses the strategy $S_{source\text{-}target}$ using which, starting from I_{source}, I_{target} can be achieved. The triplet <*Start, Make Room Booking, on the Internet*> is a section; similarly <*Start, Make Room Booking, by visiting a travel agency*> constitutes another section. A section is the basic construct of a map which itself can be seen as an assembly of sections.

A map is drawn as a directed graph from *Start* to *Stop*. Intentions are represented as nodes of the graph and strategies as edges between these. The graph is directed because the strategy shows the flow from the source to the

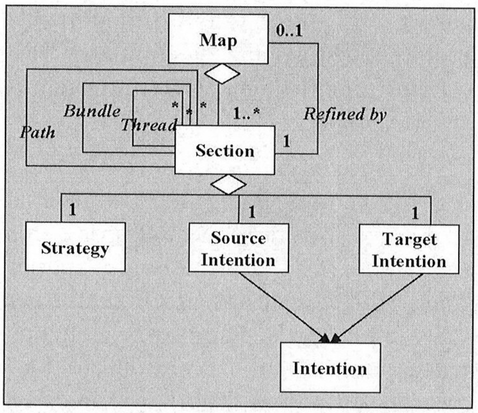

Figure 2: The map meta-model.

target intention. The map of Fig. 3 contains six sections MS0 to MS5.

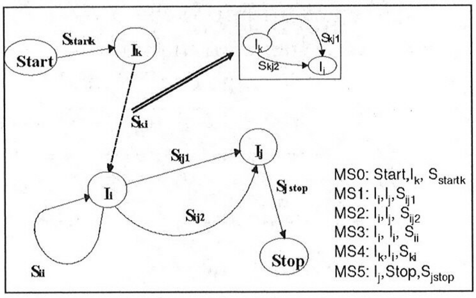

Figure 3: The map as a graph.

Section relationships

There are three relationships between sections, namely the *thread*, *path* and *bundle* which generate *multi-thread* and *multi-path* topologies in a map.

Thread relationship

It is possible for a target intention to be achieved from a source intention in many different ways. Each of these ways is expressed as a section in the map. Such a map topology is called a *multi-thread* and the sections participating in the multi-thread are said to be in a *thread relationship* with one another. MS1 and MS2 are in a thread relationship in Fig. 3. Assume that *Accept Payment* is another intention in our example and that it can be achieved in two different ways, *By electronic transfer* or *By credit card*. This leads to a thread relationship between the two sections shown in Fig. 4.

Path relationship

This establishes a precedence/succedence relationship between sections. For a section to succeed another, its source intention must be the target intention of the preceding one. For example the two sections <*Start, Make Room Booking, On the Internet*>, <*Make Room Booking, Accept Payment, By credit card*> form a path.

Given the thread and the path relationships, an intention can be achieved by several combinations of sections. Such a topology is called a *multi-path*. In general, a map from its *Start* to its *Stop* intentions is a multi-path and may contain multi-threads. MS0, MS4, MS1, MS5 is a path of the map in Fig. 3; MS0, MS4, MS3, MS2, MS5 is another path in the map.

Let us assume in our example that it is possible to *Stop* either because a customer retracts from making the booking (*By customer retraction*) or after payment (*Normally*). Fig. 5 shows the entire map with the purpose to *Make Confirmed Booking*. This map contains 6 paths from Start to Stop out of which two are highlighted in the figure.

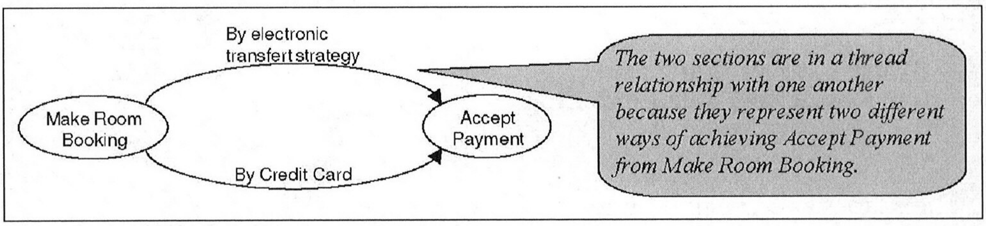

Figure 4: An example of thread relationship.

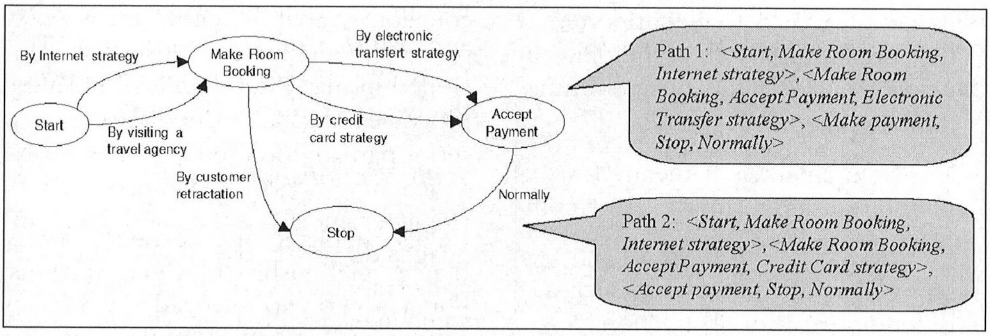

Figure 5: The multi-path of the map *Make Confirmed Booking*.

Bundle relationship

Several sections having the same pair $<I_{source}, I_{target}>$ which are mutually exclusive are in a *bundle relationship*. The group of these sections constitutes a *bundle*. Notice that the difference between a thread and bundle relationship is the exclusive OR of sections in the latter versus an OR in the former.

Refinement relationship

The map meta model also shows that a section of a map can be refined as another map through the *refinement relationship*. The entire refined map then represents the section as shown in Fig. 6. Refinement is an abstraction mechanism by which a complex assembly of sections at level *i+1* is viewed as a unique section at level *i*. As a result of refinement, a section at level *i* is represented by multiple paths & multiple threads at level *i+1*.

2.2. Properties of maps and comparison with other modelling techniques

The Map representation system has the main following properties:

- Map intentions express tasks and hide the details of task implementation. This is important to concentrate on essentail aspects of business and functionality alignment.
- Map strategies are made explicit, thus showing the different alternative ways of achieving a task. This is useful to consider different alternative ways at ERP installation and select one based on a pay-off analysis as we will show it in section 4.
- The map is a multiple assembly of tasks (through multi-path) with possibly multiple alternative ways of achieving tasks (through multi-thread) to reach the same result; thus, representing multiple variations in a class of business processes.
- The map establishes a direct relationship between system functiona-

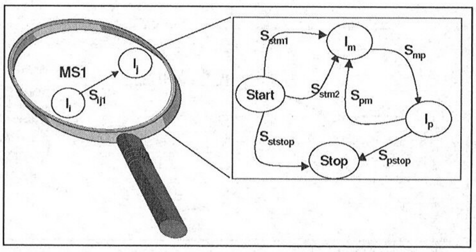

Figure 6: The refinement relationship.

lity and the tasks to be supported in the organization, thus helping in reasoning about the business/function alignment.

- Map refinement is a means for expressing tasks at any level of complexity.
- Map recursion allows customizing at different levels of abstraction.

Maps are goal models and as such they have characteristics similar to AND/OR graphs introduced in Artificial Intelligence and borrowed by most of goal driven requirements engineering approaches (Rolland, 2005). However, maps make explicit the way goals can be achieved through strategies flowing from a source goal to a target goal, thus focusing on goal achievement that is hidden in usual goal models. Besides, maps are directed graphs and they depart from AND/OR graphs by introducing precedence/succeddence relationships between goals. This allows to reflect the ordering of goals in a process plan and coincide with the need for capturing an intentional view of business processes in the goal model.

As process models, maps can be compared to the various types of process modelling languages and formalisms that have emerged supporting a variety of purposes. The existing formalisms can be roughly classified according to their orientation to activity-sequence oriented languages (e.g., UML Activity Diagram), agent-oriented languages (e.g., Role-Activity Diagram (Ould, 1995)), state-based languages (e.g. UML state charts), an intention-oriented languages (e.g. Maps). The concept of goal is central in business process modelling and design. It is included in many definitions of business processes (e.g. "a business process is a set of partially ordered activities aimed at reaching a goal" (Hammer, 1994)). However, most process modelling languages do not employ a goal construct as an integral part of the model. This is sometimes justified by viewing these models as an "internal" view of a process, focusing on *how* the process is performed and externalising *what* the process is intended to accomplish in the goal (Dietz, 2004). In contrast, intention-oriented process modelling focuses on what the process is intended to achieve, thus providing the rationale of the process, i.e. *why* the process is performed. Intention-oriented process modelling such as MAP, follows the human intention of achieving a goal as a force which drives the process. As a consequence, goals to be accomplished are explicitly represented in the process model together with the alternative ways for achieving them, thus facilitating the selection of the appropriate alternative for achieving the goal.

3. DUALITY OF MAPS TO FACILITATE BUSINESS/ FUNCTIONALITY ALIGNMENT

Now that we are aware of the MAP representation system, we show in this section, how maps can help establishing the relationship between the *business view* and the *system functionality view*.

Our analysis of the difficulties encountered in establishing a good fit between the Business and the system functionality is twofold: *(a)* the language mismatch between the business model (BM) and system functionality model (SFM) *(b)* the loose and indirect coupling between BM and SFM. The former comes from the fact that BM and SFM use different systems of concepts. The latter results from non-formally defined relationships between BM concepts and SFM concepts. The relationship between a use case and a component in Catalysis (D'Souza, 2001) or the RUP (Jacobson, 1999) are examples of such loose coupling.

To obviate the first issue we leverage the system functional view into an intentional/goal view and express both the BM and the SFM with the *same language, the Map language.* Besides, in order to express the coupling, i.e. the fit relationship in a more straightforward manner, we establish a direct coupling between the BM and SFM using maps, *by simply relating each section of a map to a system functionality.* Therefore, any section can be regarded from two viewpoints: the *business viewpoint* and the *system viewpoint.*

For example, the map presented in Fig. 7 shows how the SAP Material Management (MM) module can be abstracted into sections of a map (ASAP, 1999). Every section in the map represents both (i) a SAP's MM function, and (ii) the business goal/intention that can be satisfied by using this function.

From the *business viewpoint*, material management deals with supplying materials in the right quantity, at the right place and time, and at the minimum cost. The map identifies that the former requires two intentions: *Purchase material* and *Monitor stock* to be achieved. It also makes explicit the different manners by which each intention can be satisfied. For example, there are four strategies to *Purchase material,* namely *Reorder point planning strategy, Forecast based planning strategy, Manually* and *By reminder strategy.* The *Reorder point strategy* and the *Forecast based strategy* are planning strategies to automatically issue purchase orders whereas *Manually* allows the buyer to manually enter a purchase requisition leading to the generation of the purchase order. Finally, if the delivery is

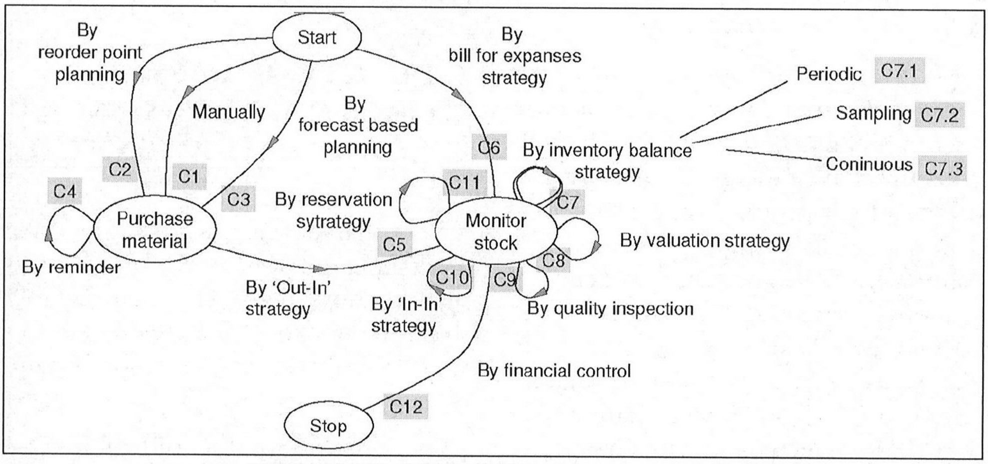

Figure 7: The Material Management Map.

not made in due time then the *Reminder strategy* can be followed to remind the vendor to deliver material.

From the *system viewpoint*, the map indicates which SAP function helps to achieve the *Purchase material* and *Monitor Stock* goals, and how. For example, the SAP MM module contains a "Create purchase order" function (or 'transaction' in SAP's terms). At the operational level, this function entails the identification of material requirements. The material requirements are defined by references to the needed materials, their vendors, their prices, the dates and plant at which they should be delivered, etc. The function contains variants depending of the purchase situation. For example, the map planning strategies correspond to the SAP functions of MM-MRP (Material Requirements Planning) Forecast Based Planning and Reorder Point Planning whereas the manual strategy is part of the MM-PUR (Purchasing) component. These variants are referred to in the four sections C1, C2, C3, and C4, as documented in Table1. For each of the four sections, the table outlines the variant of the SAP function that is to be used.

The same two viewpoints apply to the other sections of the map. Let us comment the sections related to the *Monitor Stock* intention. The intention represents the management goal of ensuring effectiveness of material logistics while maintaining financial propriety. It gives rise to a number of sections as shown in the Fig. 7 each of which is a way by which this management goal can be fulfilled.

Effectiveness of material logistics requires

- control of material movement to/from warehouses;
- on-time transfer of material to consumption points;

Code	Name	Description
C1	Purchase material manually	Create a purchase order based on a purchase requisition manually defined with information about the material, vendor, date, price, etc. If the information is correct the purchase order is created with a unique identification number.
C2	Purchase material based on reorder points	Automatically generate purchase requisitions any time a stock event that causes the stock of a given material to fit the reorder point criteria occurs. The purchase requisitions can then be transformed into purchase orders.
C3	Purchase material based on forecast	Automatically generate purchase requisitions at the dates defined in the forecast scheduling the purchases that shall be made for a given material. The forecast is computed based on former purchases of the material. Once generated, the purchase requisitions can be trans formed into purchase orders.
C4	Purchase material by reminder	Automatically remind of a purchase order for which no delivery has been noticed within due date.

Table 1: Documenting MM Map sections as SAP_MM functions.

- quality control of the material transferred.

These correspond in the map to the *In-In*, *Reservation*, and *Quality inspection* strategies.

The *In-In strategy* represents a function provided by the SAP MM-IM (Inventory Management) and MM-WM (Warehouse Management) components to post material withdrawal and update warehouse stocks accordingly.

The *Reservation strategy* allows to deliver goods to the appropriate consumption point at the appropriate time and is handled by the SAP MM-IM.

The *Quality inspection strategy* reflects the needs for inspecting stocks and is handled by a function which update the status of the stock to 'unrestricted stock' if the inspected stock conforms the requirements.

Financial propriety requires

- physical stock taking of the material;
- valuing the stock for balance sheets.

These are respectively represented in the map by the *Inventory balance* and *Valuation* strategies.

The verification between the physical stocks and the book inventory balance can be done by periodic, continuous or sample-based inventory which constitute a bundle under the *Inventory balance* strategy.

The *Valuation strategy* allows the stock to be valued for preparing a balance sheet. This is achieved by a bundle of strategies such as LIFO and FIFO and represents a SAP function in MM-IM to assign and record values on an on going basis.

As illustrated in part of the SAP-MM map above, our experience showed that the multi-thread topology of the map is useful to reason about alternative BM/SFM alignment relationships. The multi-thread (a) makes explicit the different business strategies to achieve an intention and (b) identifies the variants of the SFM that can be selected depending on the situation at hand, thus highlighting the alternative alignment relationships. We found that when eliciting the desired state (To-Be model), the multi-thread helps envisioning multiple business strategies and identifying the corresponding required system functionalities. In a customising process, the multi-thread helps exhibiting the panel of business strategies embedded in the product family and their related software variants. We develop the exploration of alternatives in the following section.

4. EXPLORING ALTERNATIVES

In this section we illustrate how maps can help decision making in exploring alternative alignment relationships between a business option and the corresponding system functionality. Exploring alternative designs using goal graphs has been recognised (Anton, 1998) (Yu, 2001) (Lamsweerde, 2001) (Paech *et al*, 2002). This is generally achieved using AND/OR refinement where "*alternative goal refinements [expressed with OR links] allow alternative system proposals to be explored.*" (Letier, 2001). However, if alternative goals help reasoning about alternative system functionalities to achieve the parent goal, the issue of exploring alignment relationship alternatives raises the question of reasoning about alternative combinations of functionalities across the entire AND/OR goal graph.

We found that maps, as a means for describing alternative complex assemblies of functionalities, can help in this exploration and in the discovery of the ones that best fit the business goals. The multi-thread topology of maps can be related to OR structures in a goal graph. But in addition, the multi-path map topology helps reasoning and evaluating alternative assemblies of functionalities. Such assemblies give rise to a *payoff analysis*. The result is the selection of sections that show the combination of the functionalities required.

For example, the map shown in Fig. 8 identifies seven different functionalities for the management of electricity supply in a utility company. Each functionality is identified by a section in the map. The entire map of Fig. 8 is a refinement of the<*Start, Sell electricity, with credit strategy*> section (C4) of a higher map. C4 is for selling electricity in a conventional way; it provides IT support to manage the process chain of conventional meter reading, electricity consumption billing and payment collection through seven sub-functionalities as the Figure shows it.

Once C4 has been selected, one has to decide on how electricity should be measured and how the financial counterpart should be obtained. Each sub-functionality selection has however a payoff that can be analysed in the view of its combination to another one The pay-off analysis for C4 sub-functionalities is summarized in the Table 2 below.

Let us consider the case where it is necessary to get financial counterparts both contract based and on consumption. The table shows that remote readings are a cost effective way to handle electricity measurement in both cases. Indeed, it is real time and therefore adapted to payment on consumption. Besides, the cost of installing remote readers can be included in the contract prices and recovered in the long term. However, the payoff table also says that

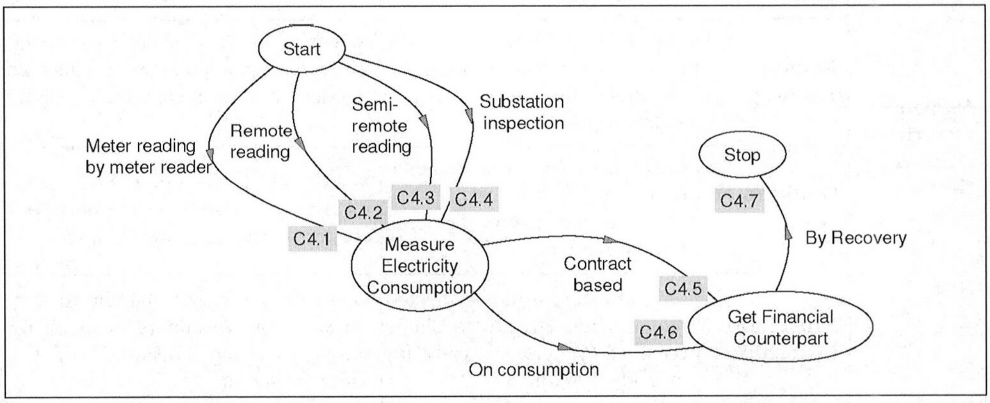

Figure 8: Sell electricity by credit strategy map.

remote reading, as it is automated, is not fully reliable and should be double-checked, e.g. by using subsection inspection. New opportunities emerge from further analysis. For example, remote reading makes it possible to analyse consumption in real time; new types of contracts can also be proposed to automatically adapt electricity production to consumption. This would be useful when electricity provision should be reliable, e.g. for refrigeration warehouses, hospitals, telephony service, etc.

5. MATCHING MAPS TO SUPPORT THE CUSTOMIZING PROCESS

In this section we partially address the alignment process in the case of an ERP system customisation. We introduce MIBE, a methodology which provides guidance to carry out this process and illustrate its use in a real ERP installation project at SNCF.

5.1. The alignment process

As introduced in section 1 our proposal is to move from *functional alignment* of the ERP installation to *goals alignment* thereby causing the customisation process to focus on goals and strategies rather than on system functionality. In order to achieve this, our proposal is to develop a goal *driven approach* which consists of:

- abstracting from the existing ERP functionality, the set of goals that it subsumes. This will establish the link between ERP system goals and ERP system functionality;
- performing the alignment at the goal level;
- deriving from the aligned goals the adaptations and extensions of the

		Get financial counterpart	
		Contract based	**On consumption**
Measure electricity consumption	**Meter reading by meter reader**	Can be envisaged at sustainable cost if visits are achieved at a low frequency e.g. once or twice a year)	Excluded because too difficult to organise all visits at the required pace.
	Remote reading	Cost effective combination that can be done in real time. However, remote reading is not completely secure. A complementary check of electricity measurement is thus needed, e.g. by meter reader, or by substation inspection.	
	Semi-remote reading	Cost effectiveness is a linear function of the number of contracts per cluster of semi-remote reader.	Very costly if the number of customers paying on consumption, per cluster of remote reader is low.
	Substation inspection	Only possible if the connected meter readers relate to single contract. Otherwise, calls for individual reading.	Cost effective way to handle the verification of consumers invoiced by remote reading clustered on the same substation.

Table 2: Pay-off summary for the selection of C4 sub-functionalities.

selected functionality by using the ERP goal to functionality link.

In order to support the alignment process, we use the MAP representation system as a means to model in a uniform way, the business goals, the ERP goals and the set of matching goals. The alignment process is therefore, merely a matching process carried out on maps. As shown in Fig. 9 the *As-Wished map*[1] represents what the organisation would like to assure in the future, the *Might-Be map*[1] models the goals subsumed by the ERP system and the *Matched map*[1] is the end product of the process, the set of goals that will be achieved by the ERP installation. This product may correspond to a subset of the ERP set of goals, perhaps suitably augmented with those that are not contained in the ERP set but included in the organisation set of goals.

The matching process is an iterative one. This allows:

- the balancing of the ERP drive with the As-Wished drive;
- the progressive refinement of the product at each iteration;
- the process to be controlled to reach the appropriate level of goals understanding.

At each iteration of the process, only those goals that have not yet been matched are investigated and detailed.

Finally, as showed in Fig. 9 we develop *similarity measures* to support making the matching decisions. Intuitively, a similarity expresses resemblance between elements of different models and measuring similarity between elements of the As-Wished and Might-Be maps evidently can help in understanding the match between business needs and ERP functionality.

5.2. The MIBE methodology

In order to formalize the matching process introduced above, we used the MAP representation system to capture process goals as map nodes and strategies to achieve those as edges. For maps to provide guidance we introduced *guidelines* that can be associated to sections in a process map to guide the selection of process goals as well as to guide strategy selection, situation identification and section achievement.

Fig. 10 shows the process model represented as a map which we developed as the core of the MIBE methodology. The root purpose of this map is *Construct Matched Map.* Achieving the purpose leads to the *Matched-map* which expresses the goals that the ERP installation shall met. Many of the intentions/strategies of the *Matched Map* are obtained from the *Might-Be map* (the ERP map) and match the *As-Wished* organizational needs. Others may not be available in the *ERP map* and will require in-house development. In such a case, the *Matched Map* makes them explicit. Again, all the intentions and strategies of the *ERP map* may not be included in the *Matched Map.* This corresponds to the ERP functionality

1. These terms refer to a hierarchy of maps.

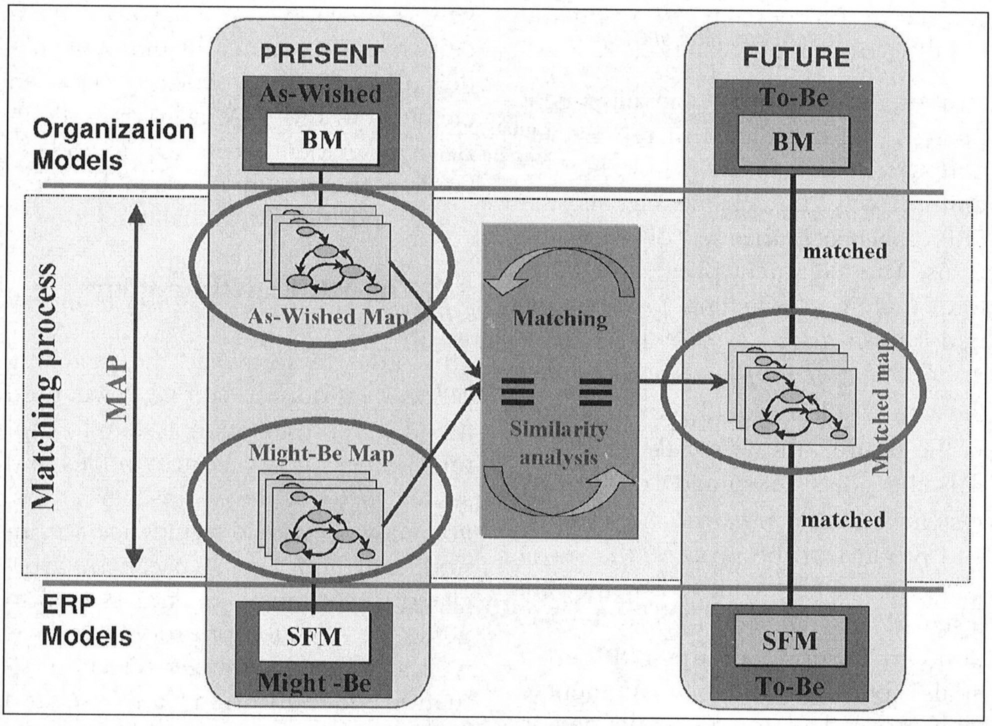

Figure 9: The matching process.

that is not matching the goals in the *As-Wished map*. Thus, the *Matched Map* is the input to the installation process.

The methodological process is organised around three main intentions *Construct As-Wished Map, Construct Might-Be Map* and *Construct Matched Map* and the various strategies to achieve them. There are in total 10 sections which are supported by methodological guidelines of three different types. A *Strategic guideline* is expressed as a map which refines the initial section; A *Tactical guideline* offers a plan or a choice to achieve the target intention of the initial section; Finally an *Informal guideline* provides textual advice on how to get the intention satisfied. The methodology involves in total almost 100 guidelines that are fully documented in (Zoukar, 2005).

As an example of guideline, let us consider the section <*Construct Might-be map, similarity measure strategy, Construct matched map*>. The guideline underlying this section guides the detection of sections in the Might-Be map which are similar to the sections in the As-Wished map and therefore, are integrated in the Matched map. Similarities are measured using *similarity metrics* associated to *similarity types*. As shown in Figure 11, we identified 14 generic types of similarities between elements belonging to two different models (such as two maps). Types are themselves classified according to two sets of criteria corresponding to two factors, *intrinsic* and *relational*.

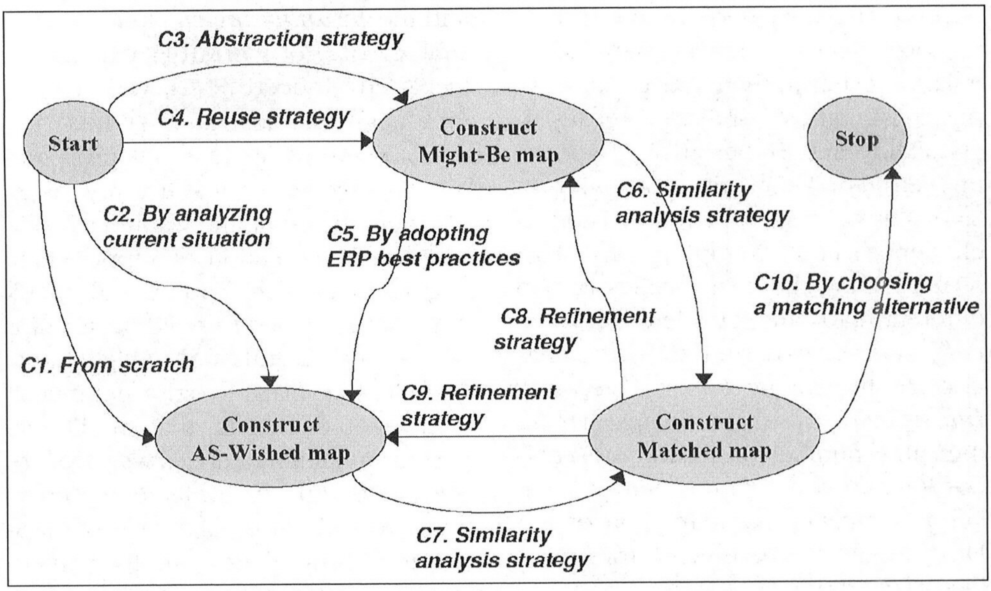

Figure 10: The MIBE process model.

Factors	Criteria	Types	Description
Intrinsic	Synonymy	TIS1	Two elements have properties whose names are identical
		TIS2	Two elements have properties whose names are similar
		TIS3	Two elements have properties whose names are close
		TIS4	Two elements have properties whose values are identical
	Hyponymy Hyperonymy	TIH2	Two elements have properties whose names are hyperonyms
		TIH3	Two elements of the properties whose values are hyponyms
Structural	Compositional	TSC3	Two compound elements are similar
	Relational	TSR1	Two not-link elements are target for the same number of links
		TSR2	Two not-link elements are source of the same number of links
		TSR3	Two link elements have identical source elements
		TSR7	Two link elements have hyperonym source elements
		TSR8	Two link elements have identical target elements
		TSR9	Two link elements have similar source elements
		TSR10	Two link elements have close source elements
		TSR11	Two link elements have hyponym source elements
		TSR12	Two link elements have hyperonym source elements
		TSR13	Two elements have the same depth
		TSR14	Two elements have the same height

Two elements have properties whose values are identical
Two elements of the properties whose values are hyponyms
Two compound elements are similar
Two link elements have identical source elements

Figure 11: Similarity types to support similarity measures.

Intrinsic similarity is based on properties of elements whereas relational similarity relates to their structures. More precisely, intrinsic similarity relates to Synonymy and Hyperonymy/Hyponymy. Structural similarity deals with relationships among and composition of elements. For example, two map nodes having the same names in two different maps are considered *intrinsically similar*, two strategy names having an hyponymy link are *declared intrinsically close*; two maps having the same number of section are *compositionally similar* etc. Metrics have been formulated as adaptation of the Dice, Jaccart and Cosine metrics (Natt Och Dag, 2001).

5.3. The SNCF case study

The MIBE methodology was finalised in a real ERP installation project at SNCF, the French National Railways Company. MIBE was defined through action-research in which actions in the project (using the methodology) and research (understanding issues and developing the methodology) were intertwined. Thus, the results of project actions and research activities influence each other. The purpose of the SNCF project was to conduct the installation and customizing of the PeopleSoft ERP system to support the SNCF To-Be supply chain.

Fig. 12 is an example of a matched map resulting of the application of the MIBE methodology to the process for planning production and supply. The construction of this map uses the Might-Be map and the As-Wished map as inputs. These were constructed following the *abstraction strategy* (C3) and the *by analysing current situation* strategy (C2) of the MIBE map shown in Fig. 10. Indeed, SNCF was not having neither a clear and synthetic understanding of its current processes and their goals nor a structured vision of where the company wanted to go in terms of its evolution of supply chain management. The additional work which was needed to build these maps was found useful and enlightening. The fact that maps avoid a number of cumbersome details that traditional process modelling implies was also appreciated. Thus, by an large, the effort involved with the construction of maps was found useful and paid for particularly, by the automatic similarity finding it permitted.

To construct the matched map the *similarity analysis strategy* (C6) was followed. The result of the performance of this strategy ends up in a common set of 6 sections of the matched map (denoted 1 and that appear in blue in Fig. 12). These are the sections of the As-Wished and Might-Be maps measured as similar.

Thus, the strategy *by choosing a matching alternative* was selected to complete the match map through two types of negotiation: *business negotiation* and *system negotiation.*

Through business negotiation, SNCF assured that its key business requirements were taken into account in the matched map. For instance, the SNCF As-Wished map indicates the need for constructing the industrial and commercial plans every 6 months. This is not considered in the matched map as PeopleSoft does not support such a requirement. As a consequence, the 6

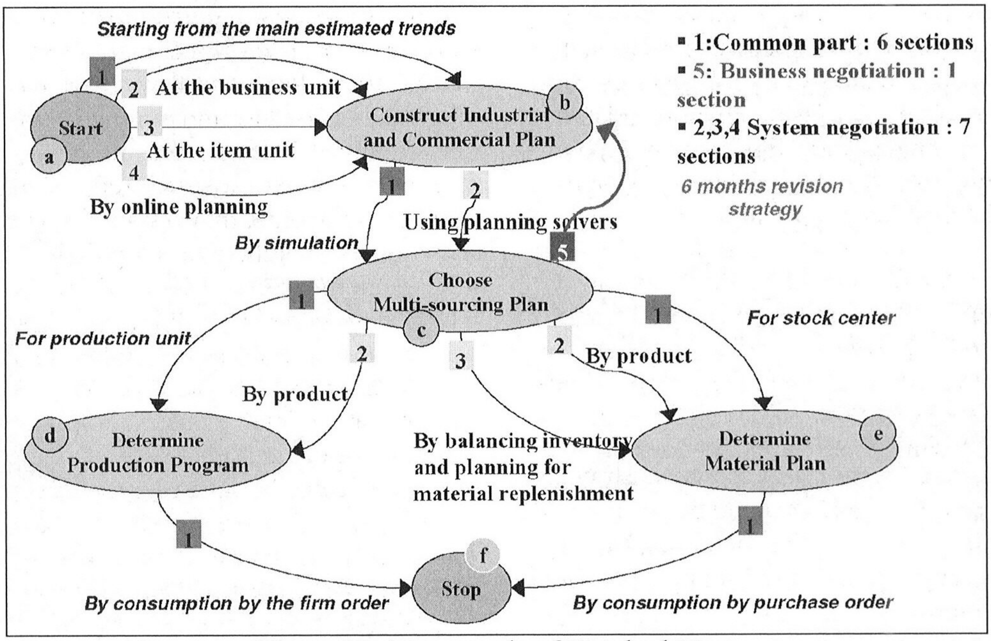

Figure 12: An example of Matched Map.

months revision strategy was added in the matched map (denoted in red with the 5 number in Fig. 12).

Through system negotiation, the ERP experts explained the role of additional business options that were found in the Might-Be map and were not yet, in the matched map. Besides the fact that sometimes, these options are necessary to keep the system integrity right, including those in the matched map might provide an added value to the SNCF way of working. The negotiation required a pay-off analysis based on cost/benefit values. For example, the *by planning solvers strategy* and the *on line planning strategy* which belong both to the Might-Be maps were not in the matched map. As the cost of implementing those is part of the standard PeopleSoft module, SNCF decided to keep them in the matched map as shown in Fig. 12. Finally, seven sections were added in the matched map as results of the system negotiation (denoted in black with 2, 3, 4 numbers).

The final matched map as shown in Fig. 12 comprises 13 sections, 6 are common to the AS-Wished and Might-Be maps, 1 results of the business negotiation and 7 of the system negotiation.

6. CONCLUSION

By expressing system functionality in goal-strategy terms, the map provides a representation of the functionality in a language that is easily understood by an organization. As shown in the paper, this helps to make the decision on whether or not to adopt the ERP approach and to agree on the issues that need to be resolved before ERP installation is done. It nudges an organization to looking at its systems in a holistic way rather than in narrow operational terms. The map also helps in customizing the ERP offer but in high level goal-strategy rather than in low level functionality terms.

The map provides a basis for a two-way interchange between SFM and BM; for example from the ERP functionality to organizational requirements and vice-versa. This is facilitated by the level at which the interchange takes place, organizational goals-strategies and SAP goals-strategies. As a result, the map has the potential to better align organizational needs with ERP offerings.

Finally, it is clear that the map needs to be supported by a guidance mechanism that helps constructing the map, checking the map correctness and systematically takes an organization through the range of facilities offered by software system such as an ERP package. This mechanism would present the different choices available for achieving an intention and aid in selecting one or more of these. This will form the topic of future work.

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