An Elicitation Strategy Anchored on ISO 9000 Documents

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Abstract

Companies that are according to ISO 9000 standards have to maintain a set of documents describing the quality system that include policies, procedures and instructions to assure the final product's conformance with ISO 9000 requirements. Each change to be introduced in the certified process has to be first written down in the respective documents that are affected by this changes and employees should be training to assure that the new procedures are understood and can be followed. Partly for this reason, it is contended here that ISO 9000 standards and associated documents can be of a great help for business procedures elicitation. This article aims to show an strategy to elicit software requirements based on the idea of elicit business procedures from ISO 9000 documents and then use this procedures to elicit the lexicon of the domain. It details a conceptual model to elicit business procedures using ISO 9000 documentation together with some heuristics on how to automatically extract this procedures from the ISO 9000 documentation.

Key words: ISO 9000, Requirements Elicitation, Requirements Baseline

1 - Introduction

Many techniques have been proposed to describe business organizations. There are techniques to design how the information flows, to describe the sequence of actions an organization follows, the hierarchy, and so on. In some ways, all these descriptions refer to business procedures, but they don't cover an important aspect, the set of rules establishing how the business works [GUIDE 96].

In this article we use the idea of eliciting business procedures as a way to represent how the business works and evolve. For us, business procedures are prescribed policies, guides or procedures that should be followed to achieve the business's goals.

This article details a partly tested conceptual model to elicit business procedures, an idea that has not as yet been explored, according to our literature review. An essential characteristic of this model is the use of ISO 9000 documentation. This article is an extension of a preliminary article on the subject [Cysneiros 98].

According to the Brazilian Quality Committee [CB-25 97], in December 1997, more than 162.000 companies, worldwide, had been certified. It is relevant that ISO 9000 certification is not restricted any more to large companies. Medium and small businesses, from small bakeries to large industrial organizations, are also being certified. Figure 1 illustrates the steady growth in number of ISO 9000 certified companies, in Brazil. Recently a private school in Rio de Janeiro got the ISO 9002 seal as well as many hospitals and laboratories.

This positive trend regarding ISO certification creates, in our opinion, an opportunity for making use of

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ISO documentation for business procedures elicitation. Indeed, our main hypothesis is that by using the ISO 9000 required documents for business procedures elicitation, one can significantly improve software requirements elicitation in organizations.

This hypothesis was inspired by the idea that since the Quality Manual used for ISO certification is the guide defining what will be done and how it will be done, as Corrigan [Corrigan 94] puts it, it could also be an important source for eliciting software requirements.

One piece of work in this area was produced by Fiorini et al [Fiorini 96] who propose a method to elicit business processes in companies that pursue total quality and to integrate these processes with requirements elicitation.

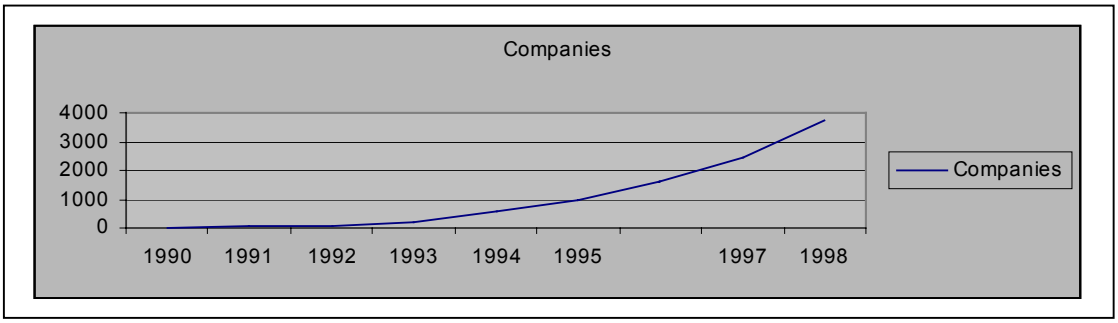

Figure 1 - Number of ISO 9000 certified companies in Brazil

Further investigations were carried out in the business administration literature. In Matos [Matos 88], we thus learnt that many companies are actually training their employees on what rules are being applied to the business. Harrington [Harrington 96], as well as Macedo-Soares and Chamone [Macedo-Soares 94] implicitly touch upon the question of business procedures when discussing the principles and key practices of total quality strategies, notably that of business process management. While not explicitly addressing the question, Corrigan [Corrigan 94], Hayes [Hayes 96], Hilary [Hilary 96], Hockman et al. [Kumberly 94], Macedo-Soares and Lucas [Macedo-Soares 96], and Struebing [Struebing 96] provide pertinent observations for its treatment in their analyses or comparisons of ISO 9000 and Total Quality Management (TQM).

Both the above mentioned literature review and a recent experience in helping a company with ISO 9000 certification by one of the authors were used to develop a tentative model for business procedures elicitation based on ISO 9000 documents. It thus became evident that the latter could play a central role in defining what Leite [Leite 93] calls Universe of Discourse (UofD):

> *"Universe of Discourse is the general context where the software should be developed and operated. The UofD includes all the sources of information and all known people related to the software. These people are also known as the actors in this UofD."*

Nevertheless, unlike the idea presented by Leite [Leite 98], this work views business procedures as a set of rules that concerns not only business polices, but also cross-functional rules and tasks definitions. Doing so, we will be capturing a large amount of different kinds of business procedures that will further dictates requirements, both functional and non-functional.

This work proposes a conceptual model to eliciting business procedures, with some heuristics of where and how to search the ISO 9000 documentation for those rules. We try to show where in the documentation one can find business procedures related to acquisition of incoming products as well as many other as those related to storing, packing and shipping.

It is important to emphasize that the ISO standards we are proposing to use are not related to ISO 9000-3 [ISO 91] which are the guidelines for the application of ISO 9001 for the development, supply and

maintenance of software. We are dealing with the standards at the organization level.

We present our proposal by first introducing ISO 9000 (Section 2), then explaining the core of our proposal (Section 3). Sections 4 details the conceptual model with different approaches to different areas of the company. It includes an example drawn from our initial case study. We conclude by showing how we view our contribution in terms of achieving better quality software systems, by reusing the information contained in ISO 9000 documents.

2 - Introduction to ISO 9000

According to ISO 9000 standards [ISO 94], a product is the result of an activity or process, and can be part, or an association of one or more of the following abstract classes:

1. **Hardware -** Equipment, components, objects, part of pieces, similar products;
2. **Software -** Methods, documents, information, procedures, instructions, and projects;
3. **Processed Materials -** Characteristics of incoming product transformation into continuing process, both physical, chemical and biological;
4. **Services -** A class of products that are consumed while being produced; in a certain sense they can be considered intangible.

At this point, it is important to make clear what we understand by the following expressions:

✓**Quality System -** The organizational structure, responsibilities, procedures, processes and resources for implementing quality management;

✓ **Quality Manual -** A document stating the quality policy and describing the quality system;

✓ **Quality Policy -** The overall intentions and direction of an organization concerning quality, as formally expressed by upper management;

✓ **Requirements for Quality -** An expression of the needs or their translation into a set of quantitatively or qualitatively stated requirements for the characteristics of an entity to enable its realization and examination;

✓ **Nonconformity -** The non-fulfillment of intended usage requirements.

From the model for the ISO 9001/9002 standards [ISO 94] it becomes clear that, for ISO 9000 purposes, the supplier is the organization providing a product to a customer. ISO 9000 standards call the company being certified as a supplier; its suppliers are called sub-suppliers.

One of the main objectives of implementing a quality system is to achieve customer satisfaction by ensuring the continued repeatability of a set of product and service characteristics that have been explicitly or implicitly agreed upon by a customer and a supplier [Sakofsky 94]. This requires controlling what is done and, consequently, implies that everyone knows *what* is done and *how* it is done [Corrigan 94].

One can clearly see how important it is to document all processes to assure the customers' requirements are met, by performing controls, when one pursues such an objective. For instance, it is relevant that one of the ISO 9000 requirements (4.5 - Document Control) states:

> "... there must be established and maintained procedures to control documents and data that relate to the requirements of the international standard. These documents shall be reviewed and approved for adequacy by authorized personnel before issue. This control shall ensure that: a) the pertinent issues of appropriated documents are available at all locations where operations essential to the effective functioning of the quality system are performed; b) obsolete documents are promptly removed from points of issue or use."

This requirement implies that every change in the process has to be documented, approved and available at all locations *before it is implemented*.

Another ISO 9000 requirement (4.2 - Quality System) states:

> *"... there must exist a documented quality system to ensure that a product conforms to specified requirements. This shall include: a) preparation of documented quality system procedures and instructions in accordance with the requirements of the ISO 9000 International Standard; b) the effective implementation of the documented quality system and instructions."*

Put differently, 'the company must follow process documentation at every step of production as well as document the production process as it is enacted'.

There is no rigid format for the Quality Manual, but it is usually divided in sections following the ISO standards. This accounts for a manual with at least four sections, where section 4 is divided into 21 sub-sections, one for each requirement of the ISO standard. When referring to section 4.3, for example, we will be referring to the section in the Quality Manual that specifies the requirement contract review.

Section 1 should refer to the scope of the quality system, Section 2 to important references on the manual and Section 3 to the necessary definitions for understanding the Quality Manual.

The ISO standard establishes the following two requirements for the Quality Manual:

- specify the structure of the quality system's documentation;
- include or refer to procedures that indicate how requirements for the quality system can be met.

The documents required by the ISO 9000 standard are usually built on a three-tier set of documents (see figure 2) [Corrigan 94] and can be described as follows:

1 - Quality Manual (QM) - It is the strategic level document. It defines "What has to be done" to assure that the specified requirements are met.
2 - Quality Control Procedures (QCP) - This document refines directives found in the Quality Manual pointing out "how the quality objectives can be achieved".
3 - Standard Operational Procedures (SOP) - This document registers the documented procedures meeting the applicable requirements of the quality system. Operational procedures can be included or referenced in the Quality Manual.

In order to satisfy ISO's requirements for a good documentation system, the documents have to be linked, e.g., if Section 4.3 of the QCP details Section 4.3 of the Quality Manual, the last one must mention it. Likely, if Section 6 of the SOP for the client's attendance procedure is detailing Section 4.3 of the QCP, the last one must mention it. Therefore, it is possible to visualize ISO's documentation hierarchy.

For practical purposes, when we use the expression "Quality Manual", we should be referring to any or all of the three documents

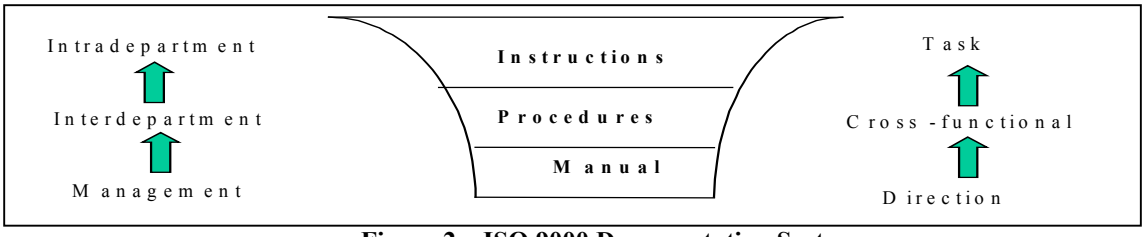

Figure 2 – ISO 9000 Documentation System

We will now detail *some* of the most important sections of the Quality Manual and provide some relevant examples of their business procedures:

Section 1 of the Quality Manual is only a presentation of the Quality Manual and is usually very short. The most important information given here is the distribution list, which establishes who is to receive the copies of the Quality Manual.

Section 3 describes the Business's Profile and contains a global scenario of business goals. It usually indicates the products or services offered by the company as well as its market profile.

Section 4 is subdivided in 21 subsections. Some quality systems include one or two extra requirements, for example, legal requirements. As mentioned before, there is no fixed format for the Quality Manual, but usually the subsections are organized according to the following format: 4.1, 4.2,..., 4.21. Some of them are described bellow.

Section 4.1, Management Responsibility, defines the quality system, the organizational structure, the responsibilities and authorities, as well as the management review. The latter process is meant to appraise the effectiveness of the quality system and should therefore be directly correlated to business health.

Section 4.2 and 4.5 were described earlier in this section.

Section 4.3, Contract Review, presents the procedures to assure that the contract established with the client is correct and that it can be carried out by the company in the specified space of time.

Section 4.9, Process Control, is where the company (the supplier) identifies and plans the production.

Section 4.10, Inspection and Testing, defines the process to assure that products are not used or processed until they have been inspected for conformance to specified requirements.

Section 4.14, Corrective Action refers to the necessity of establishing procedures to deal with non-conformities, and correcting the process so that the identified non-conformities do not reoccur.

Finally, it is important to stress that, although ISO 9000 may be a way of achieving Total Quality (TQ) and part of a TQ strategy, ISO standards and TQM should not be confounded [Hilary 96] [Hayes 96] [Macedo-Soares 94].

3 - Integrating Business procedures into the Requirements Baseline

An important assumption of our research is that requirements are not static in time. They thus necessarily change during software production [Leite 95]. This means that the requirements found during the requirements definition, continue to evolve as the software is being developed. As such, the software engineer must pay attention to the possible changes and evolution of requirements. The requirements baseline is structured as follows [Leite 98]:

- a business procedures view (proposed here)
- a lexicon model view;
- a basic model view;
- a scenarios model view;
- a hypertext view;
- a configuration view.

Our proposal is to integrate business procedures into the baseline to provide a global description of the governing rules of the macrosystem, and to help in the communication process with the client/customer.

Figure 3 portrays the overall strategy. The "ANALYZE QUALITY MANUAL" process, corresponding to step one, aims at eliciting the business procedures by way of the manuals. The heuristics, appearing as a mechanism in the SADT of Figure 3, are detailed in Section 4.

After business procedures are defined, it is time to identify and define the symbols of the Language Extended Lexicon (LEL) contained inside these rules. The objective of an LEL is to register the vocabulary of a given UofD. It is based upon the following simple idea: understand the problem's language without worrying about understanding the problem [Leite 94]. The main objective of the LEL is to register signs (words or phrases) peculiar to a specific field of application. Adding new symbols to the LEL during business procedures elicitation helps to better understand the expressions found in the ISO 9000 documentation.

The LEL is a meta-model designed to help the elicitation of the language used in the macrosystem. This model is based on the idea that a circular description of language terms improves the comprehension of the environment. Each sign is described by natural language sentences for its notions and behavioral responses. In the description of each sign, a high level of circularity is maintained, since each sentence uses signs also described in that LEL. The notions must try to elicit the symbol's meaning and its fundamental

relations with other entries. The behavioral response must specify the connotation of the symbol in UofD (See example in Figure 6).

The LEL definition will be carried out using the business procedures found to extract the symbols of LEL that can be found inside these rules (See " DEFINE LEL" on Figure 3). Notions and Behavioral response might not be found nearby the place where the business procedure is. If this is the case, it will be necessary to see in section 4.1 who is(are) the actor(s) responsible for the section where the business procedure was found and carry out a set of interviews to determine the respective notions and behavioral responses. Even when it is possible to identify some notions and behavioral responses related to the symbol of the LEL that are being defined, one should validate them using the actors involved. A good approach to find the notions and behavioral responses inside the ISO 9000 documentation is to search all the documents for the symbol of the LEL being described.

The objective of the "CHECK CONSISTENCY" process, corresponding to step four, is to provide the necessary feedback to the two previous processes. At this stage, the software engineer must look for new LEL symbols contained in the business procedures, their notions and behavioral responses, and integrate them into the LEL. This process also accounts for checking whether there are missing rules , based on LEL symbols not present in any rule. If there is any symbol not present in the business procedures, the software engineer must look for it in the Quality Manual to be absolutely sure that there are no business procedures related to this symbol.

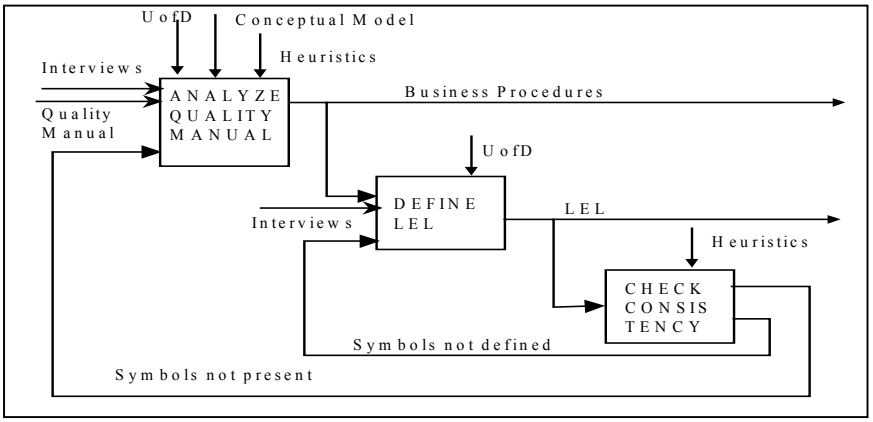

Figure 3 - SADT model for integrating Business procedures in Requirements Baseline

4 – Conceptual Model for searching ISO 9000's documentation

4.1 – The Proposed Conceptual Model

The quality leader is usually the best source from whom one can find information about how ISO 9000's documentation is structured in an organization. If the organization does not have a quality leader, the software engineer must look for the Management Representative who is responsible for maintaining the quality system. Section 4.1 states who plays this role.

Reading the Quality Manual will often prompt the software engineer to read the Quality Control Procedures manuals, and many times, also, the Operational Procedures manuals.

The more relevant parts of a Quality Manual and the respective rules that can be found inside these are briefly described below. We also present some of the sections of the Quality Manual where one can find business procedures, together with some information on what one can expect to find in each section.

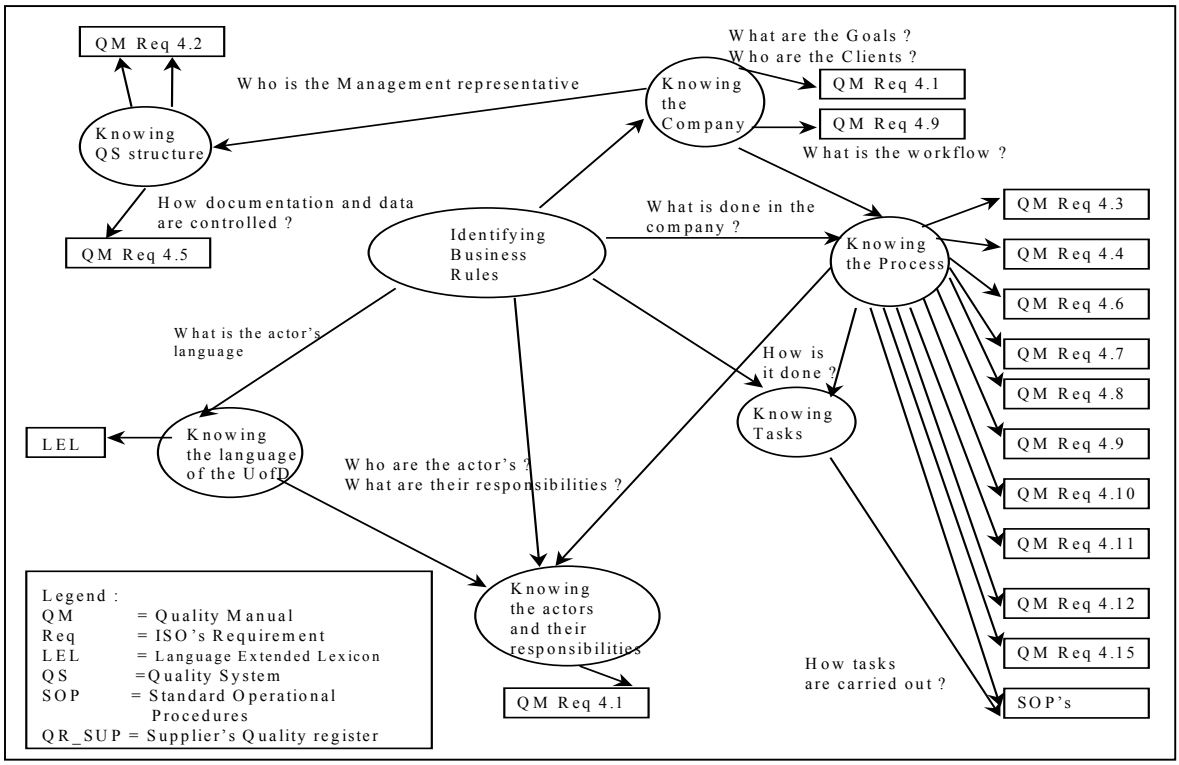

Figure 4 – A general Conceptual Model for Searching ISO's Documentation with a View to eliciting Business procedures

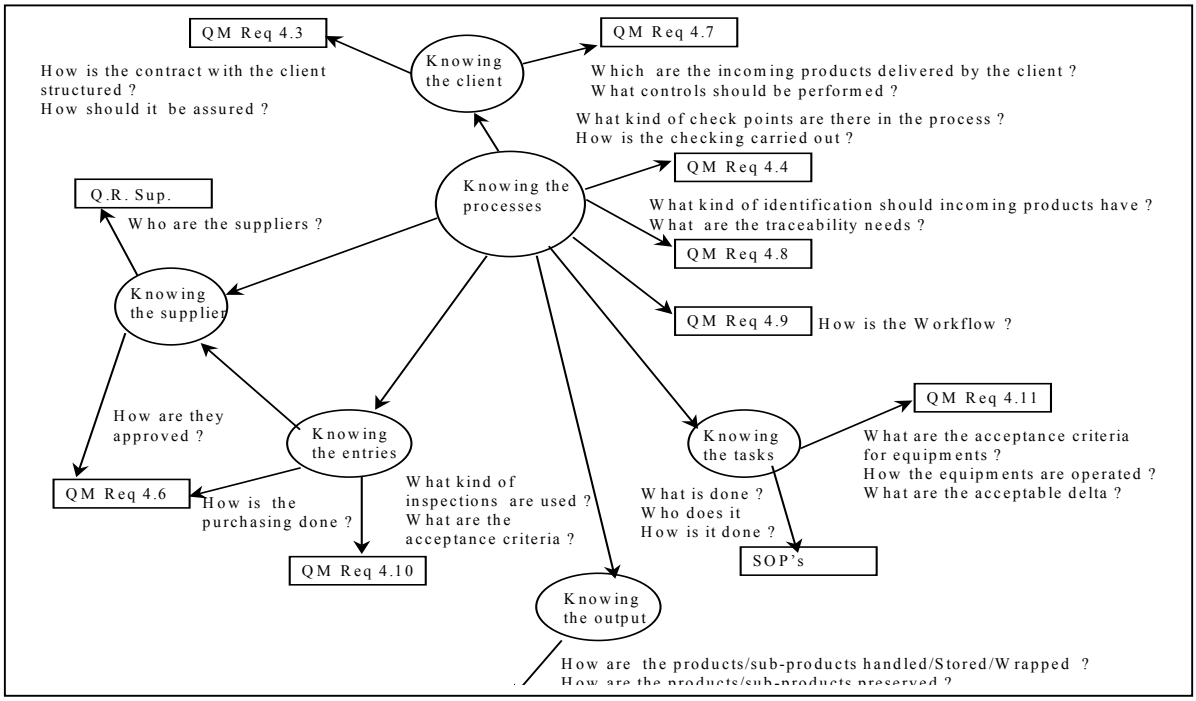

Figure 5 – Detailed conceptual model

Figure 4 shows a conceptual model, inspired by Fiorini's work [Fiorini 96] for searching ISO's 9000 documentation with the objective of eliciting business procedures. Figure 5 details how to know about the processes of the organization. These conceptual models can be understood as a guide to understand the organization and to find its business procedures.

We will now state some heuristics that can be derived from the conceptual model shown in Figures 4 and 5. Every time we refer to "product" we will be also referring to "services". This heuristics are particular to each business area. Every time we refer to Section 4.x, we are referring to a specific section of the Quality Manual as explained in Section 2 of this article.

1. **Knowing the Company :** One can learn about how the company functions and what are its goals by first reading Section 4.1. In section 4.9, one can learn about the whole company' process. Here, usually some kind of workflow, describing a general view of the company's process, can be found.
2. **Knowing the main actors :** The main actors playing roles in the UofD can be found in Section 4.1, where one can find a table specifying what are the actors responsible for each of the ISO 9000 requirements.
3. **Relationship with the Client :** To know how the company interacts with the client, one may read Section 4.3 to know how a formal contract is established with the client, and what will be used to evaluate whether the contract was performed satisfactorily. Section 4.7 establishes what are the products delivered by the client, and if necessary, the controls that must be performed to ensure conformance with the quality system. Section 4.19 must also be checked, as long as many Call Centers are treated in this section.
4. **Warehouse / Purchasing :** To understand how the purchasing works and what are the warehouses policies, one might read several sections of the Quality Manual. First of all section 4.6 establishes all the processes for purchasing products, including what, when and how it will be done. Here it is also possible to know how suppliers will be evaluated and categorized in order to keep only the ones who match the company's policies. Section 4.10 will establish the procedures for Inspection and tests that must be performed when the Warehouse receive any incoming product to assure the desired quality of these products. Sections 4.11, 4.12, 4.13 and 4.15 will also be somehow related to processes that must be performed in the warehouse to assure the quality of the incoming product, as: Avoid to have products inside the warehouse which are not in conformance with the standards (4.13), How to store the incoming products to assure its conformance (4.15), and so on.
5. **Product Delivering :** We here understand product delivering as the process of receiving the final product, storing it for a while, packing it and finally shipping it. Section 4.15 is the place where to search for business procedures related to this area.
6. **Finances :** It is not necessary to have finance processes established in ISO documentation, unless they directly interfere with the final product or with the client. Information about any finance process must be centered in Section 4.3 where everything related to the contract established with the client must be stated. Section 4.19, associated services, might also have some process related to charging clients. Section 4.1 may sometimes mention rules about finance goals, for example: "The company must have at least a cash reserve equivalent to one-month 's sales revenue" .
7. **Production :** To understand how the products are produced, one will have to read many different sections. Figure 6 gives a good view of the necessary process to understand how the products are made and its policies. Section 4.4 establishes how a new type of product is developed. Section 4.9 will represent all the productive cycle that occurs in the company. Section 4.10 will state all the inspections and tests that must be performed from the moment the product starts to be manufactured until it is finished. Section 4.12 states all kinds of identifications that a product may have while it is being manufactured to assure its conformance to standards. Section 4.11 refers to all the controls that have to be performed in any equipment related to manufacturing. Section 4.13 will have all the procedures necessary to control any product, anytime during the manufacturing process, that is not

in conformance with the requirements of the quality system. Section 4.8 plays an important role in ISO 9000 standards and must be carefully examined. This section establishes the identification process that must be carried out during the product's manufacturing to assure complete traceability of the product. ISO 9000 requires tracing every step that happened during a product manufacturing. Section 4.15 will focus on the way that the product must be handled and stored during the production cycle, as well as how and where it should be placed/delivered when it is finished.

4.2 – Additional Heuristics on Quality Manual search for Business procedures

In addition to the conceptual model, we developed some general heuristics to help the software engineer in the process of eliciting business procedures. These heuristics are basically production rules for pattern matching and they shall be used in an automated business procedures extractor. These rules are applied on the sentences that are part of the documentation (input structures) to produce the business procedures (output structures).

Dictionaries are structures used to help in the identification of possible business procedures. We basically use three different dictionaries. The first for non-functional expressions as : Must/Must not/ Can/Can Not/Taller/Thinner/Fast/Slower/ and adjectives in general. The second for condition enabler rules as: IF + phrase + then/implies + phrase or When + phrase + then/implies + phrase. The third is for the definition of facts and terms as: Subject + will + verbal phrase and also the following verbs : do, process, check, manipulate, attend, generate, provide, ask, input, enter, have, manage, inform, evaluate, analyze, develop, store, pack, ship, select, require

Input Structures	**Output Structures**
Quality Manual = {Documents} Documents = {Section} Section = {Header + Sub-Section} Header = Document's Title + ISO's Requirement's Number + Revision + Requirement's Title Sub-Sections = {Title + Sentences} Actual_Set_of_B.Proc={B.Procedure_statement} B.Procedure_statement = Number + "-" + B.Procedure + "-" + ISO's Requirement's Number	Quality Manual = {Documents} Documents = {Header + Sections} Sub-Sections = {Title + B.Procedure + ¬ B.Procedure } B.Procedure ∩ ¬ B.Procedure = ∅ B.Procedure_statement list = {B.Procedure_statement} B.Procedure_statement = Number + "-" + B.Procedure + "-" + ISO's Requirement's Number Number = unique number to identify B.Procedure_statement

4.2.1 – Derivation Heuristics

Production rules were created to be used in the process of business procedures extraction. Below we show Rule 1 that searches for rules related to purchasing.

Rule 1

```
Get Snumber from <Number>
For each <Document> from <Quality Manual> do
    For each <Header> do
        SecNum= <Requirements's Number>
        For each <Sub-Section> do
            For each <sentence> do
                If <sentence> ⊂ "customer" or <sentence> ⊂ "supplier" or <sentence> ⊂ "sub-supplier"
                Then Mark <sentence> as <B.Rule>
                        Snumber=Snumber+1
                        <B.Rules statemen>=        Snumber + "-"+ <sentence> +"-"+ SecNum
                        add <B.Rules statement> to <B.Rule statement list>
                        <Number>=Snumber
                EndIf
            EndDo
        EndDo
    Enddo
Enddo
```

4.3 Defining the LEL

Once business procedures are defined the requirements engineer must run all of the rules searching for symbols of the LEL. Once a symbol is found it must be marked in the business procedure as a LEL entry and it must be added to the Lexicon. The engineer should define the notions and behavioral responses associated with this entry by searching all the occurrences of the symbol in the Quality Manual and validating it with the users that are involved with each of the sections where the symbol appears.

4.4 - Checking LEL and Business procedures Consistency

Once the business procedures and the LEL have been identified, their consistency must be verified. Towards that end, we propose the following general heuristics:

- *Every important symbol in a business procedure has to be represented in LEL.*
- *Every LEL entry should be present in at least one business procedure*.

When this check is carried out for the first time, many symbols present in business procedures may not be present as yet in a LEL. This is the time to include them in LEL with their respective notions and behavioral responses

As this process becomes a cycle, it is possible that updating a LEL brings new symbols are not yet represented in business procedures. This may point to some forgotten business procedures.

Analyzer
Notion:
- Equipment used to perform **tests**.

Behavioral response
- Requires **calibration**.

Bar code label
Notion:
- Used to elicit a particular **recipient.**
- A unique number.
- This number is called **sample number**.

Behavioral response:
- Automatically generated by the system during **patient** data input
- Fixed the recipient by the **attendant.**
- Has to be linked to one and only one **patient**.

Kits
Notion:
- Chemicals used in **analyzers** to perform specific **tests**.

Behavioral response
- Each **Kit** has a **serial number.**
- Operator registers **Kit** data and date of opening a **spreadsheet.**

Tests
Notions:
- Are performed by **anal yzers.**
- A set of **tests** grouped in one **test** is called a **profile.**
- Can be performed by one or more **sectors**.

Behavioral Response
- Have **constraint rules** for admission purposes.
- **Reference values** are printed in **patient** report.

Figure 6 - Example of LEL entries extracted from business procedures

The software engineer must be sure this symbol is not in LEL with another name. If so, he or she should update the LEL with this alias. If not, the software engineer may go back to analyze the Quality Manuals and search for the business procedures related to the symbol.

Figure 6 gives one example of this. **Calibration** is a symbol that is part of the behavioral response of **Analyzer,** which is part of the notions of the symbol **tests, which** are found in business procedure 2. **Analyzer** is a symbol that is not present in business procedures. This could mean that there are business procedures about analyzers and calibrations not found in the analyses of the Quality Manuals.

On the other hand, symbols such as draw sites, samples, patient, as well as some others, have not as yet been represented in LEL and should be included. Notions and behavioral responses of these symbols may still not be completely clear to the software engineer. In this case, another analysis of the manual must be carried out, and, probably, also an interview with the actor responsible for the requirement where the business procedure was found.

The process of checking LEL and business procedures consistency is an interactive process. Up to now, we only have very general heuristics. These will be refined as we conduct more case studies about the method in question

4.5 – An Example Drawn From an Initial Case Study

We present here an example drawn from an initial case study. We used the Quality System of a clinical analyses laboratory that recently got its ISO 9002 seal. The same company was used before in a case study which we already built the LEL for this domain. Nevertheless, here we used the existing LEL only for purpose of comparison. We applied the conceptual model to search for business procedures and after that, we built the LEL from the rules found. The rules were validated with the actors of the UofD and the LEL compared with an existing LEL from a previous case study. We used the syntax proposed in [Cysneiros 99] to represent the business procedures, which is defined in the output structures in section 4.2

Some of these rules are presented below.

The following business procedures are obtained from Figure 7:

1. The **Draw sites** ask the **client** for a **medical order** with **tests** to be performed. – Section 4.3
2. The **Attendant** will enter all the required information in the system. – Section 4.3
3. The system will automatically generate **bar code labels** to the **samples.** – Section 4.3
4. The system will automatically generate a **protocol**. – Section 4.3
5. The **protocol** must have the **requested tests** and **delivering data.** – Section 4.3

In addition, the following business procedures were extracted from figure 8:

6. Traceability of **Kits, reagents and controls** will be assured by using a spreadsheet containing identification of the product and **date of opening**. – Section 4.8.2
7. Each **recipient** must have a **code bar label** with its unique number. – Section 4.8.2
8. The computational system will generate a **sample number** – Section 4.8.2
9. The computational system will provide a way to consult the position of specific samples and the places it has been to – Section 4.8.2

4.3. – Contract Review

The Draw sites will ask the client for a medical order with the tests to be realized.
The attendant checks if it is possible to deliver the patient's report in the time required by the client.
The attendant will enter all the required information in the system, which will automatically generate bar code labels for the samples and a protocol.
Once attendance is finished, a protocol is given to the client. The protocol must have the requested tests and delivering data.

Figure 7 - Example of a section 4.3 - Critical Analyses of the contract

4.8.2 - Traceability

4.8.2.1- Incoming Products Traceability

Traceability of Kits, reagents and controls will be assured by using a spreadsheet containing identification of the product and date of opening.
Each recipient must have a code bar label with its unique number. The computational system will generate a sample number for each recipient.
Traceability of samples collected from a client will be achieved by code bar reading every time a sample moves from one place to another. The computational system will provide a way to consult the position of specific samples and the places it has been to.

Figure 8 - Example of traceability requirements in a clinical laboratory

Words boldfaced in the above business procedures represent important symbols of the language belonging to the UofD. These symbols were represented in the LEL with its respective notions and behavioral response. Every subject and direct object of business procedures were good candidates for becoming LEL's symbols.

Notions and behavioral responses for each symbol were initially searched for in the Quality Manual and its sub-products. The Quality Manual were, in the worst case, useful to point out the actors responsible for that requirement. Every actor of the UofD present in the business procedures should be a symbol of the LEL (patient, draw sites, distribution sector), as well as words and expressions peculiar to the domain (kits, reagents, delivering data, tests) found by the process described previously.

Figure 6 gives an example of LEL extracted from Figures 5 and 6. During a real LEL specification, all symbols arising in notions and behavioral responses were represented as an LEL entry. The final version of the LEL we got here ***enclosed four new symbols*** which we haven't found in the previous case study using another method.

6 - Conclusion

Many recent works have dealt with business procedures but only a few of them addresses the question on how to find them. This article aims at filling this important gap by detailing a partly tested conceptual model to elicit business procedures, an idea that has not as yet been explored, according to our literature review. An essential characteristic of this method is the use of ISO 9000 documentation

What we propose is to take ISO 9000's documentation as a starting point for rules' elicitation. We propose a detailed conceptual model focusing different areas of a company in such a way that the software engineer can use them as guidelines to elicit business procedures in different areas of the company. Since software quality can only be achieved if the requirements are met, it is very important to have a precise definition of the requirements before engaging in software production. By its very nature, ISO 9000 documentation provides guidelines for defining requirements with the necessary precision.

Since the requirements baseline [Leite 95] [Leite 97] is geared towards natural language sentences, the integration of business procedures into the proposed scheme is very simple, using the links established by the common vocabulary, that is the LEL.

Because ISO 9000 requires a quality system to be complete, well documented and always updated, we believe that it is not only a good source for eliciting business procedures but it can also provide some reuse on the quality documentation produced by a quality process providing requirements traceability. We take as point of departure the already verified documentation in order to gather significant information about the business, which, in turn, will constitute a major source for eliciting the software requirements of the organization in question. However, as is obvious, our strategy should be complemented with other elicitation strategies to better describe the real requirements of a future system.

Future work will include case studies that should contribute to confirm the existing heuristics, as well as to develop new ones. Since the requirements baseline is based on the links provided by the common vocabulary, the future automation support, under construction, is founded on the concept of hypertext. The evolutionary nature of the requirements baseline matches ISO 9000 policies for maintaining the quality system. This match will also be stressed in future works. Finally, we intend to produce a tool to support business procedure acquisition including an assistant that will automatically extract and mark the business procedures present inside the Quality Manual.

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