Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Information Engineering

Bachelor Thesis

Title

BPMN versus BORM usability UI Study

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BACHELOR THESIS ASSIGNMENT

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Systems Engineering and Informatics

Thesis title

BPMN versus BORM usability UI Study

Objectives of thesis

Study the BPMN and BORM methodologies and notation. Prepare Usability test, which allows to check methodologies notation usability for process which contains:

2 iteration

3 selection

5 activities

try to find typical process from your live as air-tickets ordering, enrol to the subject exam, etc. The usability check in the Collaborative lab HUBRU PEF.

Methodology

Study suitable materials as BPMN and BORM how to guidelines. Prepare typical business process and model that. Perform the studies (the study should be recorded). Try to recognise the main differences between the notations. Formulate results from your findings.

The proposed extent of the thesis

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Alan Cooper and Robert Reimann: About Face 2.0: The Essentials of Interaction Design (Mar 17, 2003), ISBN-13: 978-0764526411

Jakob Nielsen's Alertbox, April 14, 2003: Paper Prototyping

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The Diploma thesis supervisor

Ing. Josef Pavlicek

DECLARATION OF INTEGRITY

I declare that I have worked on my bachelor thesis titled "BPMN Versus BORM Usability UI study" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any other person.

Signed:

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In Prague on date of submission _____15th March 2018_____

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ABSTRACT

There are several business models around the world today used in various industries and organisations.
This study was based on studying and understanding two business models BPMN (Business Process Model Notation) and BORM (Business object relationship model).
The study investigated several works that have been done by various authors and was able to study and understand business models and their applications in real life.
The two processes were compared and similarities as well as a few differences were found between them, Other business models used in organizations were also investigated, the elements and approaches related to theses two models were also explained in the literature review.

The aim of this thesis is mainly to differentiate between these two models (BPMN and BORM) and try to study previous guidelines and literature about it, also to model a process which shows activities, selections and possibly iteration in a system. A usability test was carried out in the CZU Collaborative lab using snowball sampling technique to choose participants and the result was shared and discussed with the participants to see what they understand from the flow charts.

It was concluded from the research that BORM although an older version of Business Model Usability process is also a good form of usability however BPMN seems less complicated and more user friendly.

ABSTRAKT

Existuje několik obchodních modelů po celém světě, které se dnes používají v různých průmyslových odvětvích a organizacích.
Tato studie vycházela z BPMN (Business Process Model Notation) a BORM (Model vztahů s obchodními objekty).

Studie zkoumala několik děl vytvořených různými autory a dokázala studovat a porozumět podnikatelským modelům a jejich aplikacím v reálném životě.
Dva procesy byly porovnány a mezi nimi byly shledány podobnosti i některé rozdíly. Byly zkoumány i další obchodní modely používané v organizacích, prvky a přístupy týkající se těchto dvou modelů byly také vysvětleny v přehledu literatury.

Cílem této práce je rozlišovat mezi těmito dvěma modely (BPMN a BORM) a zkusit studovat předchozí pokyny a literaturu o tom, také modelovat proces, který ukazuje aktivity, výběry a případně iteraci v systému. V rámci CZU Collaborative Laboratory byl proveden test použitelnosti pomocí techniky vzorkování sněhové koule s cílem vybrat účastníky a výsledek byl sdílen a diskutován s účastníky, aby zjistili, co chápali z diagramů.

Z výzkumu bylo zjištěno, že BORM, ačkoli starší verze procesu Business Usability je také dobrou formou použitelnosti, nicméně BPMN se zdá méně komplikovaná a uživatelsky přívětivější

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CHAPTER 1

1.0 Introduction

Our world today is highly dominated by computers and various types of software, with every new day comes a different application with different functionality.
The concept of Business Models in Information technology has become very important nowadays, with continuous changes and development in Information and communication Technologies (ICT).

Continuous and rapid growth in Information and Communication Technologies (ICT) has made the idea of Business models very important in today's world. Due to advancement in Mobile and Internet Technologies-Business and E-commerce are now the new ways of conducting business.

Moreover, rules that governed the traditional world of business are questioned in this emerging world of digital business. For example, a huge investment was needed to establish a traditional business. Traditionally, this investment was considered a strategic barrier to entry (Al-Debei, El-Haddadeh and Avison, 2008).

Business Owners in the old business setting(Traditional) are now experienced and are also able to translate business ideas and strategies directly into business processes.

There are four major phases in the historical development of business processes. The first phase is launched with the introduction of Sun Tzu's Art of War in the era of Ancient China. In the Art of War, Sun Tzu describes military strategies and tactics where he would assign specific tasks to certain people and calculate the resources needed for the execution of these tasks (von Scheel et al., 2015).

The business sector needs a simple but expressive tool for modelling business ideas, which can play the same role as that of a ERD (entity-relationship diagram), data flow diagram and flow charts .One the major advantages of these models were that they were comprehensible by domain experts and contained limited concepts, unlike the UML diagram/approach which lacks simplicity (Merunka 2010a).

1.1 Business Model Concept

Businesses and Organisations need to adapt to the evolving changes in Information and Communication Technologies (ICT) to survive and succeed, as business processes are changing businesses needs to be responsive as fast as possible in other to keep up with the digital world of business.

Al-Debei, El-Haddadeh and Avison 2008, in the article Defining the Business Model in the New World of Digital Business stated that the digital era has meant that the availability of appropriate levels of information and knowledge have become critical to the success of the business.

When discussing business process models it's good to always have in mind market/products competitors.
Due, to the increased competition among product owners, faster turnaround demand by customers and changes in market regulation, often makes organisations kick off to address these sorts of challenges and they find themselves building business process models to illustrate the flow of work and related activities(White and Miers, 2008).

Gordijn et al 2000, Stated 5 design decisions that every business models needs to represent.

- who are the value adding business actors involved?
- what are the offerings of which actors to which other actors.
- what are the elements of offerings.
- what value-creating or adding activities are producing and consuming these offerings.
- which value-creating or adding activities are performed by which actors.

The concept of Business models can be understood from different angles, let's clarify a few based on different individual perspectives:

Scholar/Author	Business Model Definition	Definition Basis/Focus
(Brian Hill, 2015)	The business model is a means of translating the value proposition into the potential for rapid revenue growth and profitability.	Value Fast growth Profit
(A. Osterwalder, Pigneur, & Tucci, 2005)	A business model is a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm. Therefore, we must consider which concepts and relationships allow a simplified description and representation of what value is provided to customers, how this is done and with which financial consequences.	Business logic, Value proposition Organization architecture.
(Kallio, Tinnilä, & Tseng, 2006)	The means by which a firm is able to create value by coordinating the flow of information, goods and services among the various industry participants it comes in contact with including customers, partners within the value chain, competitors and the government.	Value
Rajala and Wester Lund	The ways of creating value for customers and the way business turns market opportunities into profit through sets of actors, activities and collaborations.	Value Collaborative idea
(Andersson et al., 2006)	Business models are created in order to make clear who the business actors are in a business case and how to make their relations explicit. Relations in a business model are formulated in terms of values exchanged between the actors.	Collaborative idea

Table1: Business Model understanding According to different Scholars

M. Osterwalder 2004, in their article “The Business-Model Ontology” states that Although, there have been confusion about the terminology involving business models and strategy, advanced research has achieved a consensus on the position of business models as conceptual and theoretical layer between business strategy and business processes.
Many of the scholars identify a number of elements that are characteristics of different business models, these are elements which are expressed in different ways by different authors, which includes, Value proposition, resources needed to develop and implement business models, revenue idea which comprises of sources of revenue, price-quotation, principles and cost structure (Rajala & Westerlund, 2005).

1.2 Business Process Concept

Let us try to understand the word "Process” before we can move on to talk about a Business Process.
According to the Oxford Advanced dictionary a Process is defined as “A series of actions or steps taken to achieve a particular end".

Business Process as explained by von Scheel et al. 2015 in their book “The Complete Business Process Handbook “A business process is a collection of tasks and activities (business operations and actions) consisting of employees, materials, machines, systems, and methods that are being structured in such a way as to design, create, and deliver a product or a service to the consumer.

The business process can be understood as how businesses can accomplish their goals using the business process models/methods, business process can be a combination of activities related or connected with each other, which can be grouped differently.
High-level business processes occur in a more abstract context, as they are usually, utilized to clarify how a business carries out many different sets of operations. The marketing department of a large corporation, for example, can be described as a process group, which may depend entirely on the process structure of each individual organization (von Scheel et al., 2015).

A single process can consist of many actors (people, organizations, systems) performing many tasks. To accomplish the overall task, the actors must complete specified sub-tasks in an organised manner.

Sometimes, these sub-tasks can be performed in parallel or Sometimes can be sequential.

Business Process Modelling (BPM) as the main core, in Business Process Management is the activity of representing the processes of an enterprise at its current state or to what it should become (Khabbazi, Hasan, Sulaiman and Shapi 2013).

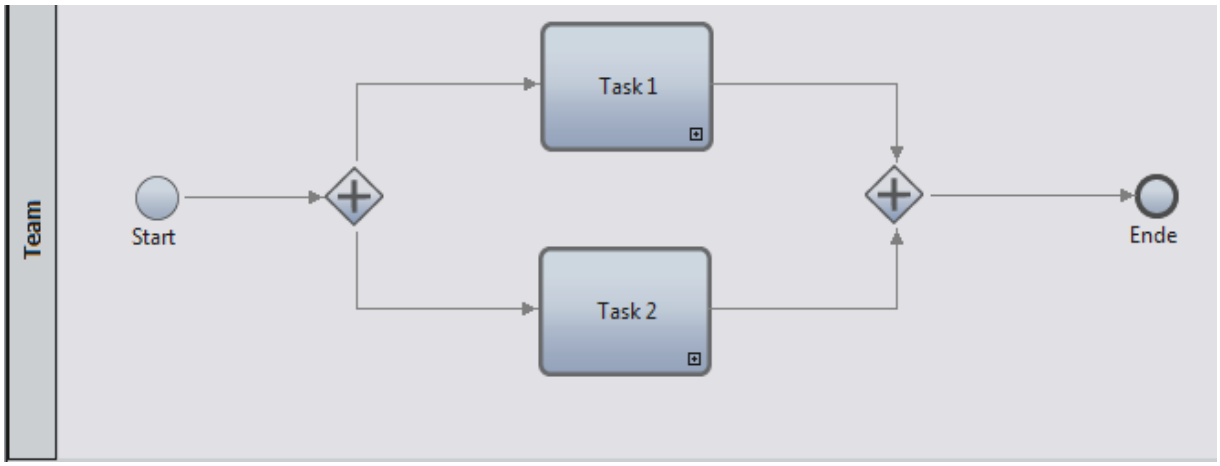


Figure 1: Parallel Process of a Business Model

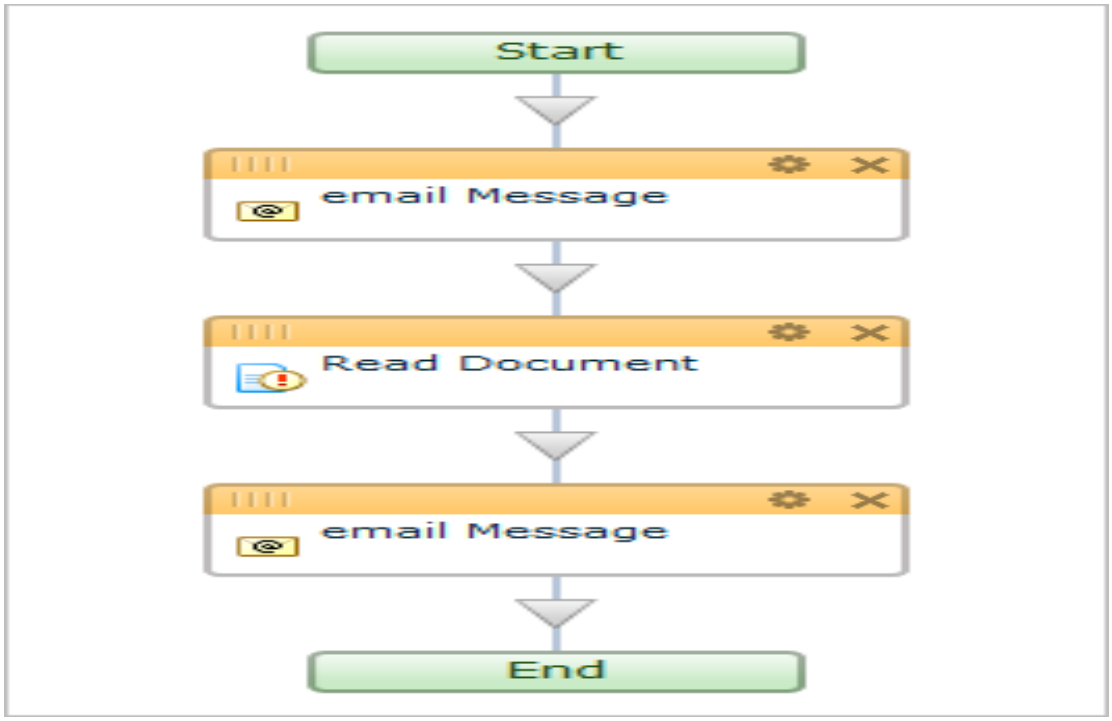


Figure 2: Sequential Process of a Business Model.

CHAPTER 2

2.0 Business Process Modelling Techniques

There are several techniques widely used to model business ideas, later in this thesis we are going to be discussing 2 types of business processes BPMN (Business Process Model Notation) and BORM (Business Object Relationship Modelling).

Below are brief introduction and explanation of a few business process techniques

Flow Chart

As defined by the System Engineering Vocabulary (SEVOCAB), Flowchart is a graphical representation of a process or the step-by-step solution of a problem, using suitably annotated geometric figures connected by flowlines for designing or documenting a process or program. Also, defined as graphical representation of the definition, analysis, or method of solution of a problem in which symbols are used to represent operations, data, flow, equipment, etc. (International Organization of standardization, ISO).

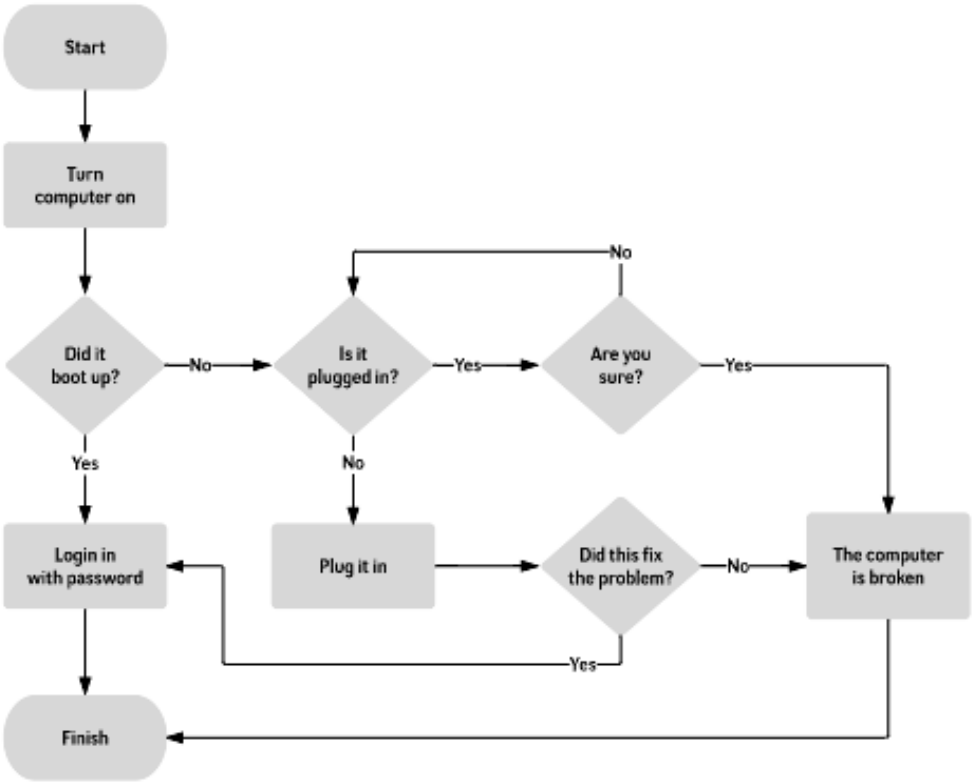


Figure 3: Image of Flowchart Example

2.1 Data Flow diagrams

Data Flow Diagrams (DFDs) are diagrams that depicts data sources, data storage, data sinks and processes performed on data as nodes, and logical flow of data as links between the nodes (ISO/IEC/IEEE 24765:2017).

Dufresne and Martin 2003, in their article, "Process Modelling for E-Business" Said Flow chart diagrams (DFD) are focused on the data in an information system, they show sequence of processing steps traversed by data, whereby each action taken is documented to distribute or transform data. DFD charts are easy to understand and interpret, which makes it easier for experts to validate and implement.

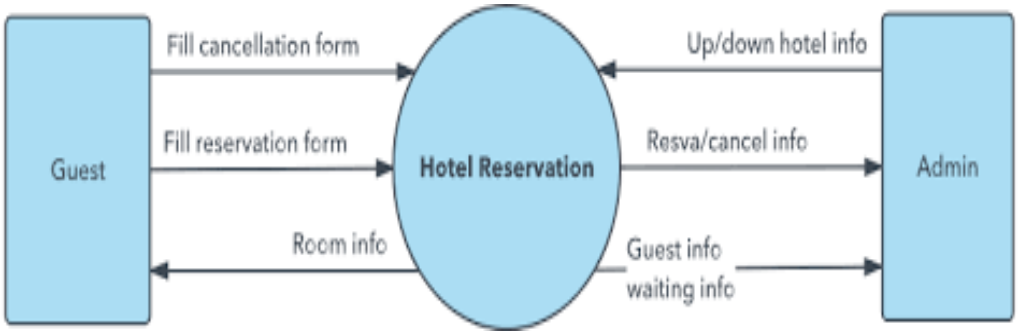


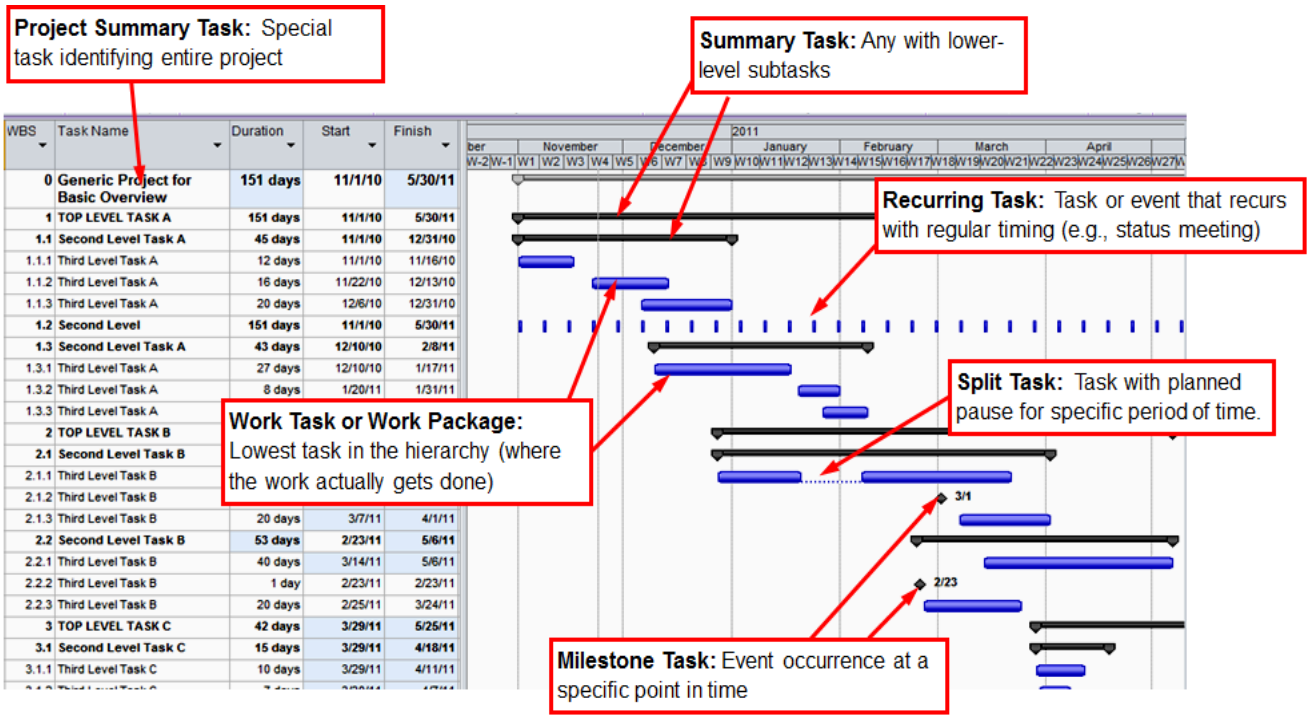
Figure 4: Image depicting the flow of data in an information system.

2.2 Gantt Chart

Named after the founder Henry Grant, who designed the first chart around the years 1910-1950 (Morris, 1994).

A Gantt chart is a chart which makes us see the relationship between activities and time, it consists of a bar chart and horizontal bars which depicts scheduled time frames of each activity (Larry Richman 2002).

A Gantt Chart is said to be a matrix that compiles all tasks or activities to be performed in a process on the vertical axis. Each row contains a single activity identification, which usually



consists of a number and a name. The horizontal axis is headed by columns indicating estimated activity duration and performance of the activity (Aguilar-Savén 2004).

Figure 5: Typical example of a project Gantt chart used for presenting tasks and timing information for a project

2.3 Unified Modelling Language Diagrams (UML)

Free Online Dictionary for computing (Foldoc), defined UML “as third generation modelling language, with an open method to visualize, construct, specify, and document the artefacts of an object-oriented software system under development. It represents the compilation of "best engineering practices" which has proven successful in modelling large, complex systems.

Classes are the most important building block of any object-oriented system. A class is a description of a set of objects that share the same attributes, operations, relationships, and semantics (Grady Booch, Ivar Jacobson, 2005).

Modelling identifies the things that are crucial to the business view UML diagrams model these crucial things as classes.

A class is an abstraction of the things that are a part of your vocabulary. A class is not an individual object, but rather represents a whole set of objects (Grady Booch, Ivar Jacobson, 2005).

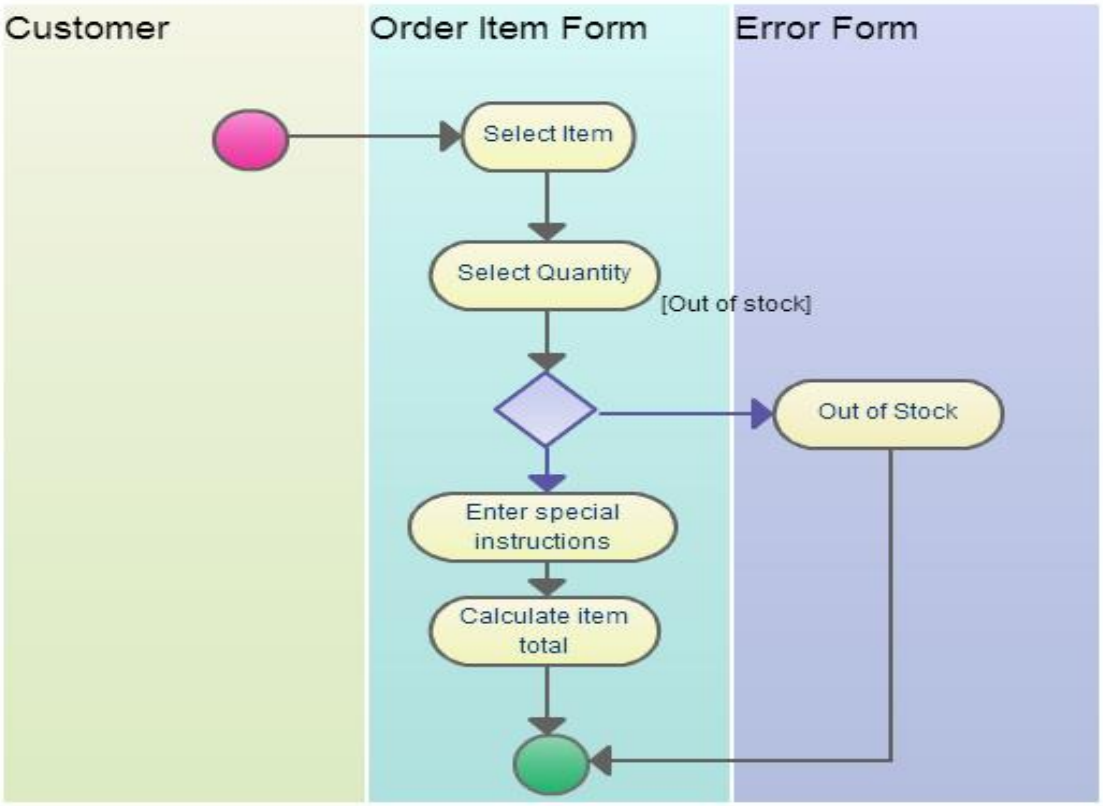


Figure 6: UML Diagram depicting the Process of good ordering.

CHAPTER 3

3.0 Business Process modelling notation(BPMN)

Brief history

The BPMN 1.0 specification was developed by the Business Process Management institute(BPMI), which is now merged with the Object Management Group (OMG), which was released publicly in May 2004 and adopted as OMG standard in 2006.In June 2005, BPMI merged with OMG, the Object Management Group.

A BPMN Specification document was released by OMG in February 2006. Version 2.0 of BPMN was developed in 2010, and the actual version of the specification was released in December 2013. The latest version (2.0.2) has been formally published by ISO as the 2013 edition standard: ISO/IEC 19510 (Stephen A. White, 2011).

The BPMN newest version, BPMN 2.0 is a fundamental evolution of the original standard. It extends the scope and capabilities of BPMN in several areas, it's not just a modelling notation, it's a model and a notation (Trisotech.com, 2015).

3.1 Definition and understanding of BPMN

BPMN is a graphical flowchart like language intended for use by business analysts and developers to build business process diagrams, its mainly for graphical design (Harvey, 2005). Also, stated by Hassen et al. 2017, In the article titled "Design and Implementation of a BPMN Extension for Modelling the Knowledge Perspective of Sensitive Business Processes" stated that, BPMN is a standard for business modelling process, very common in professional practice due to its expressiveness the well-defined meta model and the possibility of workflow integration.

BPMN has also been applied in several fields around the world not just In Business or Information technology but also in medical practice.

It is widely accepted mainly because of two factors, namely instrumentality and easiness for creating models. Research works using BPMN in the clinical domain reported quick and intuitive familiarization with BPMN, and better understanding for non-technical staffs (Martínez-Salvador, Marcos and Riaño, 2015).

BPMN is a standard for business modelling process, very common in professional practice due to its expressiveness, the well-defined meta model and the possibility of workflow integration.

It's a relatively new technique for developing and building business models. The BPMN has a corresponding formal XML-based language called Business Process Modelling Language (BPML) (James Martin et el).

Business Processing Model language (BPML)

Business Process Modelling Language (BPML) is a meta-language for the modelling of business processes, like XML, it is a meta-language for the modelling of business data. BPML provides a disconnected execution model for collaborative and transactional business processes based on the concept of a transactional finite-state machine (Douglas K Barry, 2013).

BPML has a common public interface and private implementations which is one it's important feature. The public interface of BPML can be described as ebXML business processes or Rosetta Net Partner Interface Processes independently of their private implementations.

BPMNL represents business processes as the "interleaving of data flow, event flow, and control flow. It also offers explicit support for synchronous and asynchronous distributed transactions (James Martin 2003).

3.4 BPMN Diagram elements and symbols

There are three basic types of sub models within an end-to-end BPMN model: Private (internal) business processes, Abstract (public) business processes and Collaboration (global) processes (Staccini, Joubert, Quaranta and Fieschi, 2005).

BPMN Model consists of several elements depicted by symbols use to build easy-to-read business process model charts. These symbols /elements are like that of the regular flowcharts, these symbols are used to give different meaning for every stage of the chart

The four categories of BPMN graphical elements to build diagrams include:

- Flow Objects,
- Connecting Objects
- Swim lanes
- Artefacts

Flow Objects: These are objects which represents all the actions which consists of Events, Activities and Gateways.

Connecting Objects : Are Objects which provides three different ways of connecting various objects, such as Sequence Flow, Message Flow and Association (Khabbazi et al., 2013).

3.5 Basic Elements of BPMN and shapes

Event: Defined by the Foldoc dictionary as "An occurrence or happening of significance to a task or program, such as the completion of an asynchronous input/output operation".
Types of events include: message, timer, error, compensation, signal, cancel, escalation, and link (Lucidchart.com 2016).
Represented by the circle symbol.

Figure 7: BPMN events symbols

Activity: Sets of cohesive tasks of a process(ISO.org, n.d.). They can also contain sub processes, multiple instances and loops, they are depicted by rectangles.

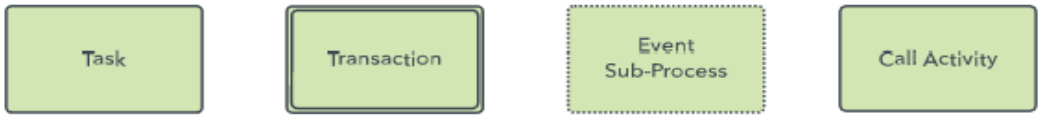


Figure 8: BPMN Activity Symbols

Gateway: Used to control the divergence, convergence and of sequence flow in a process (Trisotech.com, 2015).
A deprecated term for a device that enables data to flow between different networks (ISO.org, n.d.).
Decisions are made based on several conditions in this gateway to determine which path is taken. The gateway can either be exclusive, inclusive, parallel or complex.

Figure 9: BPMN Gateway Symbols and several types of gateway.

Sequence flow: Defined by dictionary.com as a "continuous or connected series". It can be understood as a movement of activities in an order.

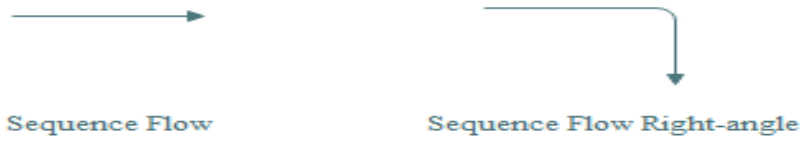


Figure 10: BPMN sequence flow.

Message Flow: Passing of information from one object(sender) to another object(receiver) (ISO/IEC/IEEE 24765:2017). Depicts messages that flow across "pools" or organization boundaries such as departments. It shouldn't connect events or activities within a pool (lucidchart.com, 2015).

Figure 11: BPMN Message flow

Association: Act of connecting text or artefact to a flow object.

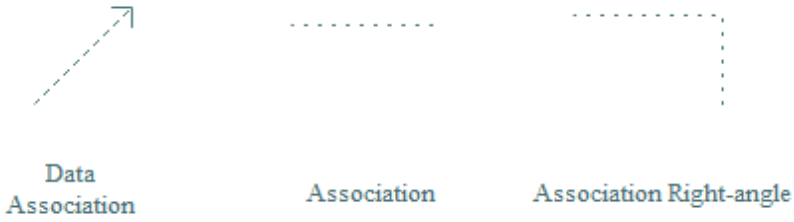


Figure 12: BPMN Association flow

Below template explains a straightforward process been carried out in BPMN.

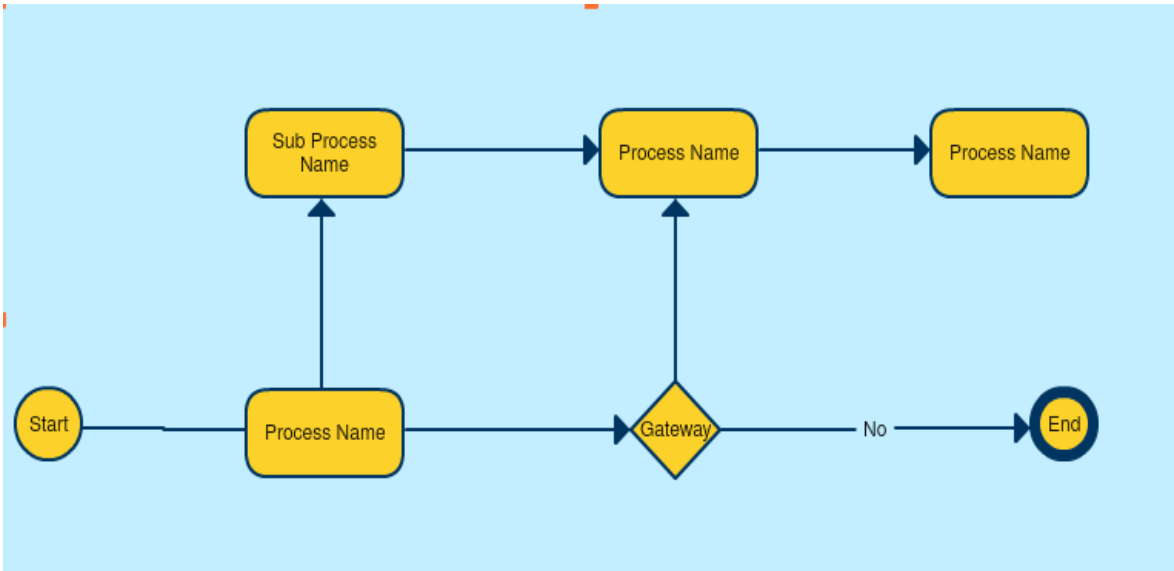


Figure 13: Simple BPMN Sample template

CHAPTER 4

4.0 Business Object Relationship Model (BORM)

This Business Model (BORM) is much older than the BPMN model, it's mostly based on the ORD (Object oriented paradigm) and process-based modelling.

4.1 Brief history of BORM

BORM model is a method used for analysing and designing information system mostly used and developed in the Czech Republic. The model development is currently supported by Deloitte & Touché Czech Republic and Central Europe where this method is also used in practice (Zdeněk Struska, 2008).

BORM method is in continuous development since 1993 when it originally was intended as an instrument to provide support for building object-oriented software systems based on pure object-oriented languages such as Smalltalk and object-oriented databases (Pries-Heje, Baskerville, Ramesh, & Levine, 2008). It has now evolved into a system development methodology that has been used successfully in about 30 projects. These systems range through all sizes of software development (Merunka, 2010b).

BORM Model has been used in the last 15 years around (1998 - 2012) for several business consulting and software engineering projects, a good example is the modelling of properties essential for the general.

4.2 Definition and understanding of BORM

Business process modelling is an approach to both processes modelling and the subsequent development of information systems, also provides methodology that facilitates the description of how genuine business systems evolve, change and behave. The BORM method is based on each object having three independent attributes called dimensions, these dimensions are data, behaviour and history (David Avison, et al, 2008) .

Merunka 2010, expatiated that BORM was developed to help start business system process analysis in a simple and precise method, from business analysis simulation to UML software design which is based on MDA (model driven approach) principle.

BORM can be regarded as a special type of MDA (Model driven Approach), it was described in the MDA terms in three ways, MDA is a software development methodology, that provides set of guidelines for the structuring of specifications, which are expressed as step by-step transformed models. It was created by the Object Management Group (OMG) in 2001 and is the most used software methodology based on the UML (The UML standard, 2005).

1. **CIM (Computer-Independent Model)**

BORM method is a visualization of the environment in which a project is being executed. It deals primarily with business process models. Its aim is to understand and describe a problem and find possible solution, a well-made CIM model enables proper descriptions of settings in an information system.

2. **PIM (Platform independent Model)**

BORM modelling concept is based on visualization of the required information system in software engineering concept.

3. **PSM (Platform specific Model)**

This is a revised form of the PIM model, which unlike PIM enables specific software implementation since it includes specific properties of the target environment and reused artefacts of IT architecture (Knott et al., 2000; Liu and Roussev, 2006).

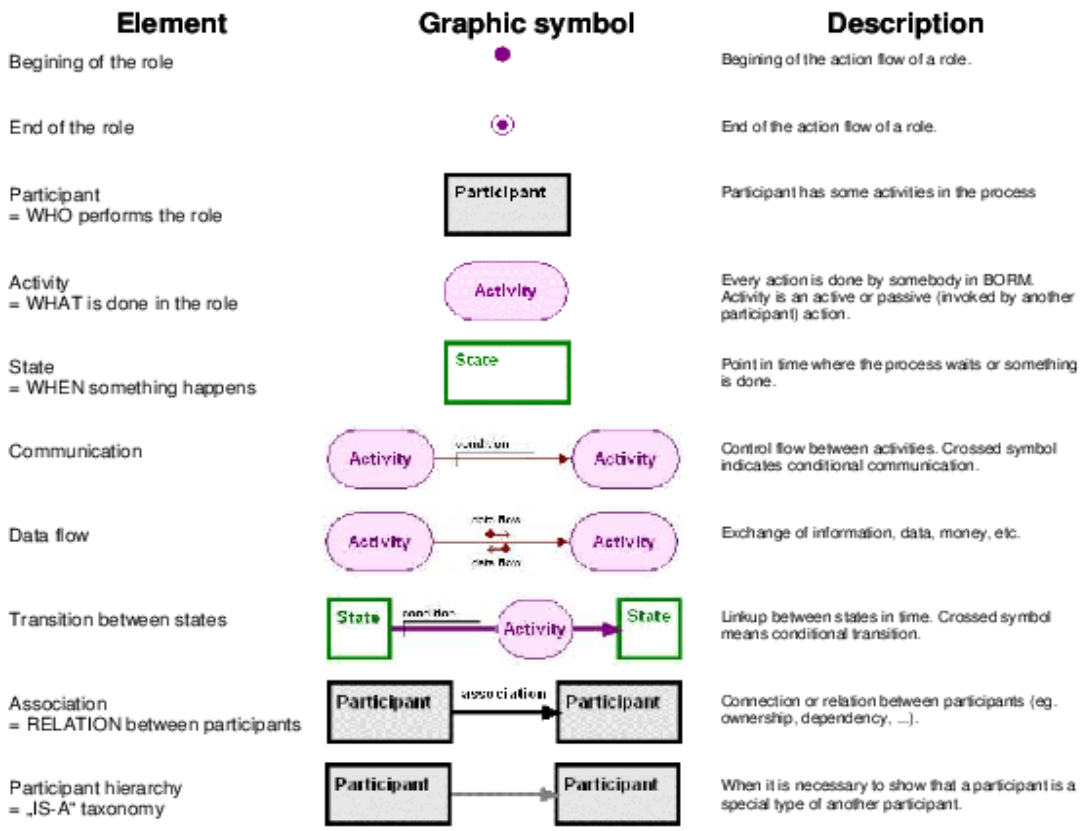


Figure 14: BORM Model symbols and meaning.

4.3 BORM Theoretical Approach

The BORM model has been theoretical explained in 3 ways. The first way is the MDA approach explained above in 1.6.2.

- **Object oriented programming**

BORM is also referred to as an (OOP) Object oriented programming/paradigm, the OOP approach has its origins in the research of GUI (graphic User Interface) and programming languages that took place in the 1970s.It's different from other software engineering approaches, it brought about non-traditional ways of thinking into the field of information technology. It's basic element is an object that describes data structures and their behaviour, OOP has been explained in many books and by different authors, this explanation by (Goldberg & Rubin, 1995).

- **Automata theory**

As stated by Brožek, et al 2010, is defined as the study of abstract finite-state automations and the problems they can solve, it's also a mathematical model for a device that reacts to its surroundings, receives, inputs and provides output. Automaton can be configured in a way that

the output from one of them becomes input for another, an automaton's behaviour is defined by a combination of its inner structure and its newly - accepted input. The automata theory is a basis for language and translation theory, and for system behaviour descriptions. Its usage for modelling and simulation in software engineering activities has been described in (Shlaer, 1992) and other publications.

4.4 Prerequisites of The BORM Model

One of the important part of the complexity estimation in the BORM method is the process diagram in which its necessary to define features and scenarios as well as participants and data streams. Participant engaged in the process conducts activities. Process diagrams are considered as one of the main outputs of the IS process analysis for estimation of diagram complexity which provides important input data for the BORM method (Zdeněk Struska, 2008).

Another essential part of the process estimation is Participants. Participants can be anything not necessarily human alone, it can be the IS or machines, participants represent a concrete unit of modelling reality in BORM concept.

Transitions between states and interacting activities are complemented by communication activities linked between participating participants. A process can be added to refine the model, using a graph of data flow that captures objects that the participants exchange/interact with each other (Zdeněk Struska, 2008).

4.5 Stages of BORM In an Information System(IS)

As stated by Pergl and Struska 2008, BORM is a model which focuses mainly on the analysis of IS, below are 6 main identified phases of IS identified by BORM:

1. **Strategic analysis**

   In this phase, the problem itself is delimited, and its interface is determined, the basic processes that are in and around the system are recognized to play.

2. **Introductory analysis**

   This is where the problem itself is being mapped the required processes in the system and the properties of the basic objects that are being discussed.

3. **Detailed analysis**

It is the development of the analysis into details of types of objects (sets objects, object classes) and object bonds (folding, inheritance, dependencies) etc.

4. **Introductory design**

   It is the first phase in which the system is been modified to be able to implement software. Therefore, there is no discussion of the analysis since the point of view should all be done and recognized. The initial proposal uses the same or very similar to the previous phases, but they differ in how they work with them.

5. **Detailed design**

   At this stage, elements of an existing model are transformed into a form that is subordinate to the target implementation environment. At this stage, we must consider the properties of specific programming languages and databases. Implementation (creation and compilation of the program). At this stage, the program is created (programmed or assembled and generated from CASE tool) the required software

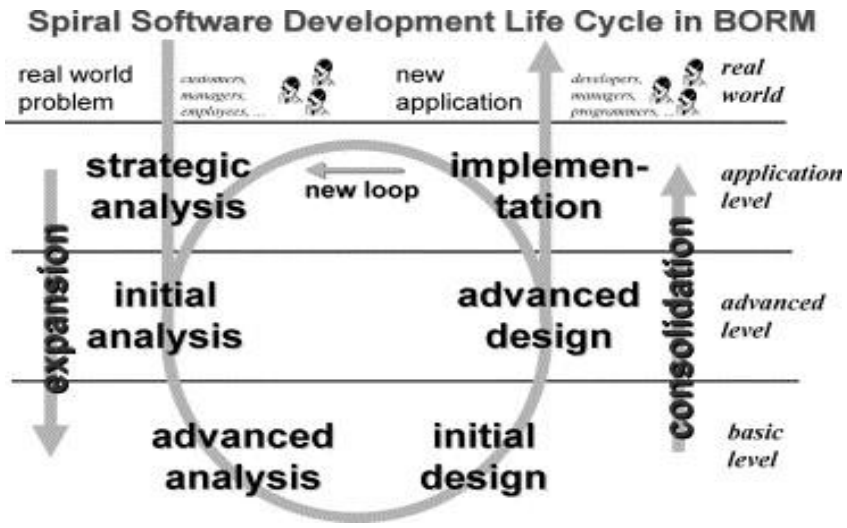


Figure 15: Stages of BORM as explained above.

The first three stages are collectively referred to as the expansion stages. Expansion ends with the finalizing of the detailed analysis conceptual model, which fully describes the solution to the problem from the requirements point of view (Yourdon, 1995).

4.6 Applications of Borm Usability in Different Organisational Aspect

The BORM model has been applied in a few areas to help develop or model processes that will improve a new or existing system.

Process Modelling of Urban Planning

BORM model was applied to a project concerned with improving decision making of Mayors and Local Administrators. It offered the possibility of modelling real life situations, it was mainly related to regional government processes of small towns and villages.

Analysis were made on the legislation and local officials knowledge related to the processes and agendas of the urban planning of the landscape areas and small settlements with regards to the new housing or building law and regional management trends in the European Union(Merunková & Merunka, 2013).

Commodity Market Public Information System

BORM was also applied in the agrarian chamber, to achieve the below goals.

System Processes - Objectives of Agrarian Chamber

To obtain governmental financial support to enable tailoring commodity production more closely to market demands.

- To convince customers that all actions are fundamentally for customer benefit
- To obtain data and money from the government to support consultancy activities for farmers
- To obtain reliable data from government sources to inform the decision-making process
- To increase overall sectorial revenue
- To encourage home production of key commodities
- To monitor conditions, check to loans for farmers and to lobby to improve such conditions.(Merunka, 2018)

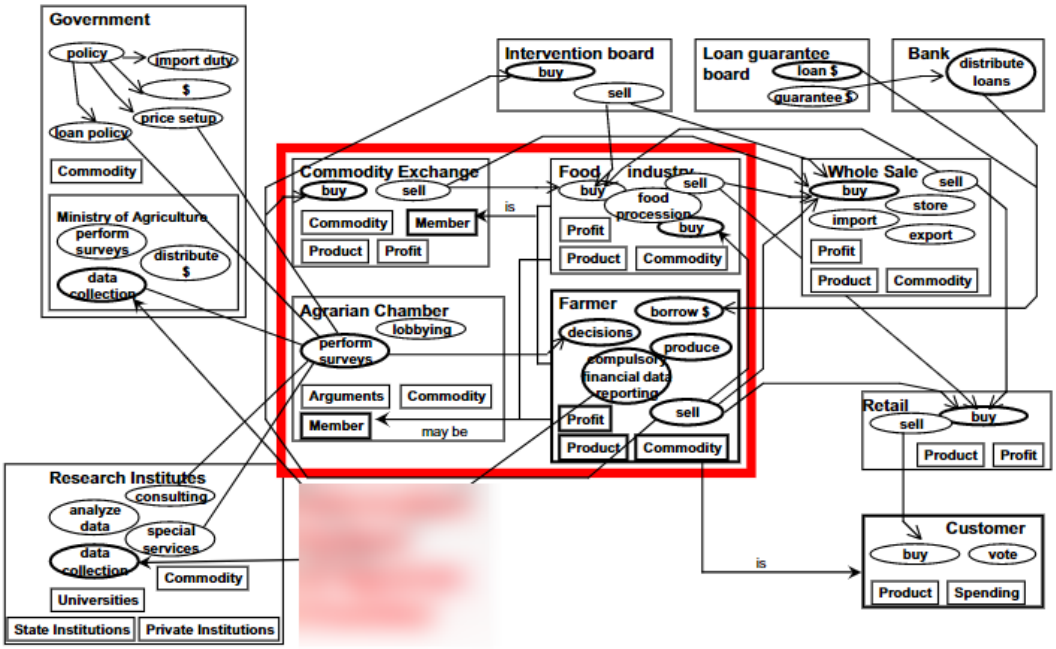


Figure 16: Typical Information system of an Agrarian chamber

CHAPTER 5

5.0 Objectives

In line with the title of the thesis and the literature review covered above on the 2 different business model notations, this study shall pursue the following objectives.

1. To review previous study/literature on the two business process notations.
2. To prepare usability test to show how the two business process notations can be applied in modelling a business process.

5.1 Materials and methods

Research approach

Usability testing , Usability as defined by the, ISO 9241-11 standard on usability 1998, "Usability is the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

Research methods

The research method chosen (usability testing) was qualitative, this method provided information on BPMN and BORM usability UI Study via the following:

Collection of information from participants after the usability test.

Interview of each participants on the knowledge of usability and improvement ideas.

Participants in the study

Snowball method was used in getting participants for the study.

Snowball is a sampling method which involves primary data sources nominating other potential primary data sources to be used in the research, snowball sampling method is based on referrals from initial subjects to generate additional subjects (John Dudovskiy, 2018).

The aim of the thesis was explained to the available students and those willing to participate in the study were taking for the usability testing

Usability Testing focus.

The usability test was conducted in the CZU Collaborative Lab.

The research was based on participants running usability test relating to typical real-life situations by focussing on documenting the processes involved in real-life testing of the below areas.

Ticket booking and reservation, on a selected airline company (Turkish airlines).

Exam registration on the University information system(UIS).

- **Usability Test Task for Turkish Airline**.

1. Open any web browser, go to www.turkishairlines.com
2. Select book a flight, Enter your departure city as Prague and arrival destination (Lagos Nigeria).
3. Select date of your choice, select one adult, return ticket, economy.
4. Click on the Search, Select the cheapest flights from search results, select for both going and coming back.
5. Click on continue, fill the form, uncheck seat reservation boxes in blue.
6. Click on continue to payment.
7. Select reserve this flight and pay later.
8. Accept terms and conditions, reservation completed.
9. Now repeat steps 5 and 6.
10. Select payment card. proceed to payment.
11. End.

- **Usability Test Task for Turkish Airline**

1. Open browser.
2. Go to uis.czu.cz
3. Select log in to personal administration of UIS.
4. Log in using your student username and password, e.g. xa….
5. Go to the section student's portal.
6. Select from the table Register for examination
7. If exams are available select, subject, check the date and time of the exam.
8. Register.
9. If no exams are available now log out

Process Modelling of the usability test.

Below are screenshots of the processes/steps needed to fulfil the usability of the above-mentioned tasks.

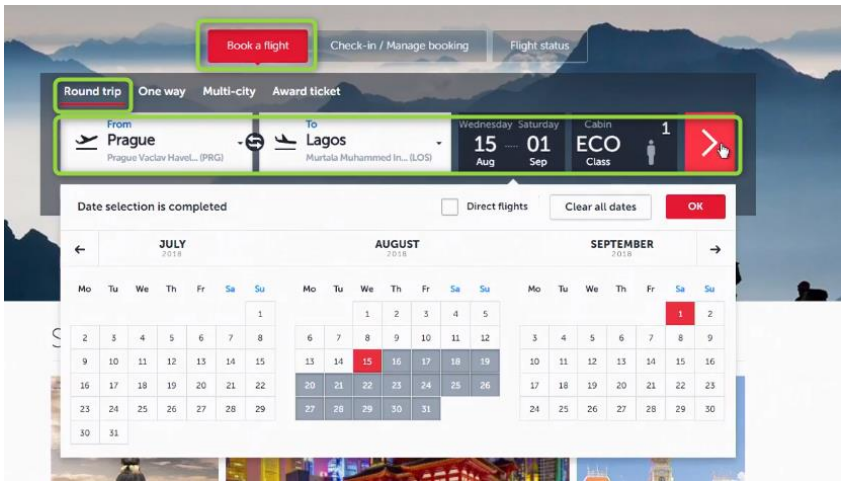


Figure 17: Step 1-3 Of usability study

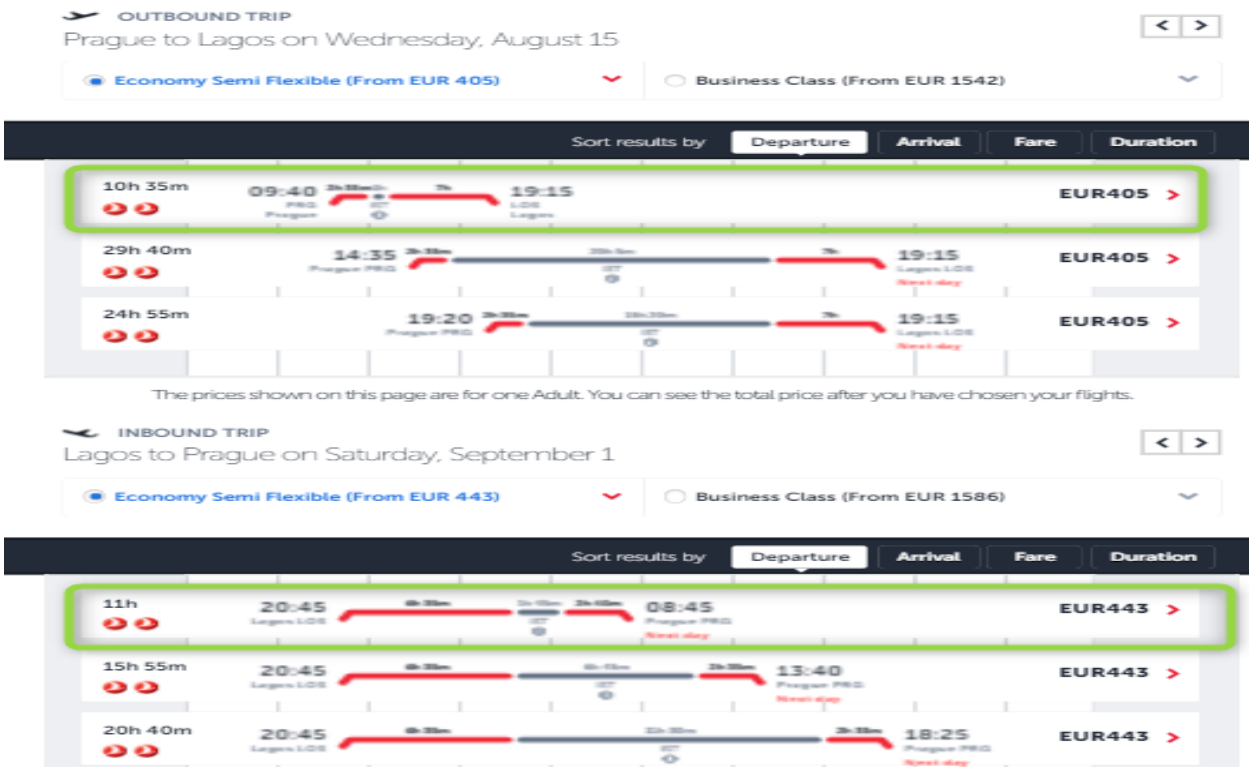


Figure 18: Step 4. Of usability study

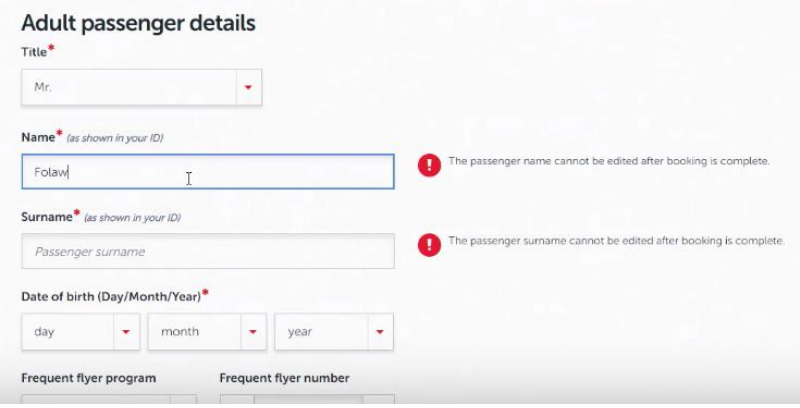


Figure 19: Step 5. Of usability study

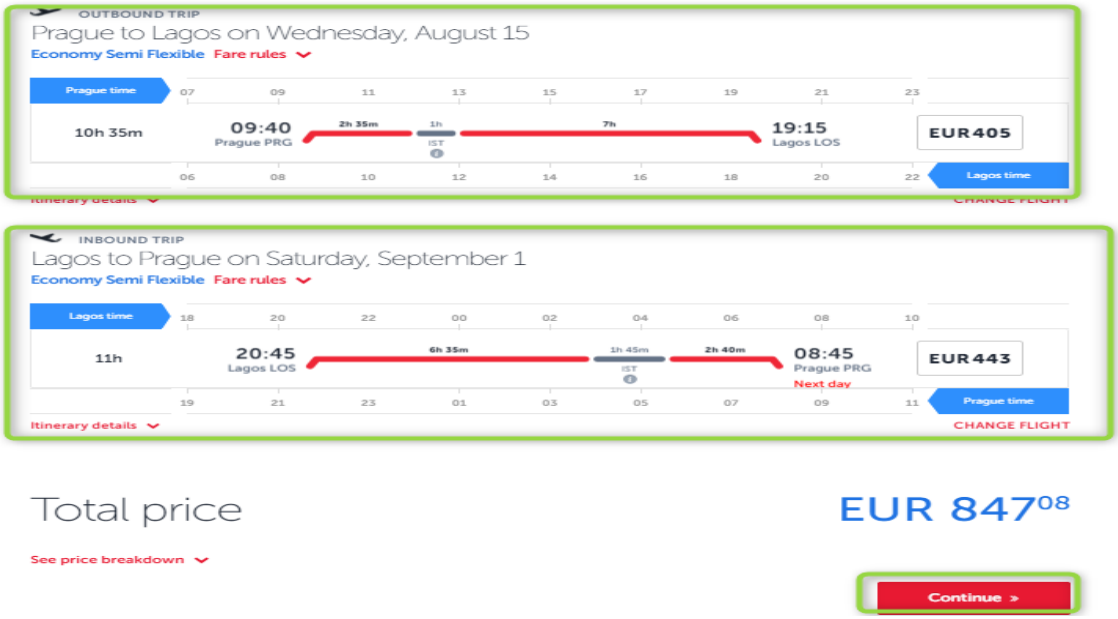


Figure 20: Step 6. Of usability study

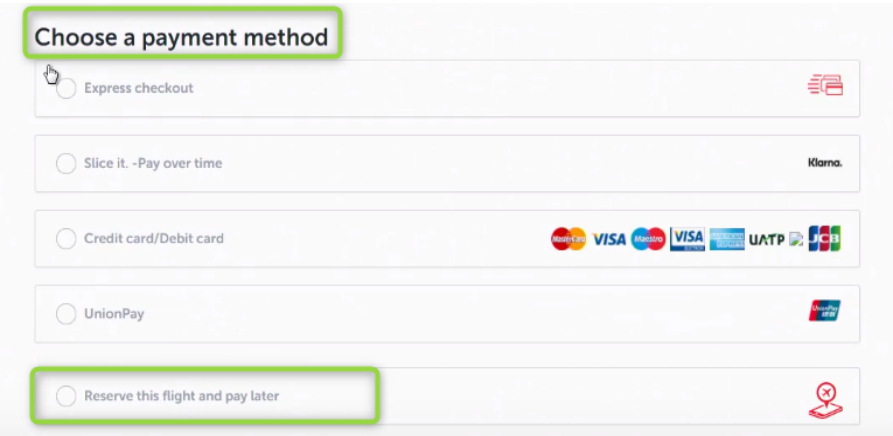


Figure 21: Step 7. Of usability study

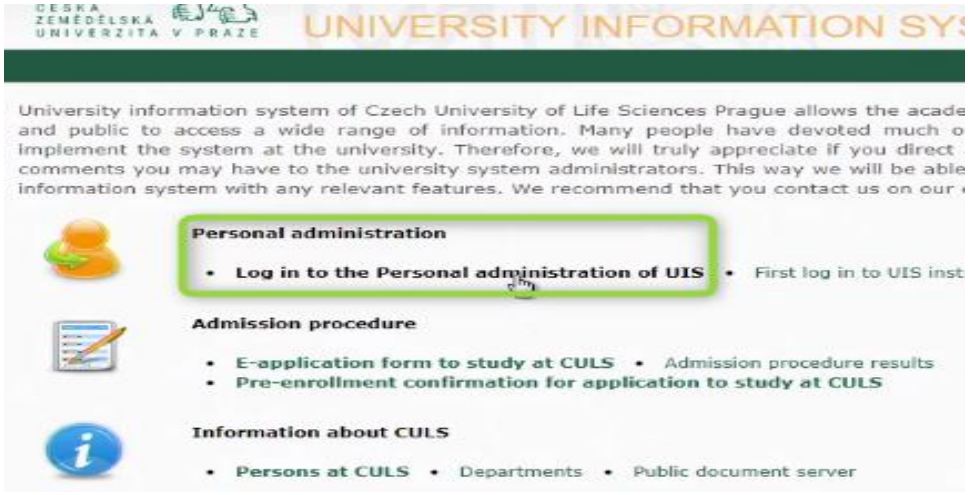


Figure 22. Step 1 UIS usability study

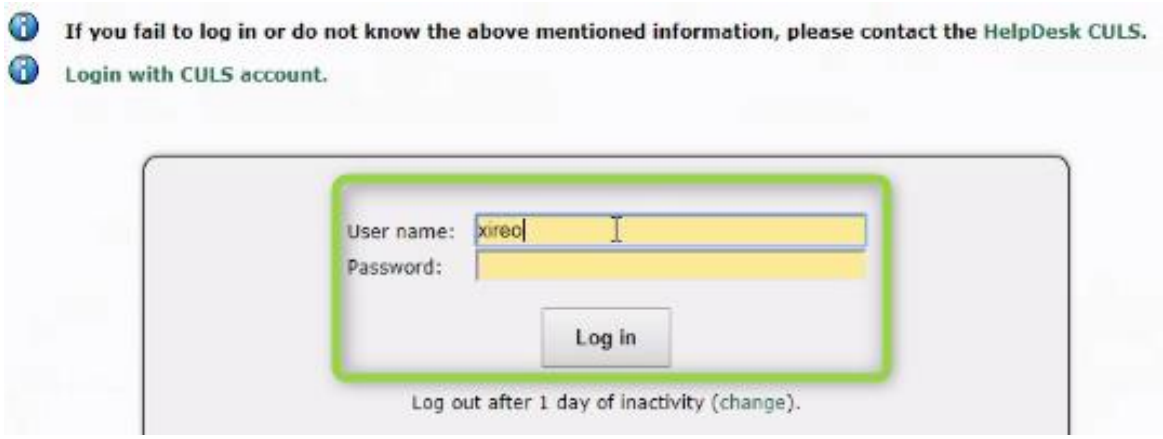


Figure 23. Step 2 UIS usability study

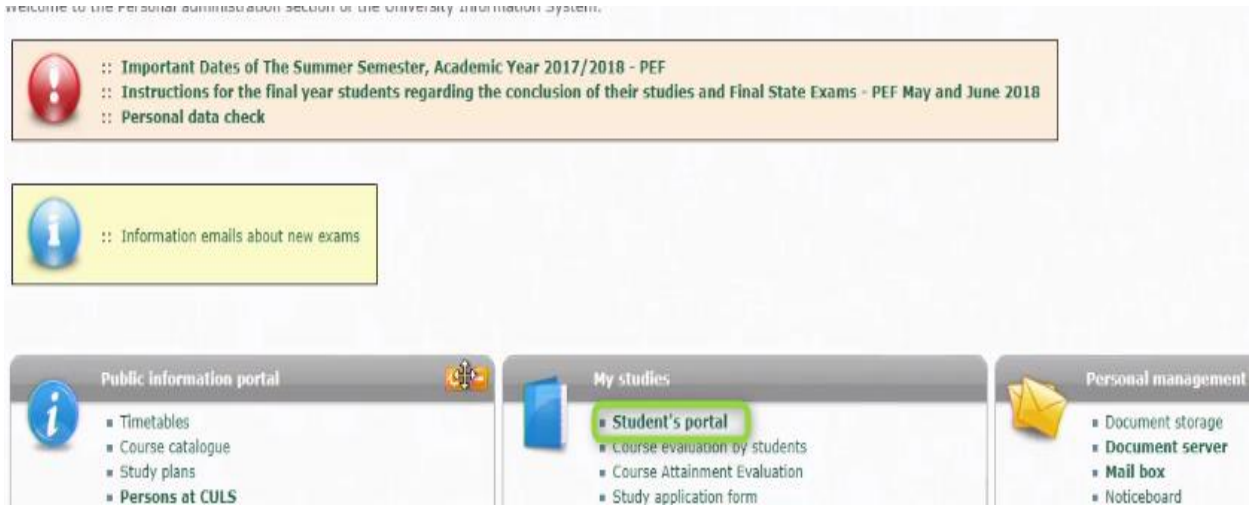


Figure 24. Step 3 UIS usability study

Figure 25. Step 4 UIS usability study

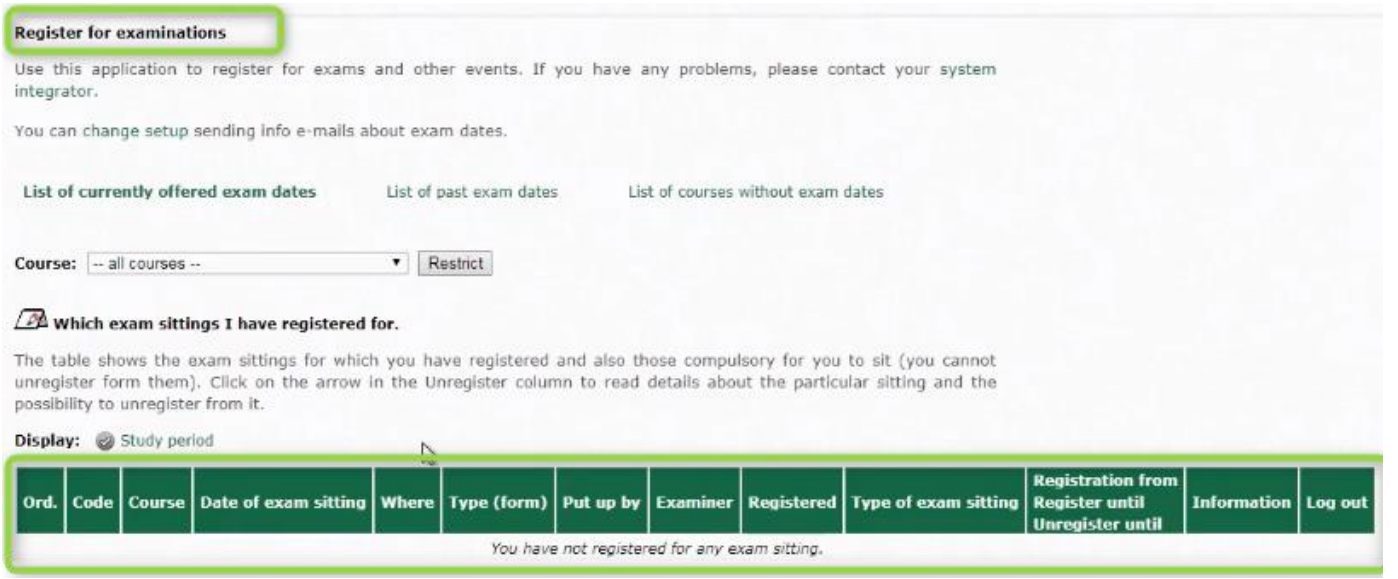


Figure 26. Step 5 UIS usability study

Below is the depiction of the air booking and exam registration process described above in a BPMN Business Model and BORM process model.

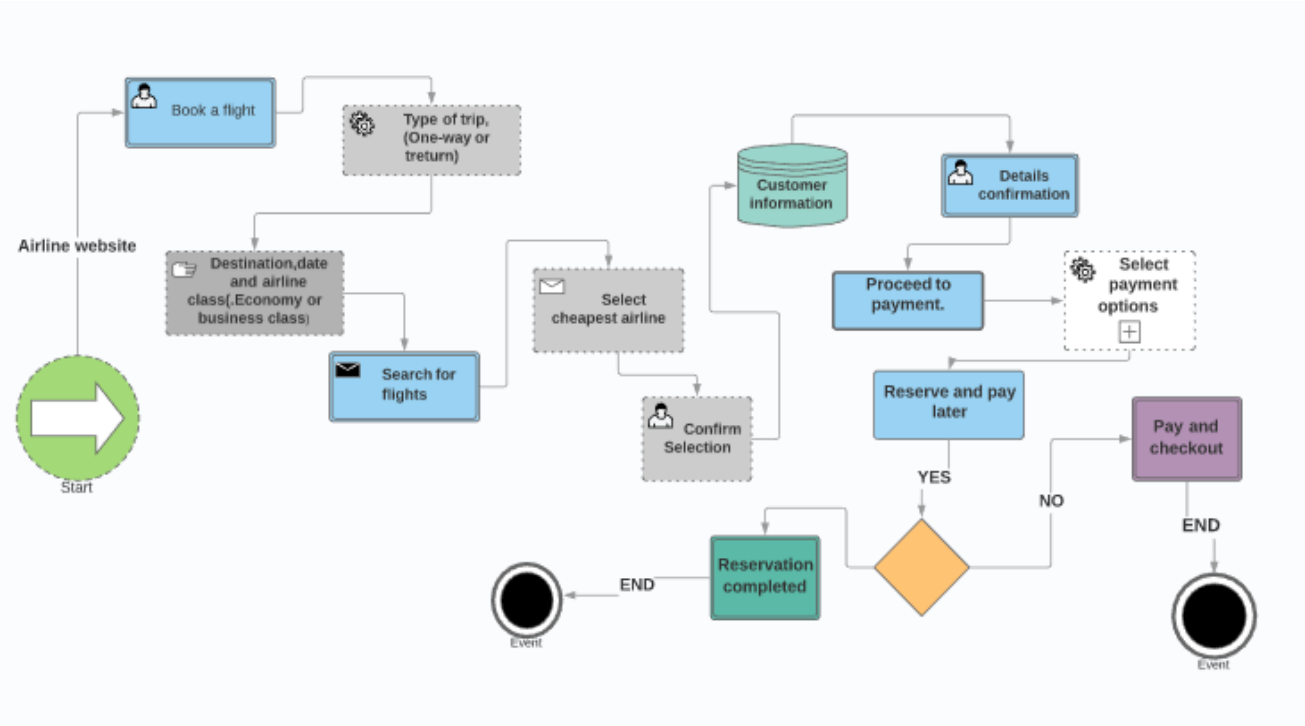


Figure 27: Air booking in BPMN tool, showing all the processes involved.

Chart tool: www.lucidchart.com

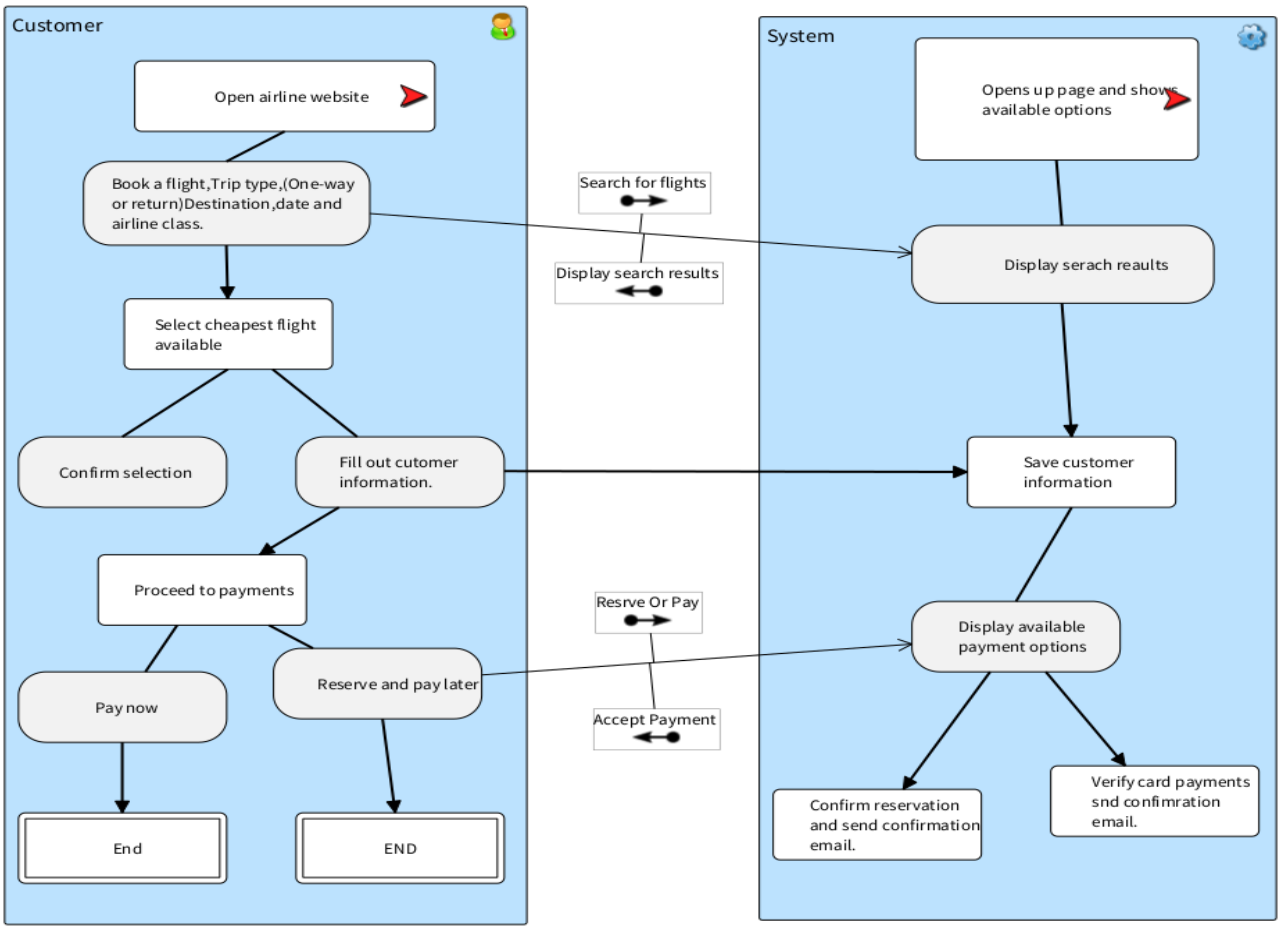


Figure 28: Air booking in BORM tool, showing all the processes involved.
Chart Tool: https://openponk.github.io/

Below image shows how the Second Task of Exam registration is been depicted in the BPMN tool

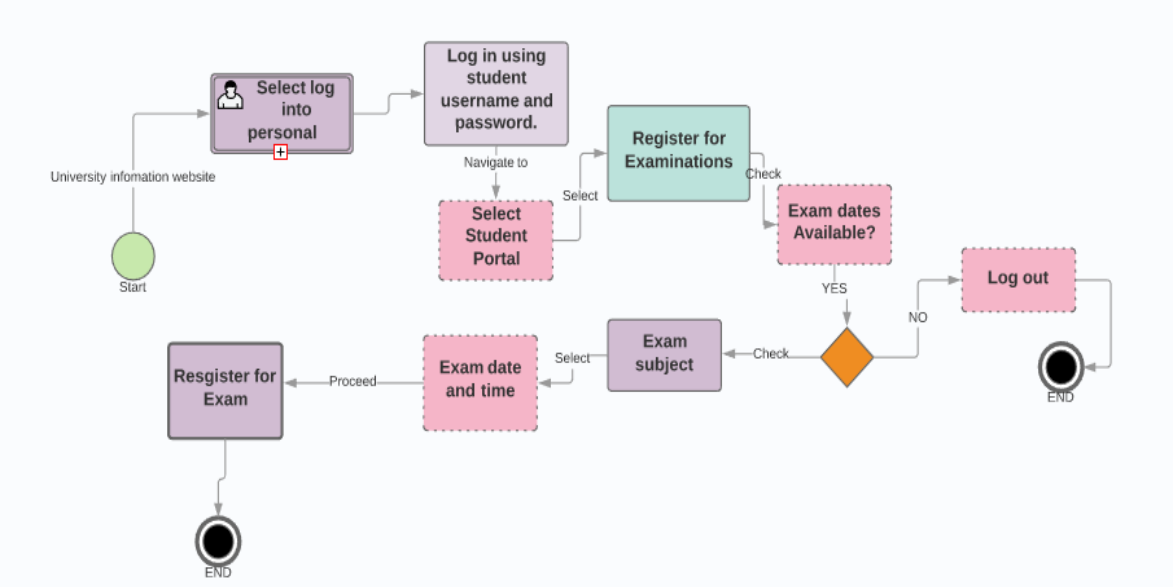


Figure 29: Exam registration BPMN
Chart tool: www.lucidchart.com

Below image shows how the Second Task of Exam registration is been depicted in the BORM tool

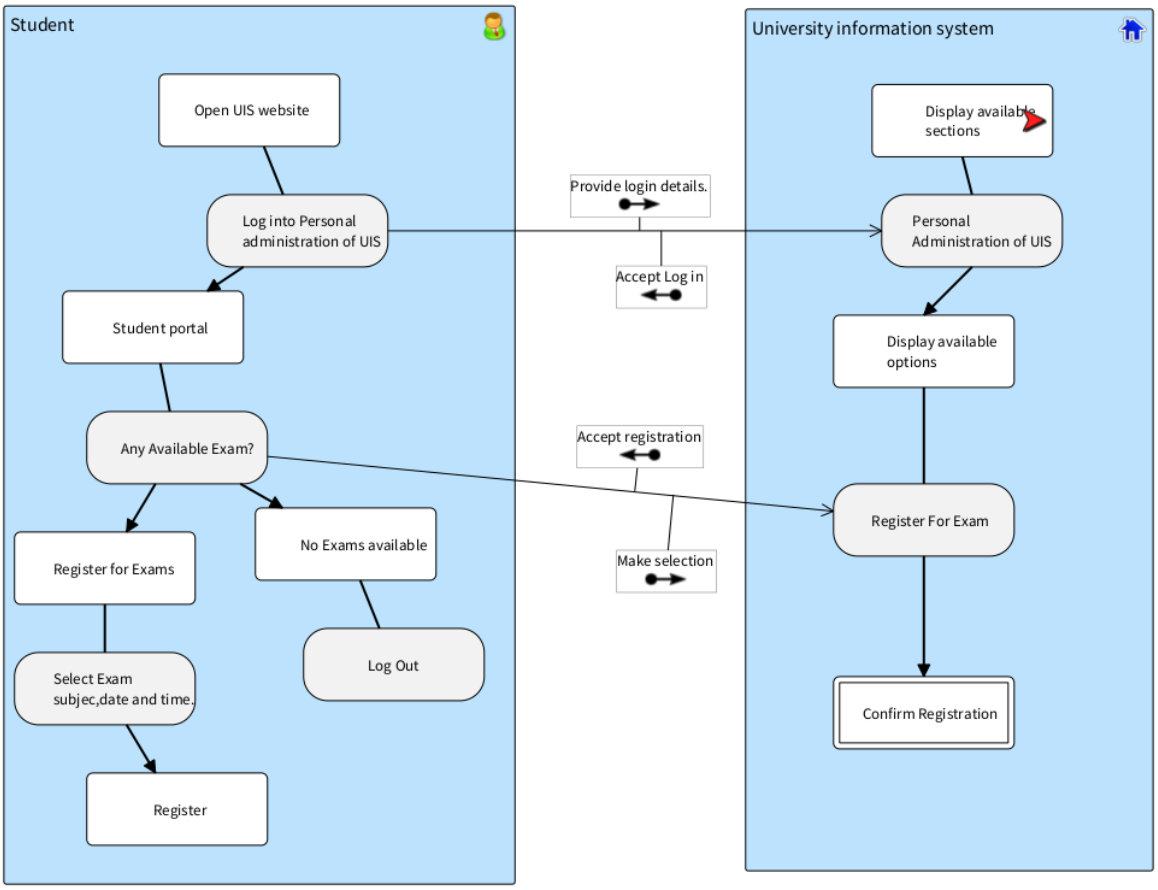


Figure 30: Air booking in BORM tool, showing all the processes involved.
Chart Tool : https://openponk.github.io/

5.2 Results and discussion

The above process diagrams were also presented to the participants after the usability test to get their opinions on which diagram or model is easily comprehensible.
The participants have little or no knowledge on Information technology and how flow charts and diagrams are created or understood.
The below result was concluded from the discussion with participants.

BORM

a. It is easy to read and understood.
b. Steps were faster to grasp.
c. The chart is straightforward, but may need better improvement, like colours to be added to make it more attractive.
d. Not complicated and can be easily interpreted, but the arrows can be a bit difficult to decipher.

BPMN

a. Takes more concentration to understand and process the information.
b. A bit more colourful but strangely enough the colours, rather than distracting were directive or demonstrated a consistent flow through the steps.

Thus, we have been able to determine the below differences between BPMN and BORM business models, these differences make the 2 business models unique in their own way.

BPMN

- Very recent Business modelling technique, based on UML and ebXML.
- Designed as a graphical visualization of business processes (Recker et al 2005).
- MDA approved and OMG standard.

BORM

- Quite old technique implemented in the early 1990's, based on the OOP/ORD Platform.

- Due to experience, it Is believed that stakeholders from the problem domain can understand the BORM approach very quickly, normally within an hour of introduction at the start of the analysis is enough (Liping Liu, 2006).
- Borm provides greater support for pure object-oriented concepts like refactoring which are an integral part of BORM development process.
- Not Approved as an OMG standard.

5.3 Limitations of the study

1. One major limitation to this research was the lack of materials from different authors or previous work to help in further understanding the BORM methodology, this limited review and research to regarding the BORM methodology
2. The BORM method is mostly applied in The Czech Republic and some parts of EU, which makes it difficult to get materials to talk on the subject as matter, as there is limitation to the use of the software, and most of the resources regarding this model is mainly by one author (Merunka).
3. Majority of the work done on BORM method was done in Czech Republic this also proves as a limitation as it does not give room for opinions of a wide variety of scholars in the Academic world.
4. A lot of other would be good materials on BORM method were in the Czech language, this was disadvantageous to a foreigner trying to do more research on the BORM method

5.4 Recommendation

Further research is recommended to fully back up the ones already done in this field of research with a more robust attempt to understanding the BORM method in particular as it is also a good business model usability system but needs further understanding and better research for the Academia to realise its effectiveness.

5.6 Conclusion

There have been several studies of different business models in the past, some focused on BORM and others on BPMN, there were also studies which compared BPMN with other business models, and compared BORM with other business models.

It can be concluded from this research that there are merits and demerits to both Business Models focused on in this work. There are also some similarities between them. These demerits, merits and similarities have been expatiated above, however we can conclude that BPMN is better than BORM basically for the following reasons:

It is easy to use to and understandable for non-technical people, unlike BORM which is popularly used by software analysts/engineers.

BPMN is intuitive and directive due to the shapes and many colours that can be applied to make it more explanatory, which can reduce communication time and fast implementation of the model.

This is in tandem with the work done by Kocbek & Jošt et al 2015, in which it was stated that there have been empirical insights about the level of BPMN acceptance and also that BPMN is still widely perceived as the de facto standard in the area of business modelling and the usage is ever increasing.

However, this is not to say BORM method is not good, as mentioned earlier in the recommendation of this work, there are no materials and various literature's available regarding BORM, so it can be a bit difficult to make a definitive conclusion on BORM in the overall business model aspect, further works will have to be pursued regarding BORM to further understand the model.

5.6.0 Table of abbreviations

1. IS: Information system
2. BORM: Business object relation model
3. BPMN: Business Process Model and Notation
4. ebXML: Electronic Business using extensible Mark-up Language
5. UML: Unified Modelling Language
6. ICT: Information and communications Technology
7. BPM: Business Process Model
8. SEVOCAB: Software and Systems Engineering Vocabulary
9. ISO: International Standard Organization
10. DFD: Date Flow Diagrams
11. MDA: Model Driven approach
12. OOP: Object oriented Paradigm
13. UI: User Interface
14. OMG: Object management group

5.6.1 Table Of figures

Figure 1: Parallel Process of a Business Model

Figure 2: Sequential Process of a Business Model

Figure 3: Image of Flowchart Example

Figure 4: flow of data in an information system

Figure 5: Gantt chart.

Figure 6: UML Diagram.

Figure 7: BPMN events symbols

Figure 8: BPMN Activity Symbols

Figure 9: BPMN Gateway Symbols and several types of gateway

Figure 10: BPMN sequence flow

Figure 11: BPMN Message flow

Figure 12: BPMN Association flow

Figure 13: Simple BPMN Sample template

Figure 14: BORM Model symbols and meaning

Figure 15: Stages of BORM

Figure 16: Information system of an Agrarian chamber

Figure 17: Step 1-3 Of usability study

Figure 18: Step 4. Of usability study

Figure 20: Step 6. Of usability study

Figure 19: Step 5. Of usability study

Figure 20: Step 6. Of usability study

Figure 21: Step 7. Of usability study

Figure 22. Step 1 UIS usability study

Figure 23. Step 2 UIS usability study

Figure 24. Step 3 UIS usability study

Figure 25. Step 4 UIS usability study

Figure 26. Step 5 UIS usability study

Figure 27: Air booking in BPMN tool.

Figure 28: Air booking in BORM tool

Figure 29: Exam registration BPMN

Figure 30: Air booking in BORM tool

5.6.2 Figure Sources

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