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Business Rules in Software Development

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Abstract

Business rules represent policies, procedures and constraints regarding how an enterprise conducts its business. BR(s) often focus on access control issues and may consist of business calculation and are evidently important for organizations. Their value has also been recognized within the information system (IS) domain, mostly because of their ability to make applications flexible and amendable to change. Problematic issues includes: the quality of software engineering projects often suffers due to the large gap between the way stakeholders present their requirements and system analysts capture and express those requirements and information systems often fail because their requirements are poorly defined.

This thesis is devoted to the study of business rules in software development life cycle. Software development life cycle contains different phases but this study concentrates on how system analysts work with business rules in the requirement specification phase and which approach they are using either BR-oriented or non BR-oriented? This study is based on the information collected by using interviews with system analysts. Various articles and books on business rules are also used. To validate our empirical findings we have compared them with our theoretical baseline. As a result we have found that most of the system analysts work with both BR-oriented and non BR-oriented approaches but BR-oriented approach makes the information system successful as well as flexible.

Key words: Business Rules, Non BR-Approach, BR-Approach, SDLC, Requirement Specification.

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LIST OF ABRIVATIONS

BR	Business Rule
IS	Information System
ATM	Automated Teller Machine
SDLC	System Development Life Cycle
ISD	Information System Development
CMMI	Capability Maturity Model Integration

1 INTRODUCTION AND BACKGROUND

Business rules represent policies, procedures and constraints regarding how an enterprise conducts its business it is intended to assert business structure or to control or influence the behavior of the business (Rosca, D., Greenspan, S. , Wild, & C., 2002). Business rules often focus on access control issues; for example, professors are allowed to input and modify the marks of the students taking the seminars they instruct, but not the marks of students in other seminars. Business rules may also consist of business calculations, such as how to convert a percentage marks that a student obtains in a seminar into a grade like A, B, or C etc. Some business rules focus on the policies of the organization, like let say the university policy is to expel for one year anyone who fails more that two courses in the same semester.

Business rules are evidently important for organizations as they describe how they are doing their business. Their value has also been recognized within the information system (IS) domain, mostly because of their ability to make applications flexible and amendable to change (Bajec, M. & Krisper, M. 2005). In order to remain useful, it is important for software to evolve according to the changes in its business environment. Business rules, which can be used to represent both user requirements and conditions to which the system should conform, should be considered as the most volatile part in today's software applications (information system) (Wan-Kadir & Loucopoulos, 2004) .

The quality of software engineering projects often suffers due to the large gap between the way stakeholders present their requirements and analysts capture and express those requirements. One of the fundamental issues concerning the improvement of information system (IS) requirements specification process is the reduction of the gap between stakeholders and analysts. Because of such division requirements may be lost during specification, while specification itself may be difficult to verify for the stakeholder. A relatively complicated representation of business knowledge and especially business rules (BR) is often considered as the main cause of the problem. This leads to the assumption that IS requirements should be more BR oriented (Kapocius et al., 2005).

1.1 PROBLEM AREA

Information systems often fail because their requirements are poorly defined (Morgan, 2002). It is very important to understand the business goals and objectives in IS development in order to make it successful. Business specification involves: Understanding the business, no reference to computers, software, screens, databases, tables, etc. Specifications for IS development include identifying pure business operations, objects, relationships, rules, constraints and behaviors of collections of business objects (Kilov). System analysts are responsible for all these specifications for IS development. They have long been able to describe an enterprise in terms of the structure of the data that enterprise uses and the organization of the functions it performs, and software developer tended to neglect the constraints “business rules” under which the enterprise operates (Business Rules Group, 1988).

System analysts use different methods for requirement specification in IS development that can be classified as BR-oriented or Non BR-oriented. If the requirement specification is based on Non BR-oriented then during the development process, developers embed business rules into code rather than explicitly define those (Stelnke & Colleen, 2003). Therefore the main drawback of Non BR-oriented is, as changes in organizations never happen spontaneously, without any reason, but are typically driven either from internal decisions of the organizations or from external forces such as government laws and regulations (Bajec, M. & Krisper, M. 2005). Such changes then leads to change the whole system rather than changes in the rules explicitly.

As mentioned previously in the background there is a gap between stakeholder and system analyst during the requirements specification phase of IS development. To reduce this gap there is a need to represent the business knowledge and especially business rules is an effective way. So, the solution leads to a point that requirement specification should be BR oriented (Kapocius et al., 2005).

1.2 RESEARCH QUESTION

- How do system analysts work with business rules in the requirement specification phase of SDLC?

1.3 PURPOSE OF RESEARCH

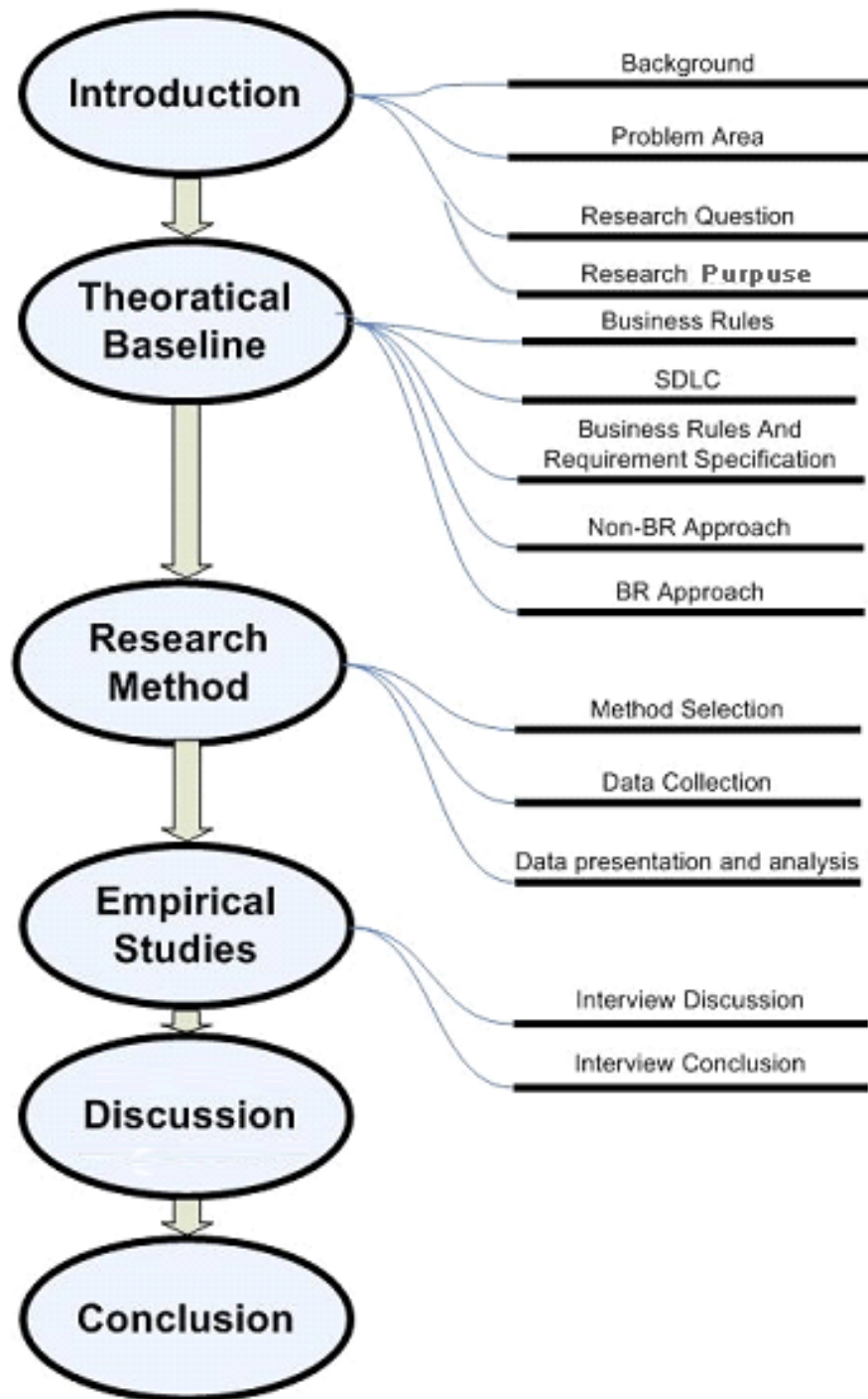
Despite the fact that changes in organizations never happen spontaneously, without any reason but they are driven from internal decisions of the organization or from external forces such as government laws and regulations (Bajec & Krisper, 2005). Therefore, these changes force to change the whole information system of that organization in order to work and compete with the external world.

Business rules are the most volatile part of today's software applications, as they represent both user requirements and conditions in which the system will run (Wan-Kadir & Loucopoulos, 2004). Therefore, the most important part of software development is the requirement phase. According to (Kapocius et al., 2005) information system requirements should be more BR oriented. Our intention behind this work is to investigate whether system analyst work with BR approach or Non-BR approach during the requirement specification phase of the SDLC. The main objective of this thesis is to contribute with the system analysts by analyzing the current literature and empirical study regarding business rules, how these business rules are used with in requirement specification phase of SDLC.

1.4 RESEARCH DELIMITATION

We limit our study to find out how system analysts work with business rules during requirement specification phase of "SDLC". SDLC includes a number of phases but our focus is on requirement specification phase. In requirement specification phase there are also other things like user requirements and functional requirements but our focal point is Business Rules.

1.5 RESEARCH STRUCTURE



Research Structure

2 THEORETICAL BASELINES

The aim of this part is to introduce the theoretical framework of our research work.

2.1 BUSINESS RULE BACKGROUND

According to Business Rules Group (1988) “there is no industry standard definition for the phrase "business rule" or even "rule."

Barbara von Halle, (2002) says that business people define the business rules as a set of conditions which provides the basis for governing the business operations. And these are understood by the business audience and the customers as well. These rules defined all of the business policies whether they are needed or not.

Now, Morgan (2002) defines a business rule as a statement which reflects some aspect of a business. He defines business rule as:

“A statement that defines or constrains some aspects of the business. It is indeed to assert business structure or to control or influence the behavior of the business” (pg. 6)

2.1.1 EXPLANATION

According to the Scott W. Ambler (2004) and the definitions mentioned above, a business rule can be expressed in various ways as

- Constraints on business which emphasize on the structure of the business and tends to persuade the various business activities.
- Focused on access control issues, how they access the system in sense of role, as in a company the supervisor's role is different from the co-workers, and the co-workers can't access the system as well the supervisors. As co-workers are restricted from some of functions of the system as they have low responsibilities than the supervisors.
- Focused on business calculations such as if some one transfer money from Nordea Sweden to Pakistan or any other country then there should be some calculation involved in the transactions with respect to exchange of currency.

- Focused on the policies of any organization, as some business have some rules in order to run in a better way their business, such as Sony Ericsson hire a new employee and their rules is for newly hired employee is that their should be some probation period of six month, after six month they employee will be permanent and enjoy the full employments facilities.
- Business flavor: During rules construction one should have to keep in mind that the business rules should have a business flavor as these rules are understandable by business person as well as the system development personals. Regardless of how to implement these rules.

Further, Barbara von Halle, (2002) is focusing on the point that in order to preserve the business rules, it should be written in simple and natural language. So that, these rules can be easily understood by business personal, and for future use in order make the system flexible with business changes.

2.1.2 BUSINESS RULE CLASSIFICATION

As Business Rules Group states that there is no standard definition for business rule. In similar way Barabara von Halle, (2002) declares that unfortunately, there is not any universal standard for business rule classification. It's not very important for us to know about such classification schemes in depth. There are many of classification and perhaps more to come.

According to Stelnke & Colleen, (2003) business rules are classified into four classes (Fig 1).

- Definition
- Guideline
- Mandate
- Inference

Classification of business rules in term of *definition* includes the terms that relate to business and should be defined in business language. As the main purpose of definition is to ensure IT and business have the level of consideration to move forward to next phases of the system.

Guidelines are basis of the business. This type includes the policies of the business and how business functions are performed. Normally these statements are found in mission statements, vision statements and are not clearly documented as these passed through generations.

Mandates are the “musts” of the business which include such business actions that must be required in order to influence the ongoing business processes. And such rules are well documented.

Inferences are one of type that is derived from one or more than one business rules, in order to derive the value.

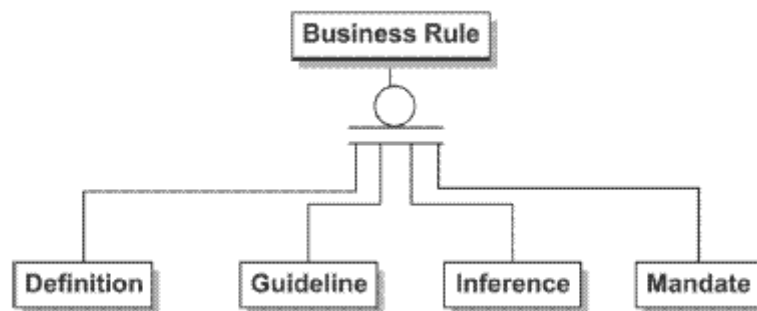


Figure 1 Business Rules Classification (Gerhard & Colleen, 2003)

Barbara von Halle, (2002) mentioned the use of business rules classifications as its main purpose is to fulfill the requirement of audience in sense that they bitterly understand. Also these classifications are the key resources while discovering rules, analyzing rules and designing of the rules.

2.1.3 BUSINESS RULES IN INFORMATION SYSTEM

According to Bajec, M. & Krisper, M. (2005) information systems are well-known in roughly every aspect of today’s business. They are considered as the fundamental elements to achieve business objective in order to dominate the market place. Organization’s business environment doesn’t change impulsively, without any cause, but the changes happened due to organization’s internal decisions or because of external forces, like government rules and regulations. And such kind of internal or external changes in organization’s business

environment directly influence the ways of working which intern effect the information system of the organization.

Stelnke & Colleen, (2003) mention that in order to conquer such kind of variations in the organization it is necessary to change their current information system or develop the new system, to fulfil new goals and objective. And it's obvious that all of these changes belong to the rules, policies as a consequence of internal or external forces, and if the information systems are developed on the basis of business rules then it is not needed to change the overall system's level. The aim of a business rule statement is to guide and influence the behaviour of business in organization --- to define how business actually is running. The application of these business rules should be consistent and shouldn't be embedded hardly into the code of application (Stelnke & Colleen, 2003).

Further, Stelnke & Colleen, (2003) state that business rules can be defined in term of principals that operate the organization's business. Every single rule should assert one aspect of the business and can be grouped or classified to make similar concept obvious. To IT it's a rule that provides the guidance in designing, developing and implementing any software and system to support the business processes. But rules are owned by the business no IT. The key role is to make the business successful through business rules, as they enable the IT to meet the goals and objective of the business.

Shao & Pound & Nlckolette, (1999) describe the importance of business rules in the information system of any organization. They say "an organisation's ability to understand, manage and evolve its business rules within its information systems is crucial to its operational effectiveness and market competitiveness". According to Shao & Pound & Nlckolette (1999), this is easily understood that business rules are crucial to operational effectiveness and market competitiveness; it is possibly amazing that little effort has been made so far to identify business rules carefully and explicitly during the process of information system's development.

Moreover, Scott W. Ambler (2004) says that the business rules are identified in the normal course of requirements gathering and analysis which is considered as the first phase of System development life cycle "SDLC" and our next section is about system development life cycle,

requirement specification and also about the key role of system analyst in requirement specification.

2.2 SYSTEM DEVELOPMENT LIFE CYCLE

As we have mentioned in the pervious section that business rules are identified in the requirement specification phase of the SDLC. We have a short explanation of SDLC. There is a standard for the software development process which is developed by the Institute of Electrical and Electronics Engineers (IEEE). The definition they gave for the software development process has been widely acknowledged in both industry and academia which is as follows:

“The life cycle of software system is normally defined as the period of time that starts when a software product is conceived and ends when the product is no longer available for use. This cycle is based on IEEE Std 610.12-1990 and consists of a concept phase, requirements phase, design phase, implementation phase, test phase, installation and checkout phase, operation and maintenance phase, and retirement phase [IEEE Std 1074-1997]” [online]

According to IEEE 1074-1997 standards, and there are six stages of software development process that are as follows:

- Software requirement and analysis
- Software design
- Software construction
- Software testing
- Software configuration management
- Software documentation development

According to IEEE 1074-1997 standards,

“The systems development life cycle (SDLC) is a conceptual model, framework used in project management that help and describe the different

stages of software development in information system i.e. from requirement specifications to maintenance”

Kay (2002) mentions that, a number of system development life cycles have been created in order to manage and provide to different process in system development. These methods are; waterfall (basic), fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize (Kay, 2002). Different methods have their own process but they are almost extended from the waterfall model.

2.2.1 REQUIREMENT SPECIFICATION

A requirements specification plays several roles in a systems development process (Bubenkojr & Wangler, 1993). It acts as a contract between the business personal and the IT. It also used to evaluate the end product that whether the system is according to the basic requirements. It also acts as a reference if in future there are some changes happened in the Information system. These changes are normally occurred due to change in the environment and requirements of the System (Bubenkojr and Wangler, 1993).

As from the SDLC six steps after requirement specification the system analysis phase starts. A main purpose of systems analysis is to collect all relevant information about the whole system surroundings such as how the data should be interact with in the system, how to present the data, how to store the data, how to manipulate the data (H. HBRBST, 1996).

Businesses rules are essential to IS to ensure the system they build follow the business practices. As stated above the traditional system development life cycle starts with the requirement gathering phase, which mainly focus on the business problem and the documents which is basis for the company rules and policies. Therefore during the requirement phase from those document system analysts extracts the rules which they seems to be rules and policies which may change during future (Stelnke & Colleen, 2003).

2.2.2 ROLE OF SYSTEM ANALYSTS

According to Green (1989), the system analysts are service providers who are responsible for defining, developing and implementing computer-based systems whilst working very closely with its users. There is a discrepancy along with expectations and proficiencies of analysts and users in the private organizations than those in the public organizations.

He declares that poorly developed systems, behavioural dysfunctions (e.g., mistrust, avoidance, rejection) and negative user satisfaction are sober penalties happen due to the conflict between analysts and users and may be very costly. As mentioned above, analysts and users belonging to public and private systems differ considerably on perceptions of all three measures.

Kaiser & Bostrom, (1982) say that systems development efforts are dependent to a large extent upon how fine systems analysts and users work together---meaning that system analysts should involve the users actively to there actions thoroughly. The most crucial stage for the analyst and user dealings occurs in the problem definition and requirement specification phase of system development process (Land, 1982). Baroudi, et al., (1986); Ginzberg, (1981); Lucas, (1975); Welke & Konsynski, (1982) has also mention that analysts and users usually work together on requirements within a project team structure and research evidence suggests that user should be keenly involved throughout the initial phase of the development process so that to make successful implementation.

One main characteristics of a good analyst is that they always tried to analysis the business problem through business rules. They mainly focus on business rules. So it's a better approach as compared to traditional analysis approach (Dorsey, 2002).

2.3 WORKING WITH BUSINESS RULES IN REQUIREMENT SPECIFICATION

In the pervious section we have discussed about SDLC and requirement specification phase and the role of system analysts in Information system development. This part will introduce how business rules are defined, documented, expressed and categorized during requirement specification process.

2.3.1 DEFINING BUSINESS RULES

Before identifying business rules there should be some criteria to validate the business rules. According to Morgan (2002) all the different definition of business rules are like “simple statements about the business” nothing technical. Stelnke, (2003) says that “some criteria should be used to determine validity of business rules”. Plotkin (1999b) lists some characteristics of a business rules that need to be present for the rule to be deemed good and so should be followed.

- Declarative
- Precise
- Atomic
- Consistent
- Business orientated

Declarative characteristic is very important to be considered while writing the business rules. An IT person use to write business rules in such a way so that they may be implemented into the application code but this is not the language of the business. They should be written in such a way so that they understood by the business people.

Precision is very important when writing the business rules. A business rule should be clear and precise to all the parties involved. If there is any term or something in business rule which is blurred to any of the business people, it might cause some sort of problems to assert the intent.

The **Atomic** principal holds the business rule to a specific and a single business concept; thus business rules can be combined to form larger more complex business rules. If a declared

business rule is fuzzy for the business audience then it is perhaps not clear. Therefore, it's required to decompose that complex rule into smaller parts in order to make them understandable and logical.

Consistency is a key element in every system (Stelnke, 2003); therefore it should be same in overall the system. As the whole systems are organized by functions and processes, but most of them require consistency in order to perform the specific function.

Finally, Stelnke, (2003) states that business rules should be **business oriented**. They should be written and described in significant business words and scope. The person concerned with business rule wouldn't want to deal with complex programming details.

2.3.2 REQUIREMENTS DOCUMENT

Kotonya & Sommerville (1998) define requirement document as a formal document which is used to communicate the requirements to users, engineers and managers (Document Slides [online]). They describe characteristics of requirement documents which are given below:

- It shows the main functions and purposes of the system.
- Highlights the constraints that are required for system operation.
- It should include the criteria of integration with other system such as the communication protocol etc.
- It also includes constraints on the development processes of system.
- It should include the technical and hardware requirements of the system, which are needed to run it.

The requirement documents also include an introduction and overview of the system, functions fulfilled by the system and glossary details of terms included in the whole system.

2.3.3 HOW TO EXPRESS BUSINESS RULES

According to Morgan (2002) rule statement is one simple kind of thing. But in fact it is possible to categorize into three levels of expression. And this categorization depends on the type or function of that rule. Morgan (2002) also describes the three level of expression in detail which is given below.

1. **Informal.** It is based on everyday natural language which is understandable by everybody within that system.

For example A bank customer can withdraw atmost 10000 sek per day through ATM.

2. **Technical.** This level is a further explanation of the informal level which is combination of both the natural language and technical terms.

For example:

Withdraw

Self.customer.amount <= 10000

3. **Formal.** This level gives more technical description of the informal level in sense with mathematical expressions that can be easily understandable by the IT personals.

For example {X, Y , (customer X)) (creditAccount Y) (holder X Y)} → (ge (age X) 18)

All the level of expression has its own importance. But according to Morgan (2002) the most desirable level is the informal level due to its easiness of understanding, and the business people more like this level too. So there is a tool for showing the whole process in the informal way as shown in the Figure-2 by Morgan (2002)

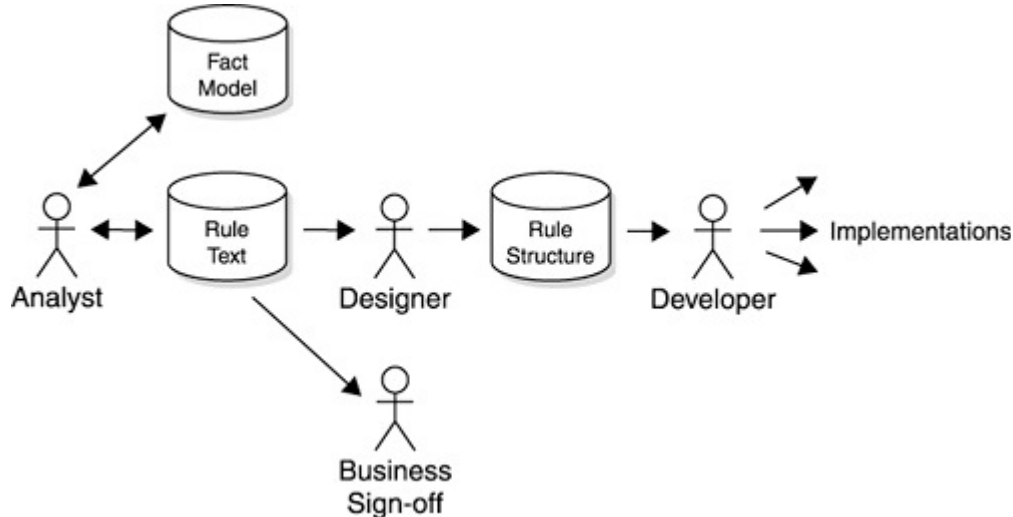


Figure 2 Low-technology rule definition (Morgan, 2002 p.64)

As from the Figure-2 it is shown that the business analysts create rules in an informal way means that they define the rules in simple text which is understandable by both the business and IT personals. But the main flow of the system is according to the analysts. According to Morgan (2002) during the translation of the informal rule to formal level it may lead to one or more rule implementation, so these translations are done by human and chances of errors. And there are no steps to remove these errors in the current tool

therefore it needs some other way which includes correction of these errors by means of iterative steps.

According to Figure-2 it's shown that the analyst works just on the business descriptions or models rather than investigating the nature of the organization, how it operates. The main flaw is the translation from informal to formal is done by some human rather than through some structure. This leads to an error during implementation. Also, there is a lack of testing those rules generated by the designer.

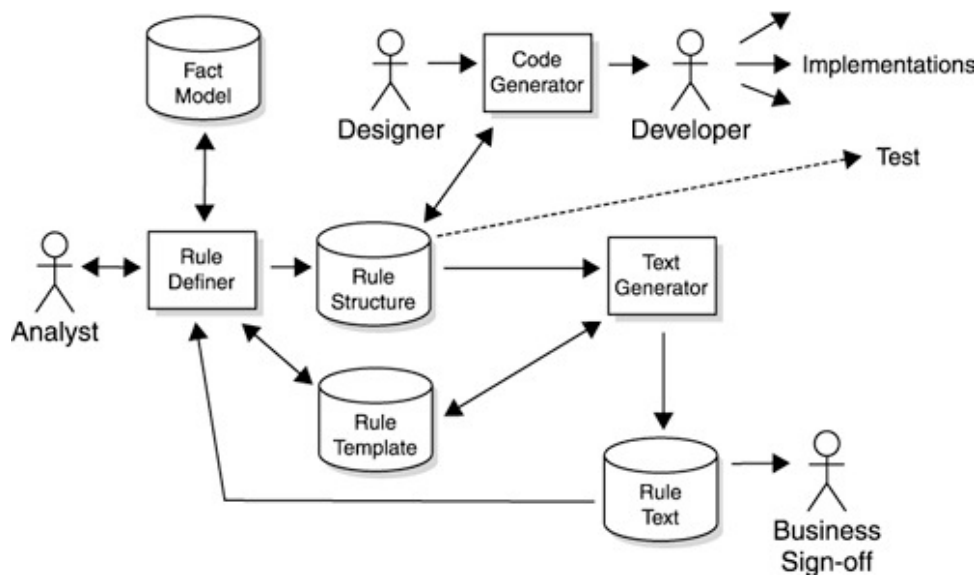


Figure 3 Controlled rule definition (Morgan, 2002 p.65)

Then Morgan (2002) presents another refined tool for the rule definition in Figure-3. As discussed above in order to remove the errors during the translation of the informal rules. In this tool, the rule structure is moved one step back to minimize the error of translations as it is obvious that if there are some structures then less chance of errors. As this tool has refined form of the Figure-2 so it removes the flaws. If we compare Figure-2 with Figure-3, this shows that code are generated by rule structures during implementations. It tests the code when rules are generated. It also involves the business persons as if the rule generated has some error than they redefine that description.

To discover the business rules it is essential to know about the kinds of rule statements, there origins and what different approaches are used to find rule statements from various origins (Morgan, 2002).

2.3.4 CATEGORIZATION OF BUSINESS RULES

Sahao & Pound, (1999) categorize business rules in the following ways:

- **Structural business rules**
Structural business rules are statements which describes the constraints and relationships of various data objects within the business organization. Numbers of description levels of data objects are possible. But at the lowest level of object descriptions are called structural rules.
- **Behavioural business rules**
The statements that reflect the dynamic aspects of the business are categorized as behavioural business rules. These statements describes that what could be done to business objects with respect to business events, and what kind of actions can make changes to these business objects.
- **Constraint business rules**
These are rule statements which emphasize on the structure of the business---how it operates and tends to persuade the various business activities and actions.

2.3.5 ORIGINS OF BUSINESS RULES

According to Morgan (2002), "In the business world it's doubtful that anyone ever sits down and says, "I think I'll create a business rule." The rules are reflections of the way that the organization works or the way it intends to work in the future."

He mentions that we can consider four main types of information source.

1. Documentation
2. Tacit know-how
3. Automation systems
4. Business records.

Documentation

Documentations can be basic sources of business rules. And source documents can be used to identify business rules in number of ways.

- Those documents which are the basis of the initiation of the project.
- Business objectives
- Historical statements

Tacit know-how.

Every organization has its own culture and values that defines the way we do things around here Morgan (2002). And they also have some previous experiences what will or won't work. So these are experiences and good source of information but always having problem during transfer or documentation.

Automation systems.

When we are going to overlap existing projects with an existing business activity such as a book store business is running with few nationwide retails then they want to integrate their store with online stores. Their current way of working could be a good source for the business rules. As this is new initiative based on some existing business.

Business records.

Existing business records can be a good source of business rules as business records shows most of the business policies as how their interaction with their customer, how many type of customer they have, how they handle each customers and through their services the customer are satisfied Morgan (2002).

2.3.6 APPROACHES FOR FINDING RULES

Here in this section we are discussing some topics what are the basic way and approaches to find rules as according to the definition of business rules above and the basic sources of business rules.

According to Morgan (2002) it is not enough to site and write the business rules if the system scope is big and having many modules. So for such system we must need some guidelines how to write a business rules.

- In order to make better business rules it is important that first analysis the whole system in depth.

- After analysis it is important to cover the ground in a systematic way so that there are no loop holes left. As almost every systems have such like deficiencies.
- The rules have to be expressed at the correct level Morgan (2002).

Morgan, (2002) says that it is necessary to find some principles that can be used to make locating business rules in such a way that have less chances of failure and more of success, not like hit-and-miss affair.

There are three approaches that can be used; it depends on the scope and nature of the system that one approach will used or combination of approaches. The best approach is the Static analysis only if the documentations are available. If the document is not available for the discovery of business rules then analysts and business specialists try to explore the business in an interactive way, in order to get more reliable information. This approach is called interaction sessions. The third and final approach is the automated as this is applicable only if rules can be found through machines rather than human beings, so the source of information should be provided by humans Morgan, (2002).

As in Table-1 show the applicability of the approaches depending on the availability of information sources. And if source of the business rules is document then the interactive approach can also be applicable but the automated approach is not reliable. If the source document is tacit know-how then the interactive approach is the suitable one. In case of Automation system s source then the automated one is the most applicable and if source information is business records then it depends on the document to be used such as customer history etc.

Source	Static Analysis	Interactive	Automated
Documentation	High	Moderate	Unreliable
Tacit Know-How	Not applicable	High	Not applicable
Automation systems	Low	Moderate	High
Business records	Depends on source	Low	Depends on source

Table-1 Applicability of discovery methods (Morgan, 2002 p110)

In this section we have discussed about how to work with business rules in requirement specification. As there are two approaches BR approach and Non-BR approach. Therefore in the next section we will discuss about these two topics.

2.4 NON-BR APPROACH FOR REQUIREMENT SPECIFICATION

In most of the ISD approaches, there are a number of steps as we have already discussed in the SDLC part. First step among all these approaches is the requirement gathering and analysis phase. Therefore the main task is to work with the system requirement - how system works? Whenever a system is designed, business owner is consulted at start to describe his or her needs in every approach in the form of requirement specifications. Therefore, system analyst works with the specification which is provided by business owner rather than focusing on the business policies, rules, constraints as in Figure-4.

As according to Maguire, (2000) lack of expectation is growing on the end of users regarding the information systems being developed by organisations. There are many reasons for this hesitation from developing new information system is due to the time period taken for implementation. And during these long period of development business requirements also changed (Maguire, 2000).

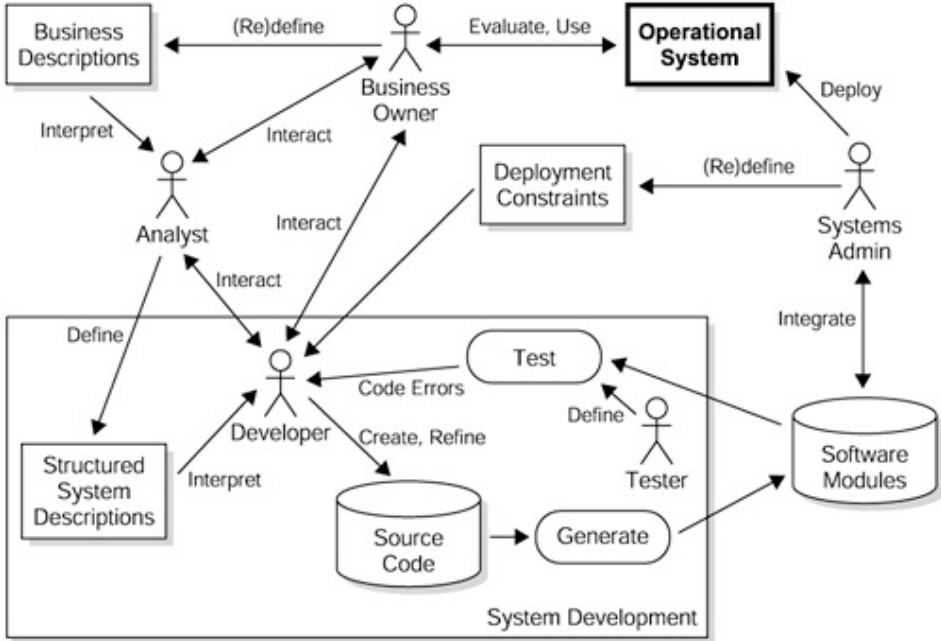


Figure 4 Current Development Process (Morgan, 2002 p.7)

Current most information system developments are based on the following steps as suggested by (Morgan, 2002).

Figure-4 shows highly simplified form of information system development, as it describe almost all main steps involve in traditional ISD. According to figure-4

- It is shown that when the business persons provide their requirement, their interactions cut-off or limits with the system development team. The main reason of less interaction is the complication of the materials and documents generated from the business description. These are difficult to understand, as they are not in natural language.
- There are some weaknesses and flaws as it will grant the code. It may contain error and will have to check before generation of code so the test step is on step forward. And up to this level the code is passed through three steps. Errors may be detected at this stage and removing these errors may lead to more errors.
- The whole process relies in this approach is fully depended on the business description provide by the business owners. This is interpreted by the analysts later on. Interpreted document is then used by the developers in order to design the product and they transfer it into source code. Therefore, due to passing through many steps it may lead to misunderstandings and complications. Also the test is performed after the code is generated therefore it may be nonflexible to make changes.
- The process is very labour intensive (Morgan, 2002). As almost every step is far from the deploying process, there may be lack of communication between labors.
- The process seems to be slow as there are too many steps involved. Big software projects are abandoned, at huge cost, because the needs of the organization are changing more quickly than the time software take to be developed. (Morgan, 2002).

2.5 BUSINESS RULES APPROACH FOR REQUIREMENT SPECIFICATION

A business rules approach is a methodology by which you capture, challenge, publish, automate, and change rules from a strategic business perspective. The main characteristic of

business rule approach is to elevate the importance of business rules, which later on used for the system development. And that finally applied in the organization's systems development and function approach (Barbara von Halle, 2002).

Further, Dorsey (2002) expresses that business rules approach is simply a better approach for requirement analysis and it is not something new. This approach is clear-cut way of describing excellent systems analysis. In fact, it's an enhanced way of describing how a quality systems analysis has always been done.

2.5.1 EFFECTIVENESS OF BUSINESS RULES APPROACH

Business Rules Approach can be effective in the following common scenarios in today's business world (Barbara von Halle, 2002).

The business needs to change, but its systems are barriers to change (Barbara von Halle, 2002). Most of the today's system are very complex and composed of many components and the external world is not aware of what is going on inside. The main reason is due to the lack of documentation and knowledge about them. Due to lack of proper documentation of current system, it's time consuming and costly to upgrade the system and do changes according to the business changes. As the average shelf life of software release is measured in months and customer expectations have accelerated therefore, it is obvious upgrades to software is greater than even before(Barbara von Halle, 2002).

New legislative mandates and directions are underway that not only require adherence, but also open the doors to new business opportunities (Barbara von Halle, 2002). Therefore, to overcome these legislative authorizations, organizations have to change their current system, in order to run the business according to the laws and regulations of the state (Barbara von Halle, 2002).

Emerging products, services, and partnerships are arising out of the Internet marketplace (Barbara von Halle, 2002). For example, integration of business over internet (B-to-B) needs changes in one or both of the system going to be integrated. Therefore rules should be well defined on both sides.

Virtual competition looms (Barbara von Halle, 2002). Virtual competition takes place only if some competitions take place virtually through internet and having competitors for the similar products.

2.5.2 ADVANTAGES OF BUSINESS RULES APPROACH

At a glance, six advantages of building systems using a business rules approach include (Barbara von Halle, 2002):

1. **Simplicity.** A business rules approach is simple to understand both for business and technical people (Barbara von Halle, 2002). As it is written in plain text so it's easy to understand. The business people are not interested, which model and methods are used but they are interested in the business policies and rules because these are the basic things on which their whole business depended.
2. **Small number of necessary, non-technical concepts.** Rule is the key term in business rules approach. Rules consist of different concepts such as decisions, rule patterns, rule families and rule clauses (Barbara von Halle, 2002). Therefore, the decisions belong to the logical part of the rule and after that in rule patterns, rules are analyzed through specific structures.
3. **Rule independence.** The main aim of business rules approach is to express the rules independently by syntax as in the rule definition it is already mentioned that it is written in plain text. And these are not dependent on technology and applications (Barbara von Halle, 2002).
4. **Ease of application development.** As the rules are identified independently and rules are tested before implementing into the code applications (Barbara von Halle, 2002) therefore, it's easy for the developer to integrate that tested rules.
5. **Rule reuse.** Rules can be reused as they are not dependent on application and technology. Therefore same rules can be implemented and transferred to some other systems too, as rules are tested separately for applications (Barbara von Halle, 2002).

6. **Simplified systems design.** It separates the main process from the rule execution. If rules are available then it is easy to implement the whole system and it minimizes the development time.

2.5.3 BENEFITS TO BUSINESS

Three benefits to the business audience of a business rules approach according to Barbara von Halle, (2002):

1. As business rules are written in natural language and provide a clear image of the whole business process. Therefore it's easy to Maintain with less effort and low cost as most the business people can change the rules by themselves.
2. As discussed above during the system development process, in business approach the rules are tested at its initial stages and approved by the business people. Therefore the business people are closer to the system specification.
3. Business rules are well documented and separated in a repository and easily available as not buried inside code such as in traditional system development process. So the business people know where to find the rules (Barbara von Halle, 2002).

2.5.4 BENEFITS TO SOFTWARE ENGINEERS

According to Barbara von Halle, 2002, the application of business rules approach provides the software engineers with a number of benefits as listed below:

- BR-approach reduce the software development time
- It helps to develop such software that is flexible to accommodate future changes in the organization's system.
- A business rules approach reduces the communication gap between requirements, analysis, and design of the system.
- BR-approach reduces the effort for coding if this code is generated from the rules. Therefore, leads to fewer opportunities for errors.
- As rules can be changed easily, this means freezing the requirements required less effort.
- Developing a system using business rules is more cost effective than using traditional method of development.

- Business rules approaches helps in evaluating technology easily

2.5.5 BUSINESS RULES APPROACH IN INFORMATION SYSTEM

The business rules approach to information systems development is becoming more and more widely accepted (Dorsey, 2002). In software development life cycle, requirement gathering phase is the main focused step. In traditional system development, in the requirement phase, the user instructs how its system should look like (Dorsey, 2002). But in business rules approach the way is some thing different, the requirement analysis phase mainly focuses on how does their business or organization works, instead of the system requirement.

2.6 Summary

In theoretical part we have discussed the main areas that are related to our research question. In the first section we have discussed the business rules definitions, business classification, business rules categories, and business rules expression. In the second section we have discussed about SDLC, Requirement specification phase and the role of system analyst in information system. In the third section we have discussed working with business rules in requirement specification. In the last section we have discussed about the approaches (BR-oriented and Non-BR) used for requirement specification.

Business rules are a set of conditions which provides the basis for governing the business operations. According to the Scott W. Ambler (2004), business rules are constraints on business that may also focus on access control issues, business calculations, policies of any organization and can have business flavor. They can also be classified.

As discussed above, information systems are well-known in every aspect of today's business and considered as the fundamental elements to achieve business goals to compete market place. Variations may happen in ongoing behaviors of any organization which cause problems in changing there IS accordingly and hence new system development is needed. Requirements specification, a responsibility of analyst plays a vital role in this context of systems development process. The most crucial stage for the analyst and user dealings occurs in the problem definition and requirement specification phase of system development process. Different approaches are used for requirement specification. A good analyst is one who always tries to analyze the business problem through with business rules, means he mainly

focuses on business rules. Non BR-oriented approach is used in traditional system development life cycle. It starts with the requirement gathering phase mainly focused on the business problem and the documents which are the basis for the company rules and policies. Variations may happen in these documents in future causing the whole information system to change. These variations belong to these rules; if the information systems are developed on the basis of business rules approach, then it is not necessarily important to change the overall system's level.

3 RESEARCH METHOD

The method is a tool to generate solutions to problems and to derive new knowledge (Lekwall & Wahlbin, 2001). This chapter presents the method choice we have made in our thesis which will provide the reader an opportunity to estimate the reliability of the result. There are several factors that can be decisive for the result of the study and there are a number of method choices that can be made. Different methods are suitable in a different way depending on the situations. We have studied the options and then made conscious choice to avoid wrong method choice that could affect our result negatively.

3.1 METHOD SELECTION

According to Lekwall & Wahlbin, (2001) there are mainly two types of research: the qualitative research approach and the quantitative research approach. The look and feel of empirical data produced by both of these approaches is totally different having different attributes. The quantitative method is often used to check statistical significant differences since large samples are used. The qualitative approach is instead used when answers to more in-depth questions are wanted (Patel & Davidsson, 2003). The qualitative method generates more information about feelings and motivations; it can be seen as more soft data (Patel & Davidsson, 2003).

Mason (2002) argues that the qualitative method is an appropriate procedure for creating understanding and imaginings of the respondent. She further argues that this method is suitable when dealing with complex questions since qualitative research can give you much more specific information from a single respondent. Holme & Solvang (1997) concur with this statement and point out that the qualitative approach is more informal than the quantitative and therefore generates a deeper knowledge from each respondent. They further argue that the best, and most common, way to obtain qualitative information is through interviews.

We conducted qualitative research study because of the nature of our research question. As our research question is “How do system analysts work with business rules in the requirement specification phase of SDLC?” and according to Cresswell (1998), in a qualitative study, the

research question often starts with how or what so that initial forays into the topic describe what is going on. This is in contrast to quantitative questions that ask why and look for a comparison of groups (e.g., Is Group 1 better at something than Group 2?) or a relationship between variables, with the intent of establishing an association, relationship, or cause and effect (e.g., Did Variable X explain what happened in Variable Y?) (Cresswell, 1998).

3.1.1 INTERVIEWS

We used interview as a method for the collection of data. As our thesis is about system analyst's works- means to investigate about the practices and experiences of system analysts in their field work and interviews are particularly useful for getting the story behind a participant's experiences. The interviewer can chase in-depth information about the concerned research topic through interviews. In addition to, interviews are also useful for the further investigation depending on the response of interviewees. (McNamara, 1999)

Other reasons to choose this research method instead of any other technique are as follows: Interviews are a far more personal form of research than others. In the personal interview, we can work directly with the respondent and it's generally easier for respondent, especially if what are sought, are opinions or impressions. Interviews provide the interviewer the opportunity to explore and investigate the topic in-depth through asking follow-up questions. We can conduct telephonic interviews, internet-based interviews etc., but it depends on the interviewees how they can be available.

3.1.2 INTERVIEW STRUCTURE

Preece et al., (2002) describes that there are four main types of interviews structures: unstructured, structured, semi-structured, and group interviews. The first three types are named according to how much control the interviewer imposes on the conversation by following a predetermined set of questions. The fourth involves a small group guided by an interviewer who facilitates discussion of a specified set of topics (Preece et al., 2002).

The most appropriate approach to interviewing depends on the evaluation goals, the questions to be addressed, and the method of research adopted. If the goal is to gain an overall impression of a subject, then an informal, unstructured interview is often the best approach. But if the goal is to get feedback about a specific issue, then a structured interview or a

questionnaire is often better. This is because the goals and questions are more specific in the latter case (Preece et al., 2002).

Since we have adopted a qualitative method, and our aim is to obtain both an overall understanding and answers about specific issues concerning system analysts' work with business rules in requirement specification phase. We chose to conduct semi-structured interviews. Semi-structured interviews combine features of structured and unstructured interviews and use both closed and open-ended questions. For consistency the interviewer has a basic script for guidance, so that the same topics are covered with each interviewee. The interviewer starts with pre-planned questions and then probes the interviewee to say more until no new relevant information is forthcoming (Preece et al., 2002).

3.1.3 CONSTRUCTING THE INTERVIEW QUESTIONS

In our interviews we have used both open-ended questions and close-ended questions. Open-ended questions are, according to Creswell (2002) the most common way of formulating qualitative questions, and we have used these in our interviews with the intention to receive deeper answers including the respondents' own opinions and comments.

We provided interview questionnaire in advance to all interviewees through e-mail. This act endorsed them to be more comfy when starting the interview. Further it can allow the interviewees to prepare themselves according to interview questions, if necessary. However, this approach may restraint the respondents to leave spontaneous answers. Though, it was considered to be more important to retrieve thorough answers than spontaneous information. Interview guide is attached as appendix 1.

3.1.4 CONDUCTING THE INTERVIEWS

As our thesis is about the Business Rules in system development concerning with "how do system analysts work with business rules?" In this context we conducted a number of telephonic interviews with a number of system analysts from different companies. To conduct qualitative research using telephonic interviews has advantages such as access, speed, and lower cost, according to Saunders et al. (2003) thus making it more convenient. However, this approach is likely to be appropriate only in particular circumstances, as when access and possibility to interviews are restricted by cost, time, and distance. We have chosen to conduct

telephone interviews due to a number of reasons: the number of interviewees is higher than in a usual qualitative research, the distance to the interviewees is significant, and the short time needed to conduct one interview makes the travel to the many spread out interviewees costly. Saunders et al. (2003) further introduce some limitation with this approach. Firstly, it may be difficult to establish a personal contact with the interviewee over the telephone, which may have an effect on the trust, which might be needed between the interviewer, and the interviewee when asking sensitive questions. Secondly, it might be difficult to conduct the interview at a favourable place and at the same time record the forthcoming data. In addition, you cannot witness the non-verbal behaviour of the interviewee which might affect your interpretation of how sensitive questions to ask. We find these limitations highly adequate; however we have overcome them by a number of facts. The nature of our questions is not sensitive in the sense that trust needs to be fully established before commencing the interview.

Further, as our questions are not sensitive as previously mentioned, the lack of witnessing non-verbal behaviour will not create a problem. As for recording the data whilst conducting the interview, we have overcome this by printing the questions in advance with blank spaces after each question, in order to easily fill in the answers while interviewing the system analysts without slowing down the pace of the interview.

3.2 CATEGORIES OF DATA COLLECTION

This section will show how we categorize our data collection process. Basically the value of the research relies on the collection of information and on the method used behind the collection. Saunders et al. (2003) describes further types of gathering which have both advantages and drawbacks. Saunders et al. (2003) also points out that the method used to gather information should be selected in line with the methodological approach and the purpose of the thesis. Two categories of data exist and can be used at the same time: primary and secondary.

Primary data are collected by the researchers themselves (Saunders et al., 2003), as we have collected through our empirical study. Other data have been collected from other available sources i.e. books, articles, journals and Internet. Internet search engines like Google, Google Scholar, Journal Storage and Lund university library search engine made this data available.

Because of its large academic database, Lund university library was the main provider of relevant data. The below keywords were used to find out relevant data through the mentioned search engines.

- Business rules
- Requirement specification
- System analysts
- SDLC (software development life cycle)
- Business rules approach
- Non BR-approach

3.3 DATA PRESENTATION AND ANALYSIS

There are different methods which make the interview analysis more meaningful. These techniques can be used to organize the interview text, to condense the interview in the form of some short sentences in order to get the meanings of what was said in the interview.

The work of transforming the collected data into an understandable text was very extensive and was carried out in several stages. The first stage was to transcribe all interviews. This text was then processed and shortened in order to complete a first draft of the empirical findings. However this text became very extensive and it was soon realized that if the empirical findings were presented in such a way the reader would have found it very hard to get a reasonable oversight of the data.

We first transcribed the data collected from the interviews and from that transcribed data we construct summary of each interview with respect to our interview questions that we conducted. Base on that summary at the end we raised some interview discussions and a conclusion of the interview discussion. Then at the end we have a discussion which includes our views from the theoretical framework as well as interview discussion.

3.4 RESEARCH QUALITY

In order to enhance credibility of our work, we use methods to enhance research validity and we put a strong emphasis on the ethical aspect of our research. Both validity and ethics are covered as follows.

3.4.1 VALIDITY

We employ using one of the methods to ensure validity of our research: Pattern matching (Yin, 2003). As pattered matching is such method which compares empirical collected data with predefined data as in our theorotical part. We are aware of the fact that literature presents a more theoretical point of view, whereas interviews with analysts and software engineers will highlight practical aspects. Yet, if both data sources will generate similar outcome, then our research outcome will gain more validity.

3.4.2 ETHICS

As we are using interviews as a data collection technique, therefore it requires sensitivity and imposes ethical considerations. Ethics should be considered especially when any research involves the humans and can affect them as well. Kvale (1996) highlights the three key points to be well thought-out when conducting interviews:

- **Informed consent:** the interviewees have to approve participating in the research, including knowing the subject and purpose of the research, and how their answers will be used. In our case we have informed our subjects beforehand about the purpose of our work and how we are going to deal with their answers.
- **Confidentiality:** during the interview sessions it's often possible to reveal the personal details of interviewees. Therefore, they must be informed that their responses will be dealt with full confidentiality. We have chosen to keep our interviewees anonymous, revealing only the companies they are working for and their positions within the companies. However, as the company sizes are rather small and the positions of our interviewees are unique, it could be possible to trace back the persons in question. We found that it was not possible to completely anonymity the interviewees by hiding all related data, because this would require reducing the companies to the type of product they develop and hide many details that are directly linked to our research question.
- **Consequences:** minimizing the risk of harm to the interviewees by balancing harm and benefits of the research is an overreaching principle when conducting research based

on interviews. The type of harm possible during an interview in our work would less likely have a psychological nature (like the intimacy of a therapeutic interview) but rather a possible work-related conflict, if the employer of the interviewee would use his or her answers in a disadvantageous way. This could be the case if the interviewee would accidentally reveal information not intended for the public or if the employer would find out about something that can lead to negative consequences for the interviewee. The basis of this approach is derived from the ethics of virtue and the simple fact that interviewees should be rewarded for their commitment. The central aspect of our work is how system analyst works with business rules. If the outcome of the research will benefit someone, it will affect system analysts who can do their job better, and in consequence section.

4 EMPIRICAL STUDIES AND RESULTS

In this part of our thesis we have shown the results of empirical study. We return to our research question - How do system analysts work with business rules in the requirement specification phase of SDLC? With respect to our research question the main source for the empirical findings was the system analysts. Therefore, we had to find practitioners and experts in the field of system development and to find out how they work during the system development life cycle? It was very important for us to get a broad spectrum of competencies and backgrounds of our interviewees. It was a bit hard for us to contact with a number of companies and to find out right people for interviews within short time span. Our work experiences and contacts helped us to find out right people for the interviews. The interviewees belong to the companies that were dealing primarily with software developments.

As mentioned in the method part we have used telephonic interviews. In advance, we have sent questionnaires along with an interview guide to our interviewees. (See appendix 1). We have conducted five interviews with system analysts and software engineers from different multinational IT companies in Pakistan: Wateen Telecom (Pvt.) Ltd, Nextwerk (Pvt.) Ltd, PowerObjects (Pvt.) Ltd, System Limited. One analyst belonged to medium size software house in Lahore (Pakistan), he was not willing to disclose his company name so we have assumed this company as company X.

Interviewee 1:

First interviewee was working as software engineer in Wateen Telecom (Pvt.) Ltd Pakistan. He was responsible for gathering system requirement and proposed feasible solution for the system. According to him **Wateen Telecom** is Pakistan's largest communication company in the private sector. It became the detrimental catalyst that has wildly moved forward the country into a digital revolution with its ability to impeccably connect and enable smarter, faster, cost-effective and flexible communication solutions to reach its valued customers. It's a child company of Abu Dhabi Group. It primarily involves in telecommunication as well as software development for its sub companies and its main development office is in Lahore (Pakistan).

After summarizing this interview we have found that interviewee 1 faced different problems during requirement gathering process including non-cooperation & incomplete knowledge of

user in describing different organizational operations and ignoring exceptions to the normal organizational operations. He focused on how different business operations are performed by the users as well as the basic system requirements provided by the users but mainly focused on business requirements. To achieve this goal I try to collect documents created by them during different business operations to better understand the business needs. To identify business rules he considered pre-requisites to a business function, specific calculations i.e. discounting and taxation etc. He categorized business rules while discovering them as normal and exceptional business rules. He writes business rules in natural language that is understandable for the non technical users and create single document for business rules and functional requirement. He used both approaches BR-oriented approach and Non BR-oriented approach for requirement specification. According to interviewee, BR-oriented approach is more beneficial because it gives us the actual picture of the way organization works. He worked with rules in such a way that the application is flexible to change.

Interviewee 2:

Second interviewee was working as system analyst in company X. According to him company X is a leading medium size software house, developing software for financial sector. **Company X** worked with the classical phase of SDLC by involving the business rules. It was mainly focused on Pakistani market regarding their clients. Therefore, clients were the organizations in Pakistan such as PEL, Waves etc. Interviewee 2 was responsible for requirement gathering and analysis. According to him he has faced problems with customers because sometime customers didn't know exactly what they need. Then he said, "To make a system suitable for the customer I follow the requirement documents and visit the business place to know about business processes by interacting business audience". He said, "Users don't always involve themselves in requirement specification phase". He tried his best to engage them as actively as possible but mostly customers feel none of their obligation. He focused on user requirements but also took the business process under consideration. He identified the business rules from analysis of user requirement and business process. He categorized business rules as validation rules and flow based rules. According to him validation rules limit or control what users can enter in a table field or a control (such as a text box) on a form. Flow based rules are related to the flow of business. He used Non-Br oriented approach for requirement specification and used to write business rules in technical and natural languages in a single document with functional requirements. He said that he uses non

BR-oriented approach but BR-oriented approach is beneficial if system entails complex business rules. He said that by placing business rules in such a way to make applications flexible for change can be ideal but it's not always achievable, most of the times it is rigid.

Interviewee 3:

This interviewee was working as team leader in NextWerk (Pvt.) Ltd Pakistan. He said that **NextWerk** is an outsourcing software development company based in the city "Lahore". Its main clients are from US. This company introduced new concept of virtual consultant - means that the consultants are based in NextWerk office (Pakistan) and works for clients in US as an employee of that US client. The company has been working for software and web development by following the pure standard of SDLC. Interviewee 3 was responsible for gather requirement from client, planning the work, distributing work to developer working for development and helping them if they face any problem in development. This interviewee told that there is a gap between system analyst and the user. Some time requirements are not clear and client don't know what exactly he/she wants. He said, "I focus on both user requirement and the way business works but mainly on business because some time user notify his requirements according to business but actually they are not. Therefore, I have to focus on both things". According to interviewee 3, he identifies business rules while studying the business process through official documents and interacting with stakeholders but combines them with functional specification. This interviewee categorized business rules in structure business rules and conditional business rules. He wrote business rules in natural language as plain text and some time represent with diagram because this is easily understandable by non technical user. He said that he uses both BR-oriented and non BR-oriented approaches depending on the system being developed. According to him BR-oriented approach is more beneficial because every business has its own rules.

Interviewee 4:

During describing the company, the fourth interviewee said that **PowerObjects** is a development and consulting firm which has grown into a multi-million dollar product and service company specializing in web site development, content management systems, web site design, programming, and distributed application development. This interviewee was responsible for requirement gathering and project planning in PowerObjects. In contrast to previous interviewees interviewee 4 focused on the business requirements rather than user

requirements. He used static analysis approach to identify business rules and categorized the BR in structural, behavioural and constraints business rules. Describing these categories he said, “Structural business rules are different statements about the data objects related to an organization e.g. customers have id number, students have registration number these statements are structural business rules as they define the relationships between the various data objects. It should be noted that these relationships are derived from business requirements. Behavioral business rules are statements about some aspects of a business. They specify what have been done to data objects in response to events, and the actions taken may result in change of state for the data objects. When an insurance claim is made, a claim reference number is allocated. If a customer withdraws money, the corresponding account is debited. These are the examples of behavioral rules. These rules specify what the system will do in response to an event. Behavioral business rules often implement much more complex business logic than can be defined through a data model, and they are usually implemented as procedural programs. Conditional business rules are statements about the conditions under which an organization’s business operates”. Like interviewee 3 this interviewee also used to write business rules in natural language because it’s understandable. Further, interviewee 4 gave short answers to some question i.e. he said that he use BR-oriented approach because it is beneficial and he also separates the business rules from the functional requirements and also put them in such a way to make application flexible for changes.

Interviewee 5:

The last interviewee was working for Systems Limited. According to him **Systems Limited** was established in 1977 as the first software house and computer services bureau in Pakistan. He said that this company is playing a major role in largest IT projects in the country. Internationally the company operates as Visionet Systems and has established itself as a key player in critical market segments of United States, providing services and products to a growing list of corporate clients many of which are counted among Fortune 500. Systems Limited is the one of few other software houses in Pakistan that has been appraised successfully at CMMI (Capability Maturity Model Integration) level 3. Interviewee 5 was working in System Limited as software engineer and was also responsible for requirement specification. Like others this interviewee also face problems during requirement phase such as unavailability of customer, lack of proper knowledge etc. that shows the gap between system analyst and the user. According to this interviewee the involvement of user during

requirement gathering depends on project of system being developed but he accepts that it is beneficial to actively involve the user during requirement specification. He said that it's better to involve user during requirement specification but main focus is on business for requirement gathering. Like interviewee 3, the interviewee 5 also used requirement documents to identify the business rules and it categorized business rules as process and structural business rules. He said that he uses both approaches but BR-oriented approach is more useful for the future changes in the system. He merges business rules with functional requirements in a single document.

4.1 INTERVIEWS DISCUSSION

In this section we have discussed the views of our interviewees on the bases of important key points: problem during requirement specification, user involvement, identification & categorization of business rules, language to write BR, and approaches they have used.

Interviewee 1 and 5 were software engineers, Interviewee 2 and 4 were the system analysts while the interviewee 3 was working as a team leader. All of these interviewees were responsible for requirement specification and had a good experience in requirement specification phase of SDLC.

According to the interviewees 1, 3, and 5 it is true that there is a gap between system analysts and stakeholders in the form of unavailability of customer, communication gap, Non-cooperation & incomplete knowledge of user in describing different organizational operations and ignoring exceptions to the normal organizational operations but according to interviewee 2, sometimes clients don't know exactly what they need. In contrast, the interviewee 4 said that he often didn't face any problem. Regarding user involvement, the interviewee 1 said that he involves the users. Interviewees 2, 3, 4, and 5 said that they involve users some times, not always. Further, interviewee 5 told that it depends on the project but it's beneficial to involve the user. Even interviewee 1, 2, 3 and 5 involve the user but they mainly focus on business requirements during requirement specification. Interviewee 4 is the one who just focus on the business requirements.

All the interviewees follow different ways to identify the business rules. Interviewee 1 makes use of pre-requisites of business operations to identify business rules. Interviewee 2 identifies

rules through analyzing user requirements and business process. Interviewee 3 does it while studying the business processes through official documents provided by the stakeholders. Interviewee 4 follows the static analysis approach to identify the business rules. Finally, the interviewee 5 uses the requirement documents for business rules identification. Like business rules identification all interviewees categorize business rules in different ways while discovering them. *Structural business rules* is a category which is commonly by interviewees 3, 4, and 5. Distinctively, interviewee 1 categorizes business rules as normal and exceptional rules, interviewee 2 categorizes business rules as validation rules & flow based rules, interviewee 3 categorizes business rules as conditional rules, interviewee 4 makes use of behavioural & constraints BR categories and finally interviewee 5 categorize BR as process business rules. While categorizing and identifying business rules each interviewee write them in natural language which is understandable for the non technical business people too. Interviewee 4 is the one who writes business rules separately from all other requirements but rest of the interviewees make single documents for writing business rules and other requirements e.g. functional requirements. All the interviewees place the business rules in such a way that it makes the system flexible.

Approach used for requirement gathering is one of the most important key points in this thesis. As we saw in above discussion, the interviewee 4 is one who said that he often don't face any problem during requirement gathering regarding user, he makes separate document for business rules and focuses only on the way business works. These are all the symptoms of adopting BR-oriented approach and interviewee 4 is the one who just uses this approach and obviously BR-oriented approach is best according to him. Only interviewee 2 uses non BR-oriented approach because he thinks that BR-oriented approach should be used only if system has complex business rules. Interviewees 1, 3, and 5 use both. They also agree with that BR-oriented approach is beneficial for a number of reasons:

- ◆ BR-oriented approach is favourable if system have complex business rules
- ◆ BR-oriented approach gives us the actual picture of the way organization works.
- ◆ BR-oriented approach is better because every system has its own rules
- ◆ BR-oriented approach accommodates the future changes of the system.

Summing up the interview discussion we represented our findings from interviews as tabular form (Table-2). It provides a quick view of each interviewee's interest on the bases of important key points regarding their way of working.

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5
Job Title	Software engineer	System analyst	Team leader	System analyst	software engineer
Responsibility	Gathering system requirement and purposed feasible solution for the system.	Requirement gathering and analysis	Gathering requirement from client, planning the work, distributing work to developer and to help them	Requirement gathering and project planning	Software engineer also responsible for requirement specification
Problem during requirement gathering	Non-cooperation & incomplete knowledge of user in describing different organizational operations and ignoring exceptions to the normal organizational operations.	Some times customers don't know exactly what they need	Communication gap between system analyst and the user	Not really	Unavailability of customer, lack of proper knowledge
User involvement	Yes	User doesn't always involve themselves	Not always	Not always	Depends on project but it's beneficial to involve user
Focus on the user requirements or business	Focused on both but mainly on business requirements	Focused on user requirements but also took the business process under consideration	Focused on both but mainly on business	Focused on the business	Mainly focused on business
Identifying business rules	From pre-requisites of business operations	Through analyzing user requirement and business process	While studying the business process through official documents and stakeholders	Static analysis approach	Requirement Documents

Categorization of business rules	Normal and exceptional business rules	Validation rules and flow based rules	Structural and conditional business rules	Structural, behavioural and constraints business rules	Structural and process business rules
Language to write business Rules	Natural language	Technical and natural languages	Natural language as plain text and diagram too	Natural language	Natural language
Mergence/Separate of Business Rules with other requirements	Single document	Single document	Single document	Separate BR from other requirements	Single document
Approach used for requirement gathering	Both approaches	Non BR-oriented	Both approaches	BR-oriented	Both approaches
Favourable Approach	BR-oriented approach because it gives actual picture of the way organization works.	BR-oriented approach for system having complex BR	BR-oriented because every business has its own rules.	BR-oriented	BR-oriented approach for future changes
Do they place rules/constraints in such a way to make system flexible	Yes	It's ideal, but not always achievable, most of times it's rigid.	Yes	Yes	Yes

Table-2 Short representation of results collected through interviews.

4.1.1 CONCLUSION

Concluding our interview discussion and using short representation of results, we have found from our empirical study that:

- ◆ System analysts face different kind of problems during requirement specification e.g. non-cooperation, unavailability & incomplete knowledge of user in describing organizational operations and communication gap between system analyst and user.
- ◆ System analysts involve users sometimes in requirement specification but it depends on the project.

- ◆ Mostly system analysts focus on the way business works during requirement specification.
- ◆ System analysts follow different ways to identify and categorize business rules.
For example, identification of business rules through pre-requisites of business operations, through analyzing user requirement & business process, while studying business process through official documents, using static analysis approach and also using requirement documents. Categorization as Normal, exceptional, validation, business, flow based, structural, conditional, behavioral, constraints and process business rules.
- ◆ Natural language is used by the system analysts to write business rules because it's understandable for non technical business people.
- ◆ Single document is created for both business rules and functional requirements.
- ◆ Both BR-oriented approach and non BR-oriented approach are used by the system analysts but BR-oriented approach is beneficial for number of reasons i.e. it gives actual picture of the way organization works, it is better to accommodate future changes in the system, also beneficial for a system having complex business rules.

5 DISCUSSION

Before starting our discussion let's repeat again the research question i.e. How do system analysts work with business rules in the requirement specification phase of SDLC? and to answer this question we have collected data from already available resources like articles, books, publication, journals and internet sources. Then we have conducted an empirical study through qualitative research approach with respect to our research question and the theoretical baseline. Empirical study provided us the primary data (empirical data) to answer our research question. Now we are going to discuss all the underlying concepts in the light of theoretical baseline and empirical findings. We will discuss our findings under the following headings.

- ✓ Responsibilities of Analysts and Software Engineers
- ✓ Gap Between System Analysts And Users
- ✓ Working with Business rules
 - Business rules identification
 - Business rules Categorization
 - Business Rules Expression and documentation
- ✓ Approaches to Requirement Specification

5.1 **RESPONSIBILITIES OF ANALYSTS AND SOFTWARE ENGINEERS**

In theoretical part of this thesis, under the heading 2.2.2 according to Green (1989), the system analysts are service providers who are responsible for defining, developing and implementing computer-based systems whilst working very closely with its users. According to our empirical study as shown in table-2 the interviewee 1 is responsible for gathering system requirements and also proposing a feasible solution for the system being developed. Interviewee 3 is responsible for gathering requirements from clients and also planning the work & distributing it to other developers. Interviewee 4 has responsibilities of requirements gathering and project planning. Finally, the interviewee 5 is a software engineer also responsible for requirements specification. All of these results show that all interviewees

mentioned above have various responsibilities regarding their job descriptions but the main task is the requirement gathering.

5.2 GAP BETWEEN SYSTEM ANALYSTS AND USERS

As mentioned in the introduction part of this thesis, according to Kapocius et al., (2005) the quality of software engineering projects often suffers due to the large gap between the way stakeholders present their requirements and analysts capture and express those requirements. The quality of software engineering projects can be improved through reduction of the gap between stakeholders and analysts. Our empirical finding also reflects that there is a gap between system analysts and the users as shown in table-2 like non-cooperation & incomplete knowledge of user in describing different organizational operations are the problems faced by interviewee 1, unavailability of user and lack of proper knowledge are the problems faced by interviewees 2 and 5, and interviewee 3 said that there is a communication gap between him and the user.

5.3 WORKING WITH BUSINESS RULES

In the introduction part of thesis, according to Bajec, M. &Krisper, M. (2005) Business rules are evidently important for organizations as they describe how they are doing their business. Their value has also been recognized within the information system (IS) domain, mostly because of their ability to make applications flexible and amendable to change. This shows that when we have to build an information system for a business, it is very important to handle business rules in a proper way. Here we have discussed how system analysts and software engineers work with identification, categorization, expression and documentation of business rules.

5.3.1 BUSINESS RULES IDENTIFICATION

As shown in table-1 under the heading 2.3.6 of the theoretical part, there are three approaches used for identification of business rules that are static analysis, interactive session and automated rule discovery.

In our empirical study, interviewees identify business rules differently as shown in table-2. The interviewee 4 uses static analysis approach to identify business rules which is one of the approaches mentioned above. Interviewee 5 identifies rules from requirement document that also falls in static analysis approach but he didn't mention the name of this approach. Interviewee 1 identifies business rules from pre-requisites of business operations. Finally, the interviewee 3 and 4 identify business rules while analysing the business process through official documents and interacting with stakeholders therefore, it can be some kind of interactive session approach but they didn't mention the name of the approach.

5.3.2 BUSINESS RULES CATEGORIZATION

In theoretical part under the heading 2.3.4 according to J Sahao & C J Pound, (1999) business rules can be categorized as structural, behavioural and constraints business rules. In our empirical findings as shown in table-2, the interviewee 1 categorizes business rules in two categories: normal and exceptional rules. Interviewee 2 categorizes business rules as validation rules and flow based business rules. Interviewee 3 categorizes business rules as structural and conditional business rules. Interviewee 4 categorizes business rules as structural, behavioural and constraints business rules. Finally, the interviewee 5 categorizes business rules as structural and process business rules. Comparing the results with theoretical part, the interviewees 1 and 2 categorize business rules differently. Only interviewee 4 categorizes business rules according to the theoretical part but interviewee 3 and 5 use just one category which is mentioned in theoretical part i.e. structural business rules.

5.3.3 BUSINESS RULES EXPRESSION AND DOCUMENTATION

Business rules can be expressed in different ways at different levels of software development. As in the theory part under the heading 2.3.3 according to Tony Morgan (2002) there are three level of expression of business rules. Those are *Informal*, *Technical* and *formal*. In our empirical findings (Table-2), we have found that system analysts express business rules in natural language because this is understandable for both technical and non technical people and this is an informal level of expressing business rules. One of our interviewees i.e. interviewee 2 uses both natural and technical languages and if we relate it with theoretical part then it can be combination of informal and technical level of expressing business rules.

5.4 BR-ORIENTED & NON BR-ORIENTED APPROACHE

In our empirical study as shown in table-2 we have found that 3 of our interviewees use both approaches for requirement specification but the interviewee 4 is only one which uses BR-oriented approach. According to 4 interviewees, BR-Oriented approach is more beneficial. As interviewees 1, 3 and 5 use both approaches but according to interviewee 1, BR-oriented approach is beneficial because it gives actual picture of the way organization works. Interviewee 3 said that BR-oriented is favourable because every business has its own rules and according to interviewee 5, BR-oriented approach is more useful for the future changes in the system being developed. Interviewee 2 is only one who uses non BR-oriented approach for requirement specification. According to him if system contains complex business rules then BR-oriented approach is more beneficial.

According to theoretical part under heading 1.1 there is a gap between the system analyst and business persons and Kapocius et al., (2005) proposes a solution that to eliminate this gap BR-oriented approach should be used. Relating this with our empirical findings from the results of interviewee 4 as shown in table-2 we can see that he is using BR-oriented approach, makes separate document for business rules, focuses on business requirements during requirement specification and hence do not face problem regarding user. Under the heading 2.4 of theoretical part it is mentioned that in non BR-oriented approach system analyst mainly works only with the requirement specification rather than focusing on the business process, but according to our empirical findings interviewee 2 focuses on both user requirements and business process as shown in table-2.

Under heading 4.1 from our empirical study it is shown that BR-oriented approach gives us the actual picture of the way organization works and accommodates the future changes of the system. Relating with theoretical part under the heading 2.5.3 Barbara von Halle, (2002) also says that this approach provides a clear image of the whole business process and under 2.5.4 Barbara von Halle, (2002) says again that this approach helps to develop such software that is flexible to accommodate future changes in the organization's system.

6 CONCLUSION

Before writing the conclusion let us repeat the research question i.e. how do system analysts work with business rules in the requirement specification phase of SDLC? As mentioned in theoretical part under the heading 1.1 that information systems often fail because their requirements are poorly defined. It is very important to understand the business goals & objectives in IS development in order to make it successful and the system analysts are responsible for all these specifications for IS development. In theoretical part under the heading 2.2.2 Dr. Paul Dorsey, (2002) says that one main characteristics of a good analyst is that they always tried to analysis the business problem through business rules. They mainly focus on business rules. This was the purpose of thesis to see how system analysts work with business rules in requirement specification phase of SDLC and which approach they are using either BR-oriented or non BR-oriented. In this thesis we have tried to provide the reader with an opportunity to understand the current working trends of system analysts regarding business rules.

In the light of our empirical findings and discussions we have concluded that only system analysts are not responsible for requirement gathering but the team leaders and the software engineers having other responsibilities can also be responsible for requirement gathering.

There is a gap between system analysts and users in the form of non-cooperation, incomplete knowledge, unavailability of user and communication between them.

While discovering business rules, commonly these are identified using static analysis approach and interactive session approach.

Empirical findings show that there is not any single standard to categorize business rules because system analysts categorize business rules in their own ways. Informal level of expressing business rules is commonly used, it doesn't matter which approach is used for requirement specification whether BR-oriented or non BR-oriented.

In theoretical baseline as mentioned in the summary of the theory part, the non BR-oriented approach is used in traditional system development life cycle but our empirical finding shows

that still it is used for the requirement gathering as shown in table-2. According to our empirical results, both BR-oriented and non BR-oriented approaches are used but BR-oriented approach is best to reduce the gap between system analysts and users to make the system successful.

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8 Appendix 1

8.1 Interview Guide

Date and time: -----

Interviewer: -----

Interviewee: -----

Company: -----

8.1.1 PURPOSE OF THE INTERVIEW

Our research work is about how system analysts do work with business rules during requirement specification. Therefore, the purpose of this interview is to learn about analyst's work and what they think of existing trends regarding business rules in requirement gathering activity.

8.1.2 ABBREVIATIONS

BR => Business rules

8.1.3 QUESTIONNAIRE

1. What kind of responsibilities do you have?
2. Do you face any problem during requirement gathering phase? (*As in our problem statement it is mentioned with reference that there is a gape between analyst and stakeholder*)
3. Does user actively involved during requirement specification phase?
4. Do you focus on the user requirements rather than how their business does work during requirement gathering?
5. How you identify business rules?
6. Do you categorize business rules while discovering them?
7. Do you write business Rules in natural language which is understandable by non-technical & business audiences?
8. Do you merge business rules with functional requirements or make separate document?
9. Which approach do you use for requirement gathering BR-oriented or Non-BR?
10. Which approach is beneficial for requirement gathering BR-oriented or Non-BR?
11. Do you make separate document for business rules?

12. Do you place the rules/constraints in such a way so that to make the application flexible for changes.

- Is there anything else you have in your mind and would like to add or mention?

Thank you so much for your participation. Your help is greatly appreciated.

9 Appendix 2

9.1 Interview Transcription

Interviewer: Naeem, Nasim, Faheem

Interviewee: 1

N: What kind of responsibilities do you have?

Interviewee: My responsibilities include gathering system requirements, to analyze those requirements, propose one or more feasible solutions for the required business need and to implement the finalized solution.

N: Do you face any problem during requirement gathering phase?

Interviewee: Different problems faced during requirement gathering process include non-cooperation of users in describing different organizational operations, incomplete knowledge of different organizational operations and ignoring exceptions to the normal organizational operations.

N: Does user actively involved during requirement specification phase?

Interviewee: hmm. Yes

N: Do you focus on the user requirements rather than how their business does work during requirement gathering?

Interviewee: I focus on how different business operations are performed by the users as well as the basic system requirements provided by the users. To achieve this goal I try to collect documents created by them during different business operations to better understand the business needs.

F: In short it means you focus on both user requirements and business requirements?

Interviewee: hmm. Yes but mainly I focus on Business requirements.

N: How you identify business rules?

Interviewee: I consider pre-requisites to a business function, specific calculations i.e. discounting and taxation etc. during a business function and above all set of steps during a business function as business rules.

N: Are these pre-requisites in the form of any document?

Interviewee: Yes. Basically I use static analysis approach to identify business rules.

N: Do you categorize business rules while discovering them?

Interviewee: The only categorization I make is to separate normal and exceptional business rules.

F: What do you mean exceptional business rules?

Interviewee: Exceptional business rules are those that are not normal. For example, to be in class 7 u have to clear class 6 but in exceptional case one can be promoted to class 7 from class 5

N: Do you write business Rules in natural language which is understandable by non-technical & business audiences?

Interviewee: I write business rules in a language understandable by non-technical and business audience.

N: Do you merge business rules with functional requirements or make separate document?

Interviewee: I make a single document for functional requirements and business rules.

N: Which approach do you use for requirement gathering BR-oriented or Non-BR?

Interviewee: I try to use both approaches as the user being questioned for gathering system requirements tries to tell what he/she wants the information system to perform. The problem I face during this is that each user has his perspective of the system. To overcome this I try to identify different functions performed and also identify any exceptions to the normal execution of steps.

N: Which approach is beneficial for requirement gathering BR-oriented or Non-BR?

Interviewee: BR-oriented approach is more beneficial because it gives you the actual picture of current working of the organization.

N: Do you make separate document for business rules?

Interviewee: I make a single document for functional requirements and business rules.

N: Do you place the rules/constraints in such a way so that to make the application flexible for changes.

Interviewee: Yes, I have to make application flexible for change because changes can occur frequently in different organizational operations.

Interviewers: Nasim, Faheem and Naeem

Interviewee: 2

N: What kind of responsibilities do you have?

Interviewee: I am working as a system analysts. My major responsibility is requirement analysis.

N: Do you face any problem during requirement gathering phase?

Interviewee: Yes, most of the time customer themselves do not know what they want and what they need.

N: Then, how you know what exactly customer want?

Interviewee: Good question, I follow requirement documents and I visit the business place to know about business processes by interacting business audience.

F: Does user actively involved during requirement specification phase?

Interviewee: Not always, we try our best to engage them as actively as possible, but most of the time the customer feels none of his obligation.

N: Do you focus on the user requirements rather than how their business does work during requirement gathering?

Interviewee: We first listen to the user requirements and then ask them a few questions to clarify business processes. If we found an anomaly in what they said and how business works, we forward that exception and ask explanation.

N: How you identify business rules?

Interviewee: By the requirements forwarded by the user and analysis of business processes involved.

N: Do you categorize business rules while discovering them?

Interviewee: Yes, we categorize them as validation rules, business and flow based rules.

N: What do you mean by validation rules and flow based rules.

Interviewee: Validation rule limits or controls what users can enter in a table field or a control (such as a text box) on a form. Flow based rules are related to the flow of business.

N: Do you write business Rules in natural language which is understandable by non-technical & business audiences?

Interviewee: No. we use a mix language (technical + natural).

N: Do you merge business rules with functional requirements or make separate document?

Interviewee: We merge business rules in functional specifications.

N: Which approach do you use for requirement gathering BR-oriented or Non-BR?

Interviewee: Non-BR oriented

N: Which approach is beneficial for requirement gathering BR-oriented or Non-BR?

Interviewee: It depends on the type of system. If it entails complex BR it's sometime beneficial to go for BR-oriented approach.

N: Do you make separate document for business rules?

Interviewee: No, we use functional spec document to record business rules.

N: Do you place the rules/constraints in such a way so that to make the application flexible

for changes.

Interviewee: It's ideal, but not always achievable, most of the times it's rigid.

Interviewers: Nasim, Faheem and Naeem

Interviewee: 3

N: What kind of responsibilities do you have?

Interviewee: Well I am working a team lead. So, my main responsibilities are gather requirement from client, looking the client requirement, planning the work, distributing work to developer working under me.

N: Do you face any problem during requirement gathering phase?

Interviewee: Some time, when the requirements are not clear and Client do not know what exactly he wants.

N: Does user actively involved during requirement specification phase?

Interviewee: Some user Involved actively but some are not

N: Do you focus on the user requirements rather then how their business does work during requirement gathering?

Interviewee: I focus on both user requirement and the way business works but mainly on business because some time user notify his requirements according to business but actually they are not. Therefore, I have to focus on both things

N: How you identify business rules?

Interviewee: By going through the business process.

F: How you go through the business process?

Interviewee: Reviewing official documents and by interacting with stakeholder.

N: Do you categorize business rules while discovering them?

Interviewee: Yes

F: How you categorize business rules?

Interviewee: Normally, I categorize business rules into structured business rules and conditional business rules.

F: Do you write business Rules in natural language which is understandable by non-technical & business audiences?

Interviewee: Yes, sometime in plain text, some time in the form of diagrams

N: Do you merge business rules with functional requirements or make separate document?

Interviewee: I merge them with functional specification

N: Which approach do you use for requirement gathering BR-oriented or Non-BR?

Interviewee: I use both approaches. It depends on the system being developed.

N: Which approach is beneficial for requirement gathering BR-oriented or Non-BR?

Interviewee: BR-oriented, every business have its own rules, this approach is best.

F: Do you place the rules/constraints in such a way so that to make the application flexible for changes.

Interviewee: Yes

Interviewers: Nasim, Faheem and Naeem

Interviewee: 4

N: What kind of responsibilities do you have?

Interviewee: I am responsible for requirement gathering and project planning.

N: Do you face any problem during requirement gathering phase?

Interviewee: Not really.

N: Does user actively involved during requirement specification phase?

Interviewee: Some time user is involved and some time not.

F: Do you focus on the user requirements rather than how their business does work during requirement gathering?

Interviewee: Some times user requirement but mostly their business requirements.

N: How you identify business rules?

Interviewee: I use static analysis approach to identify the business rules.

N: Do you categorize business rules while discovering them?

Interviewee: Yes.

N: How do you categorize business rules?

Interviewee: I categorize business rules structure, behavioural and conditional business rules.

N: What do you mean by structural business rules, behavioral and constraints business rules?

Interviewee: Structural business rules are different statements about the data objects related to an organization e.g. customers have id number, students have registration number these statements are structural business rules as they define the relationships between the various data objects. It should be noted that these relationships are derived from business requirements. Behavioral business rules are statements about some aspects of a business. They specify what have been done to data objects in response to events, and the actions taken may result in change of state for the data objects. When an insurance claim is made, a claim reference number is allocated. If a customer withdraws money, the corresponding account is debited. These are the examples of behavioral rules. These rules specify what the system will do in response to an event. Behavioral business rules often implement much more complex business logic than can be defined through a data model, and they are usually implemented as procedural programs. Conditional business rules are statements about the conditions under which an organization's business operates.

N: Do you write business Rules in natural language which is understandable by non-technical & business audiences?

Interviewee: Yes

N: Do you merge business rules with functional requirements or make separate document?

Interviewee: No

N: Which approach do you use for requirement gathering BR-oriented or Non-BR?

Interviewee: BR-oriented

N: Which approach is beneficial for requirement gathering BR-oriented or Non-BR?

Interviewee: BR-oriented

N: Do you make separate document for business rules?

Interviewee: Yes.

N: Do you place the rules/constraints in such a way so that to make the application flexible for changes.

Interviewee: Yes.

Interviewers: Nasim, Faheem and Naeem

Interviewee: 5

N: What kind of responsibilities do you have?

Interviewee: I am working as a Software engineer. My main responsibilities include requirement specification and provide feasible solutions for the proposed system.

N: Do you face any problem during requirement gathering phase?

Interviewee: I face different problems during the requirement phase such as unavailability of customer, lack of proper knowledge etc but it's depend on the user.

N: Does user actively involved during requirement specification phase?

Interviewee: It depends on project.

F: Is it beneficial to involve the user during the requirement specification.

Interviewee: Yes of course.

F: Do you focus on the user requirements rather then how their business does work during requirement gathering?

Interviewee: I focused on business requirements because that is the most important, as it make the system flexible.

N: Do you place the rules/constraints in such a way so that to make the application flexible for changes.

Interviewee: Yes.

N: How you identify business rules?

Interviewee: I identified the business rules by analyzing the business requirement documents provided by the customer.

N: Do you categorize business rules while discovering them?

Interviewee: Yes, I categorize business rules as structural and process business rules.

N: Do you write business Rules in natural language which is understandable by non-technical & business audiences?

Interviewee: Yes.

N: Do you merge business rules with functional requirements or make separate document?

Interviewee: Yes, I merged business rules with functional requirements.

N: Which approach do you use for requirement gathering BR-oriented or Non-BR?

Interviewee: I used both approaches for requirement specification.

N: Which approach is beneficial for requirement gathering BR-oriented or Non-BR?

Interviewee: BR-oriented because this approach is more useful for the future changes in the system.

N: Do you make separate document for business rules?

Interviewee: No, I make single document for both business rules and requirement specification.