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Informatics for Business Is More than Process Automation: i-Business > e-Process

J. Q. Trelewicz, J. L. C. Sanz, D. W. McDavid, A. Chandra, S. C. Bell

IBM Research Division
Almaden Research Center
650 Harry Road
San Jose, CA 95120-6099



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IBM Almaden Research Center
650 Harry Road, San Jose, CA 95120 USA
e-mail: trelewicz@us.ibm.com

ABSTRACT

In the rapidly changing, global markets of the early 21st century, many businesses – not only IT businesses – are forced to evolve quickly to remain competitive. New tools have made possible the real-time collection, analysis, and display of enterprise data, that can help business executives to make enterprise-level decisions quickly. This has spawned a new trend for tools for “business design”, “business process integration”, etc.

Business process design and automation is not new to IT and manufacturing companies. When asked how to design and analyze a business, many technical practitioners think of business process. However, process alone is not sufficient to design and analyze a business, and tools that focus solely on process will isolate many business practitioners. Furthermore, focusing on process for the purpose of automation ignores many important aspects of collaboration among employees in a business, the interest and capabilities of individuals in developing relationships with clients, the understanding of the situation and conditions emerging from the market or sector that the organization serves, etc.

Many tools, designed by IT practitioners, classify their design, monitoring, and analysis techniques into one of “strategy” or “operations”. This hierarchy ultimately shows the relatively poor theoretical understanding on which tools for e-business have grown. In this paper, we lay some stronger foundations and a more solid theoretical framework. We show that informatics for business design and analysis require a toolkit of models, including process and others. The impact of people on the business is also included in the model, and an example shows the importance of this inclusion. We introduce an approach for utilizing multiple models together for electronic assistance for design, analysis, and management of business.

1. INTRODUCTION TO INFORMATICS FOR BUSINESS

Strategy encompasses the most important decisions and actions to achieve the purpose of the enterprise. This may be contrasted with tactics, which are more focused decisions and actions, and operations, which are the most immediate and real-time decisions and actions taken by the enterprise.

In this paper, we discuss an approach to informatics for business. We include in this tools, methods, and algorithms (all of which we will call “tools” in this paper) that support clarity and alignment of strategic, tactical, and operational decisions and actions with the purpose of the enterprise. These tools can help to design, document, and analyze business. Such tools have the value proposition of helping business executives to make enterprise-level decisions quickly, so that they can evolve their business with a rapidly-changing market. Such tools can also assist in designing and managing relationships with service partners for company value networks (i.e., a network of companies collaborating to deliver a good or service) or outsourcing.

While there have been many detailed investigations of the “behavioral” aspects of the enterprise, non-behavioral traits remain largely unexplored. For example, existing tools downplay the architectural elements of a business beyond its processes, such as business capabilities, outcomes or commitments.

Two critical aspects govern the approach of this paper. The first is that business informatics, in order to be useful, must offer a clear advantage over competing tools. In the case of tools for business analysis, one of the primary competitors is the “cocktail napkin”: the simple, manual tool for capturing requirements, drawing relationships, and communicating these structures to other people. The cocktail napkin, the spreadsheet, and the text document are still the primary means of business informatics in use today. Business informatics that do not provide significant advantages over these tools will fail to provide value to the market.

The second aspect is the concept of “modeling”. We will make very specific and sparse use of the overused words “model” and “modeling”.

A model is only useful for the question that it is designed to answer.

This means that there is no “universal model” that can be used to answer all (even unanticipated) questions. It may be possible to evolve an existing model to provide additional information, or to answer different questions, but this requires a change to the model. The authors recommend that any author claiming to have a universal model of business that answers all unanticipated questions be taken with a healthy dose of skepticism.

Many business analysts understand “business model” to imply a way of doing business. For example, when a company operates as a distributor without owning any assets, we say that the “business model” of the company is that of a “distributor”. Thus, the “business model” is a pre-specified form in which we quickly recognize the way the company operates their business with their market. Business models are known and pre-established forms into which a business is represented, organized and understood.

We will use the word “model” for the abstract structure that is captured by the design tools, as a compact way to refer to the nodes, connections, and characteristics that are captured with the business requirements and relationships.

2. BUSINESS THEORY CONTEXT

In this section, we lay the business theory context for our “toolkit” approach to informatics for business. This context is used to justify the elements of the toolkit that are discussed in the subsequent sections.

2.1. What is strategy?

For many information technology and business people, any enterprise subject not related to operational concerns becomes necessarily of a strategic nature. Furthermore, “strategy” is placed at the top of a “hierarchical view” of the business representation. At such highest level of the representation, the hierarchical view assumes that key corporate executives make strategic calls which are later mapped onto lower-level layers of operations and execution. This “operations vs. strategy” approach suggests a clear-cut division in the minds of many technical people consisting of two “business camps”. However, it would be hard to find a large corporation that works today with this division between strategy and operations.

It used to be that strategy was embodied in the company’s multiple-year plan, but the rapidly changing markets of the current world economy have made this kind of strategic planning largely obsolete. From a practical standpoint, it is known that strategic goals change very quickly in enterprises [2, 3]. At the same time, it is dangerous to claim that strategy is merely “emergent”, because this view seems to discount the role of purposefulness in business. Strategy is more appropriately viewed as the structure of roles and accountabilities created by the executive management of a company [1]. If these roles were permitted to negotiate and renegotiate their interactions based on marketplace shifts and imperatives, a company would have an adaptive strategy. This view of strategy as structure is well supported by the tool and model framework that we discuss below.

The actual strategic imperatives will ultimately depend on the priorities of the organization, which definitely include operational concerns; and finally corporate strategy, business strategy, transformation strategy, change strategy, networked enterprise strategy, being all of them different concepts, play their own role in the evolution of a business. In other words, there is not a “unique strategy dimension” in any business, as for example, there are strategic issues within business operations and these issues interplay very closely with the rest of the strategic concerns in the company. On the other hand, it is widely known even in the business community that “strategy” is an inexact term that has been abused in the literature [4] and therefore, the classification of business into “strategy” and “operations” ultimately shows the relatively poor theoretical understanding on which business has grown within the IT community.

2.2. Is process sufficient for business design?

The risks of dividing business into “operations” and “strategy” has been discussed in Section 2.1. However, many tools for so-called “operational business design” show shortcomings. Many of these tools focus entirely on process or workflow. Process is attractive for automation (when the actions of people are excluded) and monitoring and is straightforward to understand. However, process only describes one, narrow view of the time sequence activities of a business. If the entire business were process that could be automated, the business would be executed in Java on a computer, and the owner of the company could wait at home for his paychecks to arrive. This absurd statement shows the limitations of process as a descriptor of the business.

Analyzing a business solely in terms of its process can overlook some of the most important as-

pects of the business. For example, trying to reduce the operating costs of a business, by automating and optimizing parts of the existing process, ignores the possibility that parts of that process may be irrelevant – they may have been created to support a now-defunct portion of the value proposition or the organizational structure.

More importantly, focusing solely on the process ignores those critical aspects of the business that are not steps in sequence. For example, maintaining a healthy human resource structure for the company is imperative to its operation, and can have important implications on the enterprise knowledge management and social responsibility of the company.

One other aspect of processes must be highlighted. “Business processes” and “business operations” are often understood as identical concepts when, in fact, they are not. Processes, as an integral part of behavior, are present at different levels of the business architecture. For example, a business outcome, i.e., a value proposition offered by an enterprise, may be delivered as a service. The actual definition of such an outcome includes a number of processes that describe the behavior to be delivered by the service. In addition, for strategy activities in a company, there will also be specific processes that define the actual behavior embedded into these activities. “Strategy” is a specific type of business concern and hence, its concept does include a behavioral component. The foundations of this statement are deeply rooted in the fractal or recursive nature of business architectures [5]. In other words, there are “behavior concerns” at all levels of the architecture of a business.

On the other hand, operations could be thought of as the execution, i.e., the “run-time dynamics” of the business. In simple terms, “operations” is a synonym of “running the actual business”. Business operations call for processes to be executed but there are also many other effects caused on the enterprise. The business informatics approaches discussed in this paper will address both “strategy” and “operations”, employing process and other models, as appropriate.

3. WHY IS UML NOT SUFFICIENT?

Some IT practitioners tout UML as an approach for “modeling” (designing and documenting) business (e.g., [6]). There are two categories of shortcoming with this approach. First, as a user interface, UML is extremely “heavyweight” for capturing the requirements of a business at a high level, since UML was designed for capturing formal, complete design frameworks for IT. Asking a bank executive to capture the bank’s “strategic” business requirements as if they were concrete implementation re-

quirements is absurd. The bank executive is not interested in capturing a formal IT implementation framework for the model of his business; instead, he is interested in capturing his requirements. Whether or not these requirements are mapped into a UML framework inside the tool is not his concern.

The second category of shortcomings of UML encompasses technical aspects of the approach. A comprehensive analysis of the technical shortcomings of UML for business informatics is described in a recent book [7]. In summary, UML is not a specification language, but a visual framework for capturing relationships, structures, and use cases. UML does not itself impose any appropriate semantic formalism or rigor, only structural formalism. UML has been used effectively for capturing requirements, in a way that they can be communicated to other implementers. Force-fitting a business design into UML, for the sole purpose of utilizing UML drawing tools, adds no value, because the formalism and rigor for the business requirements must have been developed already, before the creation of the UML model.

4. ELEMENTS OF THE TOOLKIT

In this section, we discuss some of the aspects of a business that can be useful in informatics for business; e.g., tools for business design, documentation, and analysis. We have discussed Process and Capability Nets in our previous papers [8], which are summarized here for completeness.

Additional nets are possible for the model. We have several new nets under development in our work. However, in this paper, we have chosen a subset of nets that are well understood by many lay people, and which are directly relevant to our concrete examples in Section 5. The business analyst would only employ those nets that are directly relevant to the questions that the model was created to address.

All of the nets have certain structural elements: vertices (nodes), edges (connections between the nodes), edge weights (indicating a criticality or cost on a connection), and edge direction (indicating the direction of dependence or sequence). These structural elements, with their associated semantics, support a level of rigor required for meaningful analysis of the model. This structure shows quickly that the nets may be considered to be graphs for some analytical algorithms.

Connections are made between these nets in the model, creating a hypergraph for purposes of analysis. The mathematical implications of the graphs and the hypergraph are beyond the scope of this paper.

4.1. Process Net

Ask many people how to represent the design of a business, and their first answer will be “process”. Process Nets describe, on a time scale, sequences of activities that are executed in the operation of the business. Many IT people and business analysts think about process in procedural terms. However, the reader should be cautious that imposing proceduralism on the business can be a source of brittleness and fragility under conditions of change and stress. It is important that process is only captured in our model where procedural aspects are appropriate.

The Process Net consists of processes, depicted as labeled boxes. Process Nets may be hierarchical; that is, one process in a Process Net may itself be a Process Net. Connections between the processes represent the sequence of process flow. If more than one connection passes out of a process, this indicates either a decision point or parallel paths to be undertaken in subsequent steps. If more than one connection passes into a process, this may or may not indicate a resequencing of parallel paths. This may indicate a process which is performed as a step in several different process sequences. Furthermore, the connections do not indicate the type of flow; e.g., finish-before-start, start-before-start, etc. Such detailed semantics are useful at simulation levels of the business, which are beyond the scope of this paper. Some processes have transition in both directions; e.g., it may be possible for process *A* to transition to process *B*, and for process *B* to transition to process *A*.

The weights of the connections may represent several things, although a single meaning is chosen for a given Process Net. One example of connection weight may be the monetary cost of this step in the process flow, or the complexity of this step in the process flow (e.g., amount of training required). If there is utility in analyzing the Process Net with more than one meaning to the connection weights, then multiple instantiations of the net are created with the same processes, using the different meanings of the process weights. This preserves homogeneity within an instantiation, while allowing multiple-dimensional analysis.

4.2. Capability Net

A Capability Net is a way of looking at a business, or business area, from the perspective of what it is able to do or provide in the way of useful affordances toward the accomplishment of desired business results. Our definition of capabilities draws from that used in the literature [9], with some semantic refinements to facilitate rigorous analysis. The key architectural elements articulated by this viewpoint are

capabilities and results. A result is something valued by the business or one of its stakeholders, and elicits work or other investment in order that such a result can be realized. A capability represents the company’s providing or producing some result, either by performing some action, or simply by existing in an available form. The network of capabilities results from analyzing dependencies (enablement, in some sense) among various capabilities that have been identified.

Based on this exploration of both capability dependencies and result dependencies, we propose that the difference between a capability dependency and a result is mostly a matter of degree, and not much more than a modeling convention. In a Capability Net, the reason that there is a dependency is because one capability offers some service or object that is needed by another capability. This can be seen as simply a more granular form of (interim) result. It should be noted that we include both tangible and intangible “results” in the Capability Net.

Capabilities are distinguished from processes, in that processes rely on a time sequence for definition, whereas capabilities have no explicit time sequence. Connections between capabilities are unidirectional, corresponding to the direction of enablement. The weight assigned to the connection reflects the degree to which the enabled capability depends on the enabling capability.

For example, a capability may be important to a business’s value proposition to its customers, and an important enabler of its cost model. Without being able to document clearly the dependencies of this capability on the others, the business risks making organizational decisions without realizing the full impact of its decisions on its full capabilities.

Process is connected to capability, but the mapping is neither injective nor surjective. For example, a capability to provide order status information to a client may involve a process to perform the capability. However, a capability may connect to several or no processes. For example, the capability to provide low-cost fees to clients may be tied to no process, but may be enabled by other capabilities implemented by processes.

4.3. Role Net

The organizational reporting structure, often described in the organizational chart, is tied to the responsibility and authorization view of the business. It has long been known that role definition is important in business process modeling. We also find that this is at the heart of the relationship model, in terms of roles and accountabilities, as well as the results architecture when we drive down into the results to determine who the results matter to,

and what kind of value they hold for the results.

The Role Net consists of labeled elements that represent the roles played by people in the enterprise. Connections are made from one role that “reports to” another. It should be noted that a given role may report to more than one role, indicating “dotted line” reporting, or potentially reporting in a matrix organization. The weight of the connection indicates the degree of dependence for authorization in the particular business scenario being analyzed in this model.

For example, consider the reporting relationship of an auditor to his personnel manager and to his team leader in a matrix organization. The personnel manager may only affect the auditor in personnel reviews and promotions, whereas the team leader may be required to authorize all transactions. This would give the personnel manager a weak connection, and the team leader a stronger connection, if the model is being used to analyze the company’s auditing functions.

Roles may perform one or more process steps. A role may be connected to no process steps, if it supports some aspect of the business that is not captured in the model. Recall that the model is created only to answer specific types of questions, or to document specific requirements about the business.

4.4. Resource Net

Resources are elements in the enterprise that may be accessed to provide some functionality or input required for the execution of an activity. Resources themselves are not considered to be activities, but rather, passive elements in the enterprise. Resources can include, for example, buildings, vehicles, processing machines, supplies, raw materials, subassemblies, applications and databases, and knowledge repositories.

Connections are made from the resource that performs the access. For example, an accounting application may access a database. The weight of the connection indicates the degree of dependence that one resource has on another. Some processes and capabilities may require access to one or more resources. Connections are made for each resource required.

5. ASKING QUESTIONS OF THE MODEL

Making connections between the nets brings real power to the tools for business. It is through these connections that the model may be used for analysis. In this section, we discuss several examples of the types of analysis that may be performed. It is described why these examples require more than pro-

cess analysis, to show the importance of the multi-net model.

In all of the examples, the “structure” of the model is analyzed to answer a question. Informatics for business can help the analyst to make very complex deductions, based on subtle structural characteristics of the model. This can be especially helpful if the model is created by a team of analysts, so that no one analyst has a complete mental picture of the entire model. It is the ability to handle complexity, combined with the reusability and persistence of components, that makes such business informatics superior to the “cocktail napkin”.

5.1. Business “use cases”

The analyst can use the business informatics tools to show which parts of one aspect of the enterprise are associated with a part of another aspect. IT practitioners might recognize this as a kind of analysis of use cases. The concept of business use cases was developed about twenty years ago [10], although we do not take a strictly object-oriented approach, which can be limiting in allowing executives to capture strategy.

Consider a bank that is planning to upgrade some IT tools that are used in the business. The users of the tools, and their supervisors, will require training to use the new tools effectively. The bank wants to identify their training needs for the next quarter, and the other parts of their business that may be affected or interrupted by this training. The bank has a model of existing roles, capabilities, process, and resources, with the nets connected together.

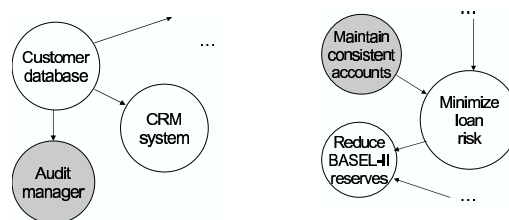


Рис. 1: Resource Net for the example.

Рис. 2: Capability Net for the example.

The IT tools to be upgraded are highlighted in the Resource Net. From the connections between the nets, connectedness maps on the other nets can be calculated. Potential impact on a node in one of the nets is determined by the existence of significantly-weighted path through the nets from the node to the highlighted items in the Resource Net. Figures 1-4 show small snapshots of the Resource, Capability, Process, and Role Nets, respectively. The highlighted resource is the application that is planned to be updated.

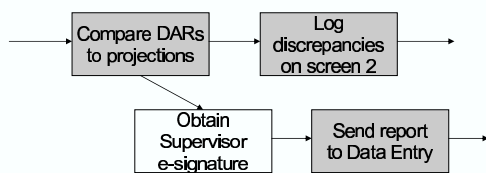


Рис. 3: Process Net for the example.

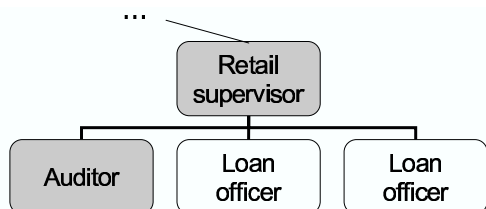


Рис. 4: Role Net for the example.

Blocks are highlighted to show those that would be highlighted in the connectedness map.

- Suppose that “Log discrepancies on screen 2” is strongly dependent on the specifics of the “Audit manager” resource, while “Compare DARs to projections” is only weakly connected. This would cause the “Log” process to be highlighted, while the “Compare” process would be highlighted as somewhat connected.
- Suppose that “Maintain consistent accounts” is connected strongly to all four of the highlighted process steps. This would result in “Maintain” being highlighted.
- Suppose that “Auditor” plays a strong role in “Log” and “Compare”, but with a weak link to “Retail supervisor”, because of the partial functional independence of the auditor. This would highlight “Auditor” as connected, and “Supervisor” as somewhat connected.

Analyzing these connectedness maps gives the following: the auditor will require a higher degree of retraining than the supervisor. As a result, disruption in all of the highlighted process steps, and the steps that follow with strong linkage, is expected. Also, care must be taken to avoid disrupting the highlighted capability, since two other capabilities are strongly connected to it.

The result is that the business analyst can build a story of retraining and resulting risk by simply highlighting a resource that is planned for upgrading. This story can be used to assist in the business case for the upgrade and to build the deployment and risk mitigation plan for the upgrade. It is possible that this picture of risk weakens the busi-

ness case for upgrading, which is a particularly compelling reason for such an analysis.

An analysis of process alone would not have revealed these potential impacts from the resource upgrade. Instead, it is likely that an analyst performing the upgrade using only a process model would have simply sent all auditors to training, expecting that the business would continue to function normally. This approach could spend unnecessary cost on training auditors with less need for the tool, and could ignore potential risks to the business that could result from training disruption (unavailability of personnel during the training activities) or deployment disruption (changes to other nets in the business resulting from the upgrade of the resource).

5.2. Impact analysis

A change in one aspect of the business can be reflected on the other aspects of the business. This is a dynamic extension of the structural analysis discussed in Section 5.1. For example, suppose that the method by which audits are performed in the bank is to change, through definition of a new process, designed to meet Basel-II requirements more closely. The affected process steps can be highlighted in the Process Net. The analyst will be able to show

- which capabilities are likely to be impacted, since the affected process steps may implement more than one capability;
- which parts of the Role Net are likely to be impacted, so that retraining or reorganization planning can be initiated; and
- which resources may require upgrading or replacing.

5.3. Component-based design

The full model may be used for business design or redesign. For example, a “best practices” audit function can be modeled in this way, with its associated roles, capabilities, processes, and resources. A business seeking to employ this function, or to customize it for the specific function of retail loan audit, can use the model to discover how this function will interface with the existing functions in the business, and what types of change will be required at the interface of the new function to ensure smooth integration. Such analysis is important for choosing a “best practice” to employ, so that the function may be chosen for best fit with the existing functions in the business. The concept of building libraries of components of best practices is not a new one (e.g., [11]), but doing so with semantic rigor facilitates integration and component reuse for improved implementation.

Another critical aspect of the business that can be handled as a type of component is best practice for measurement. We do not have a separate net for measurement, since measurement is, in some sense, present in all other aspects of the business. For example, how employees are motivated in a given business function drives their effectiveness in their execution of processes, and their delivery of capabilities for long-lasting health of the business – this is relevant in many economies and sizes of companies; e.g., [12, 13]. Templates for effective measurement for a given function can be included in the component for that function, to help the analyst to design the business.

6. CONCLUSIONS

We have introduced a foundation for business informatics – tools to assist business analysts with business design and management. This foundation draws on well-established models from the literature, as well as some new semantic concepts to facilitate interconnection and analysis. The pitfalls of the “operations vs. strategy” delineation were outlined, in the context of how business is strategized and operated. Our foundation utilizes a number of aspects of business that are well understood by both the business expert and the lay person, allowing the tools to be employed by non-specialists for business analysis. An example shows how analysis of this model can reveal more about business impact of misleadingly “simple” changes, than some conventional techniques.

In our current research, we are developing new nets for the business that are not discussed in this paper. These nets address such important aspects of the business as human-human interactions, and the allocation of human capital. We are also building a framework for the measurement and component templates mentioned in Section 5.3.

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