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M.Sc. Thesis

Use of *Soft System Methodology* for the Analysis and Design of Computer-Based *Management Information Systems*

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Title of Thesis

The use of SSM for the analysis & design of computer based MIS in relation to DFD & UML

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Abbreviations:

MIS..... Management Information Systems
SSM ..... Soft System Methodology
ISD ..... Information System Development
IS ..... Information Systems
DFD ..... Data Flow Diagram
UML ..... Unified Modeling Language
RD ..... Root Definition
ICT ..... Information and Communication Technologies
SDLC ..... Systems Development Lifecycle
CATWOE ..... Customer, Actors, Transformation, Weltanschauung, Owner, and Environment
CM ..... Conceptual Model
ISDM ..... Information Systems Development Methodology
L.D. ..... Libyan Dinar

Chapter One:

Introduction and Research Approach

- Introduction
- Philosophical Underpinnings
- Previous Studies
- Research Objectives
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Abstract

In this research we will use formal *Soft System Methodology* [1] in understanding and analyzing the *Management Information Systems MIS*. We selected SSM that has various techniques and high potential in the field of Information System Development and especially the systems that interact with social, political, and cultural factors, which affect the understanding and analysis process of these systems. All of the methodologies and technologies used today in the development of *Information Systems IS* breakdown the system into groups of activities that work together in distributing data to perform the systems functions. This means, that the methods currently used in information system analysis are not concerned with the social, cultural and political environment of the system, whereas the environment of system has a direct effect on the systems performance.

The objective of this research is to exploit SSM techniques in understanding and analyzing the social and political components of the system, additionally we will study the role of this methodology in understanding and detecting *The Undefined Systems*, if some social and political factors intervene it could convert some parts of the system into undefined sub systems which complicate the methodologies of developing the system like *Structured Approach* and *Object Oriented Approach* in understanding these systems (*Undefined Systems*) , and with the addition to SSM and its role in the study of the social and cultural components of the system, methods like DFD and UML are used in understanding and analyzing the information side of the system and building the *Conceptual Models* and plans for the information system , a collected framework will be installed where SSM with DFD and UML are used to develop the *Management Information Systems MIS*, In addition to these methodologies SSM, UML, and DFD , we will use the evaluation and measure theories of undefined systems to expect interference of the social , political and cultural component of the information system and the extension of affect on the system in the case of its presents.

1.1 Introduction

The spread of *Information Systems* are increasing in many fields and are considered to be one of the most important branches of computer science but more studies are to be carried out in this field, that there are many methodologies used in the analysis and modeling of information systems, like *Structured Approach* and *Object-Oriented Approach* that contains techniques that can analyze the information systems into sub systems which also analyze the activities of the system and design the plans that help construct this system , and define its form and data framework that flow with these activities , but Information System Development is not always an easy process because of the interference of social , political and cultural factors , Moreover the human activities are an important and substantial part of the current study of system, Therefore these factors increase in ambiguity while understanding the system which makes the process of developing the system difficult.

The problem that this research will acknowledge is to shed light on the social, cultural and political components while the *Information System Development ISD* process, when the social, cultural and political factors intervene as an essential part of the information system, some component of information system can be converted into an *Undefined System*. Because the *Inputs* of the social or political systems are undefined or unexpected that's why we can not conclude or anticipate the forms of *Outputs* of this social system, an example: the enrolment and register system at a university is one of the information systems that social factors are included where that if we count on current system development methodologies we will notice that they don't understand or analyze the social or cultural relationships that effect the students chance of being accepted or rejected by the school like the interference of help from relatives for some students.

In this research a framework will be suggested that can develop the system which can be used to understand and analyze the social side of the system and at the same time it analyzes and develops the information system followed in the organization, as we use the SSM methodology as the main method in analyzing and understanding the information systems, and use the tools and techniques of the SSM (e.g *Social and Cultural Analysis , Political Analysis , Root Definition , and Rich Picture*). In the traditional methodologies does not contain any tools or techniques to analyze the social relationships inside the organization, and the human activities that often have an effect on the information system .In the second chapter in this research we will explain in detail about the SSM methodology that is used in this research and its relation with the

techniques in this research, we will also explain the function of all of these techniques SSM with DFD & UML in a complete framework, and we will apply all of these methodologies and the mentioned techniques on the Libyan insurance system, and study the flaws and features of the SSM in the *Information System* field.

1.2 Philosophical Underpinnings

Social systems are known to be complicated to understand due to having no expected inputs and have unexpected outputs for these systems , after these types of systems and complicated social factors intervene with the information system the process of expecting the input system is very difficult , and that might convert some parts of information system into a undefined system. This means, the system's input and output are vague and, furthermore we will define the information system and the probability of its interaction with the human activities and the social systems.

1.2.1 Information System

Information System, the term information system is often used to denote a computer system, or more broadly, an interrelated mechanical system of information and communication technologies (ICT) such as the World Wide Web [2]. However, more formal academic definitions recognize the socially embedded nature of these technologies:

> 'Traditionally, an information system has been defined in terms of two perspectives: one relating to its function; the other, to its structure. From a structural perspective, an information system consists of a collection of people, processes, data, models, technology and partly formalized language, forming a cohesive structure which serves some organizational purpose or function. From a functional perspective, an information system is a technologically implemented medium for the purpose of recorded, storing, and disseminating linguistic expressions as well as for the supporting of inference making. Through performing these elementary functions, IS facilitate the creation and the exchange of meanings that serve socially defined purposes such as control, sense-making, and argumentation. In either of these two perspectives on Information Systems, it should be noted that humans are included within its boundaries which means that the services provided by an IS in part depend upon human capabilities and contributions'
>
> (Hirschheim *et al*, 1995) [3]

From the previous definition of the information system functionally or structurally, the humans appear to be one of the most important components of the Information System and are considered to be an important part of the information system. This means, while analyzing the information system we must focus on this important part and effect on

the systems performance , yet humans directly effect on the information system by every persons unique human activity and there is no doubt about the importance's of this part that effect the information system.

When we process the developing system we must consider the social side that represents human activities and the result of the social relationships of the human interaction inside the information system under the study , Because the human activities and the result of the social factors have a great effect on the performance of the information system , as we mentioned the methods currently used in analyzing and understanding the information system are not concerned with the analysis of this important part and effect of the system and it is the *Social Side and Human Activities* .

We observe from the definition that the information system contains Processes, *Data, and Models* and this is called the informational side of the system, and to analyze this part we will use traditional technologies that are used in the field of information systems like *DFD and UML* and with this we have expanded the field of developing systems so that the social developing system are included to the traditional *Management Information System MIS.*

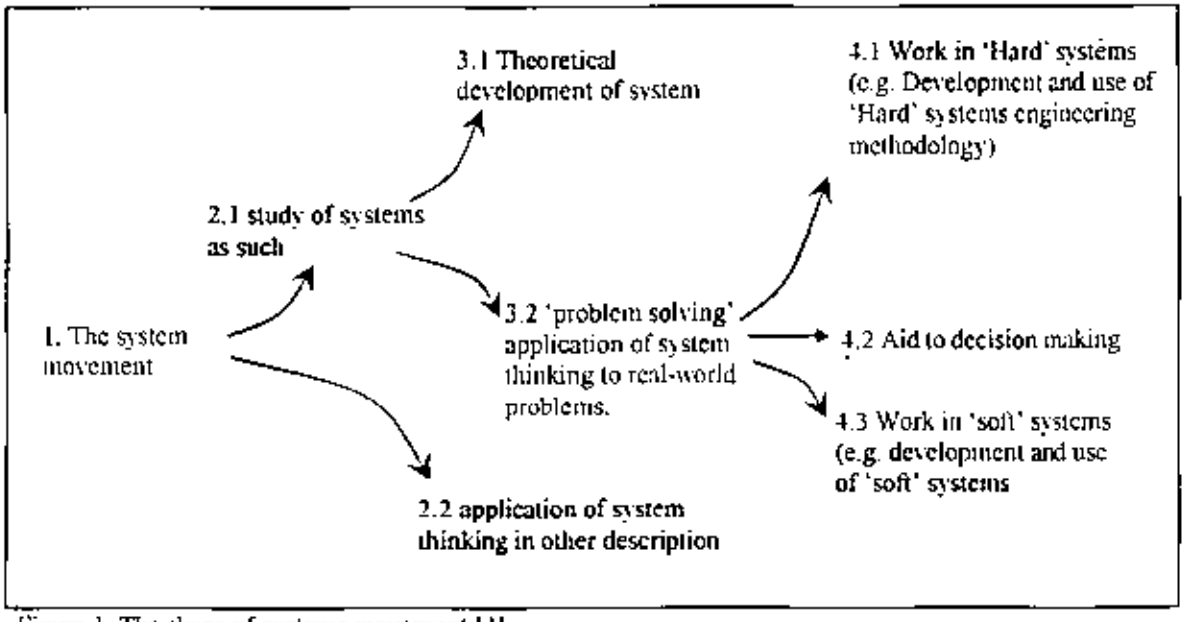

Figure 1: The shape of systems movement [4]

1.2.2 Information System Development (ISD)

Within the field of IS, Information System Development (ISD) can be characterized as Structured or Object-Oriented methods, with many complementary or alternative approaches, some based in practice, and some more academic. For many researchers, particularly those with computing science backgrounds, ISD mainly represents the dual activities of analyzing business systems and designing computerized information systems that support them. This starts with systems analysis and ends with programming. Such technical accounts of ISD are usually based on linear process models such as the systems development lifecycle (SDLC), which presuppose that development can be organized in a set of time-delineated steps which are consequent upon each other [5]. However, for the purposes of this research, is that the term ISD includes a bigger range for its containment of developing information system, In addition it analysing and understands the accompanying systems like the social systems and Human Activities which is an important part of the information system.

1.2.3 Why we use SSM?

1. SSM is foundation for more of ISD methodologies.
2. SSM's basic stages are like the ISD's stages (e.g. Defining the problem, Requirements, System Description, and Analysis), and which we can develop it to use in *Information System Development* field.
3. SSM can be dealing with *Undefined Systems*, and it can be developing a current system by improvements and recommendations additions.
4. In SSM we can use other methodologies or system thinking, we will discuss this point in chapter 2 and 3.
5. Flexibility

One of the key benefits of SSM is that it is very flexible and can be adapted to any problem situation in the real world. Checkland & Scholes formulate this idea as they draw conclusions from a series of action research studies (Checkland & Scholes) [6]:

> SSM is not necessarily a methodology for carrying out a special highlighted study, but can be applied to any situation in which purposeful action to bring about improvement is sought.
>
> (Checkland & Scholes) [6]

6. SSM can to arrival to models witch reflect the system in the real world by add the improvements and recommendations.

1.3 Previous Studies

Since Peter Checkland introduced the SSM methodology in the year 1980 and the interest of this methodology increases for its containment of original techniques and it excessive ability to analyze the complicated social systems. Many studies and researchs have been carried out on the SSM methodology and various application and performance evaluation in many fields. But few of these researches that have studied the SSM in the *Information System Development ISD* fild, Here we mention to some of studies as:

- **SocioTechnical Soft Systems Methodology – a sociotechnical approach to Soft Systems Methodology.**

Authors: Lena Attefalk and Gunilla Langervik MASTER THESIS (2001)
Department of Informatics, at the University of Gothenburg

- ***Information Systems Development as Action Research –Soft System Methodology and Structuration Theory.***

Author: Jeremy Rose Ph.D. Thesis (November 2000)

- **A Soft Systems Methodology Model for Clinical Decision Support Systems.**

Authors: Lee Philip and Loo Grace (2001)
Dept of Management Sc & Information Systems the University of Auckland, New Zealand

- **Using Soft Systems Methodology in the Analysis of Public Involvement in EIA.**

Author: Anna L. Johnson PhD Candidate (1991)
University of Otago, Dunedin, New Zealand

- **Re-interpreting Soft Systems Methodology: introducing actuality into the field of management information studies.**

Author: Kenici Uchiyama (1999)
The Department of Management System Development at the Daito Bunka University in Tokyo.

1.4 Research Problem and Objectives

In the *Management Information Systems MIS*, and during the process of development the information system we notice that the systems developers and the computer engineers don't give the social, cultural and political factors much attention, as we mentions perversely the social, cultural and political components are considered an important part of the information system, in some cases these factors convert some parts of information system into a undefined system, this leads to neglecting the social side of the system during the ISD process to reach to the concept for the system doesn't reflect the system in the real world that's why the system development process is a failed process , To solve this problem we will use UML and DFD with SSM in a united framework ,The goals of this research are :

1. The expansion the *Information System Development ISD* range to cover all the social, cultural and political sides of the information system suggested in the study.
2. Developing the SSM to working with undefined systems *Fuzzy systems*.
3. Locating a united framework in which SSM technologies function with traditional technologies used in the information system development and to overcome the issue of the interference of unexpected factors (*Human Activities*) that affect the performance of the system.
4. Appling the Soft System Methodology on the *Libyan Insurance System*.
5. Clarify the problems and the features of using the SSM in the field of *Information System Development ISD*.

1.5 The Case Study Defined

The Insurance System in Libya will be the Case Study suggested in this research, which contains the study of the components of the social, cultural, political system and human activies, It have unexpected inputs and outputs, furthermore the insurance system is effected by the complexed social, cultural and political factors making analyzing by the use the currnetly traditional tools of systems devolopment , that is why we will use the SSM methodology to solve the issue of the interference of *Human Activities* and the *Social Factors* that have an effect on the system.

1.5.1 The Insurance Definition

Insurance is social system designed to minimize he phenomena of uncertainty that insured feels, by transferring burden of certain risks to the insurer who undertakes compensating the insured all or part of sustained financial loss [7]. There are five types of insurance policies:

1.5.2 Insurance Branches

1. Life insurance includes all insurance operation that pertains to prospects of life, death, or incapability [8].
2. Fire insurance branch, usually covers damages caused by explosion, disturbance or natural phenomena.
3. Road, maritime and air insurance branch including vessels and airplane bodies and the transported goods on those vessels and planes.
4. Car insurance branch, intended by that to cover all risks that may rise by using a motorcar, including damages that may afflict other.
5. Accident insurance branch includes insurance operation which are not covered by one of previous stated branches; those private accidents insurance, accidents of labor insurance assaults.

In this research, we will employ Soft System Methodology SSM to develop the forth type of previous state insurance types (Car Insurance). Where the actual system employed by Libya Insurance Company-Benghazi branch. By apply efficiencies of methodology in car insurance system.

1.6 Thesis Overview

The thesis is structured in five chapters:

1.6.1 Chapter One: Introduction, Research Approach

This part of the research contains the introduction and concept of the research, we will start by identifying the research problem and identify the suggested methodology to solve this problem, SSM is the research methodology and the role of this method in the information system field IS. In this chapter we will discus the goals of this research and the pervious studies on the SSM methodology, and finally we will determine the *Case Study* which is the *Insurance System in Libya* which we will apply these methods.

1.6.2 Chapter Tow: Research Methods

In this chapter we will introduce the *Soft system methodology* in detail and narrate its seven stages and all of the tools and techniques of this methododology, And we will define the difference between the Soft System Methodology's techniques with some techniques used in information development systems like UML and DFD, and we will suggest the use of an united framework which consists of SSM with UML and DFD.

1.6.3 Chapter Three: SSM in ISD and Fuzzy Systems

In this chapter we will explain the role that the SSM methodology could play in the analysis and design of information systems, and show the qualities of mentioned methods in the understanding and defining the undefined systems which are the social, cultural and political system which are a big part the system, where we can not expect its outputs because its inputs are unexpected like the insurance system that usually has some surprises that makes the systems environment complicated. In this introduce the mathematical theories that used in defining the undefined systems in the same suggested framework, and this is the benefit of the equations in the result and the expectation of the complex social component of system.

1.6.4 Chapter Four: SSM in Action (Case Study)

In the forth chapter we will use the SSM methodology in the field of *Information System Development ISD* this is the researches main idea , this is to take advantage of the qualities of the tools of the SSM in the field of information systems , which we suggest applying the methodology on the *Insurance System in Libya* (Libyan Insurance Company) , and this study will reflect the power of SSM in analyzing systems where the complex social , cultural and political factors intervene

, and we will use traditional ISD methods like UML and DFD on the SSM side

1.6.5 Chapter Five: Conclusion

In this part of the research we will see the end result of using SSM in the field of information system development ISD where all the problems and features of the use of SSM in the analysis and design of information systems and its role in understanding the undefined systems, in addition the chapter contains a References list which used in the research.

1.7 The Research Structure

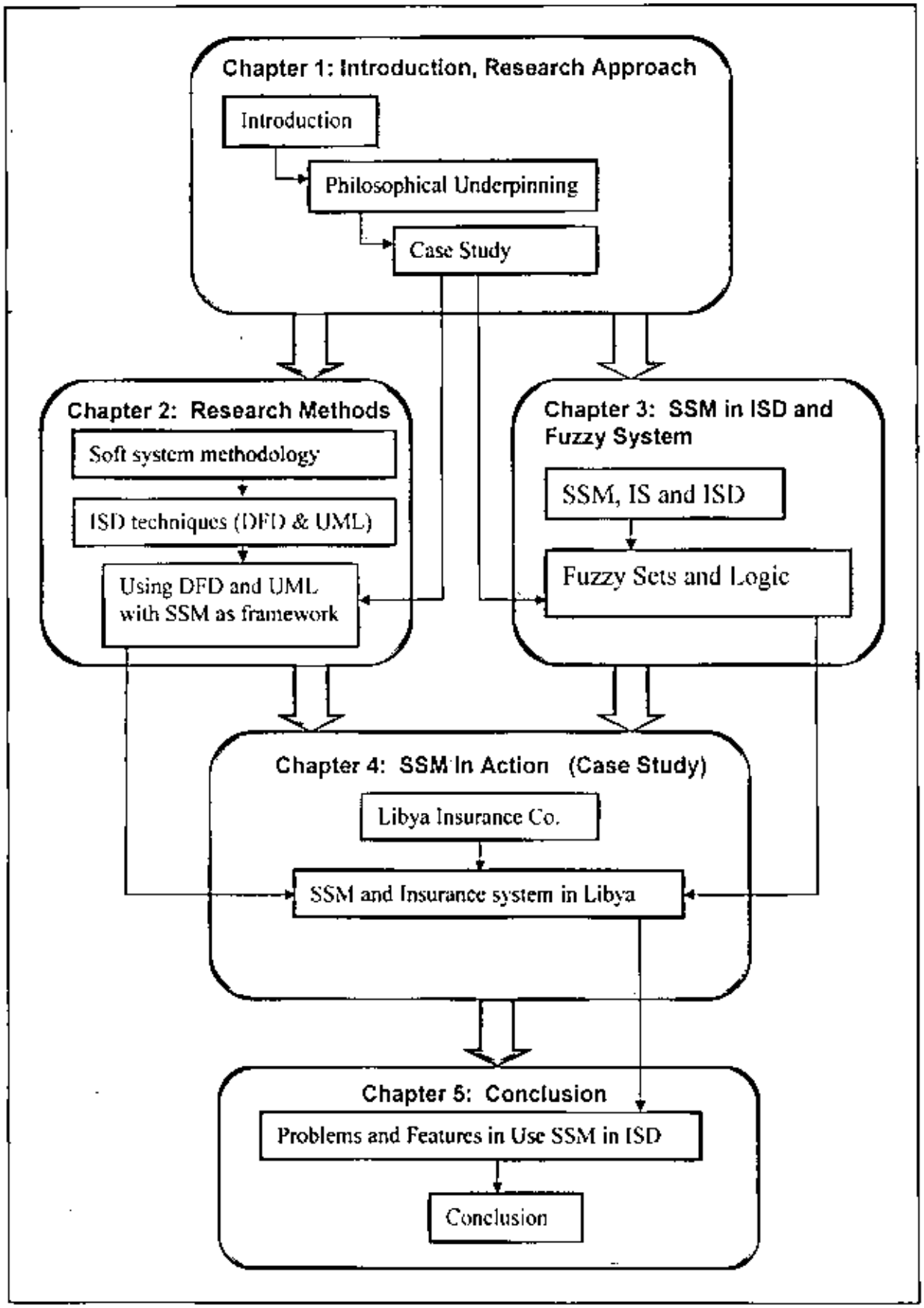

Figure 2: The Structure of the Thesis

Chapter Two:

The Research Methods

- Soft system methodology in detail
- Unified Modeling Language UML Structured Approach and DFD
- Using DFD and UML with SSM as Framework

In this chapter the methodologies studied that are suggested in this research will introduce the first version of soft system methodology as peter checkland introduced during the 1970s and the advanced version in the year 1981 . we will present the SSM as a main methodology in this research where it will be used in analysing and understanding the *Management Information Systems MIS* and specially the systems that show human activities and the social factors that have an effect on the studied process of analysing and understanding the system, Furthermore in this chapter we will explain in detail all the stages of soft system methodology and to exploit the techniques that this methodology has and they are (*Rich Picture , Social and Cultural Analysis , Political Analysis , Root Definition*), which help the system analyzer clarify the social side of the Information System followed in the association , and draw a complete picture of the management and social relationships and clarify the decision centers in the association , and study the policies followed inside the association and draw the future policies . From another side, We will introduce the current techniques used in developing information systems like DFD and UML where these techniques are used in modeling the information system which used in the association and explain all of the system activities and follow the data, and explain the scenario that can happen in the system from that we can represent the systems activities and the systems functions and documentation them. As we will use all of the mentioned methodologies in a united framework with the use of SSM in analyzing the social side of the studied system and this it what is known as Soft Problems where the SSM exceeded in analyzing and understanding this kind of problem, for analyzing the technical side and the followed information system in the association we will used traditional techniques DFD and UML to analyze and this is known as Hard Problems. At the end of this chapter we will explain the strengths and weaknesses points of all the studied mentioned methodologies, we mean here by strength and weakness is that in every stage of system development stages any one of the mentioned methodologies will be better that others, the better method is the one that contains techniques and tools the explain the system more clearly. Where the SSM method is the mean method in analyzing and we will use the techniques DFD and UML depending on the need of them during the stages of the system developing process , that is why these two methods have tools and techniques to analyze , modeling and understand information systems , that's why SSM allows the developer to use other methodologies , techniques , and tools to represent the studied system for it doesn't mind using the advantages of these techniques: DFD and UML and tools on the SSM side and that is to overcome the soft problems that accompany the system , and in the end of this chapter we will clarify how these methods work with each other in a united framework.

2.1 Soft and Hard Problems

Hard problems are problems characterized by the fact that they can be well defined. We assume that there is a definite solution and we can define a number of specific goals that must be accomplished. In essence, with a hard problem we can define what success will look like prior to embarking on implementing the solution. The "WHAT" and the "HOW" of a hard problem can be determined early on in the methodology.
Soft problems, on the other hand, are difficult to define. They will have a large social and political component. When we think of soft problems, we don't think of problems but of problem situations. [9]

In this research we will study the relationship between *the Soft Problems* and *the Hard Problems*, where the social, political and cultural factors in the studied system have an effect on the system developer that leads to a picture that does not express the studied system. In these kind of systems the social, political and cultural factors represent a soft problem, From Another Side, the information system followed inside the association represents hard problems which we want to distinguish form these mentioned factors which we don't need in the information system, but we need it analyzing and understanding the current system as it is in the real world , and build the models that reflect the system activities and social , political and cultural sides as they are in the real world , and the role of these activities in executing the system activities and the flow of data during these activities with the addition of the use of SSM in analyzing the social factors and human activities that effect on the information system , the social , political and cultural factors that are often vague and immeasurable , that is why the system developer finds itself in front of part of the system that inputs are unexpected , an example (in the car insurance system the system developer can suggest the dangers that a car may encounter in general , but the system developer can not predict the system interact to every flaw , in other words the system developer can not predict the compensation of every mistake and dangers that are followed by the car or passengers , we will clarify this case in chapter four where we run a study on the use of SSM in analyzing and understanding *The Insurance System* , We will intervene the unexpected social , political and cultural factors with the information system.

2.2 Soft System Methodology SSM

Soft Systems Methodology SSM [10] provides a structured approach for dealing with soft problems. Peter Checkland developed the methodology during the 1970s while at Lancaster. Checkland's first book on SSM was published in 1981. He derived the methodology by summarizing experiences from projects over a number of years.

SSM considers the different views of people. It assumes that each individual will see the world differently, which will often lead to varying understandings and evaluations of situations. Inevitably, the culture and politics of an organization will include diverse views. These views may not be necessarily opposed to each, but they may be different enough to cause problems in defining clear objectives. Because the process assumes people will have different views, the goal is to achieve consensual action by moving towards understanding of the varying perceptions. The practitioners of SSM must be open to other people's ideas for the process to be successful.

2.2.1 SSM Process

2.2.1.1. Traditional (1975)

In 1975, Peter Checkland [10] introduced the traditional SSM methodology which was composed of seven stages. These stages are shown in (Figure 3) and are listed as follows:

1. The problem situation unstructured.
2. The problem situation structured.
3. Root definitions of relevant systems.
4. Conceptual models.
5. Comparison of stage 4 and stage 2.
6. Identify feasible and desirable changes.
7. Action to improve the problem situation.

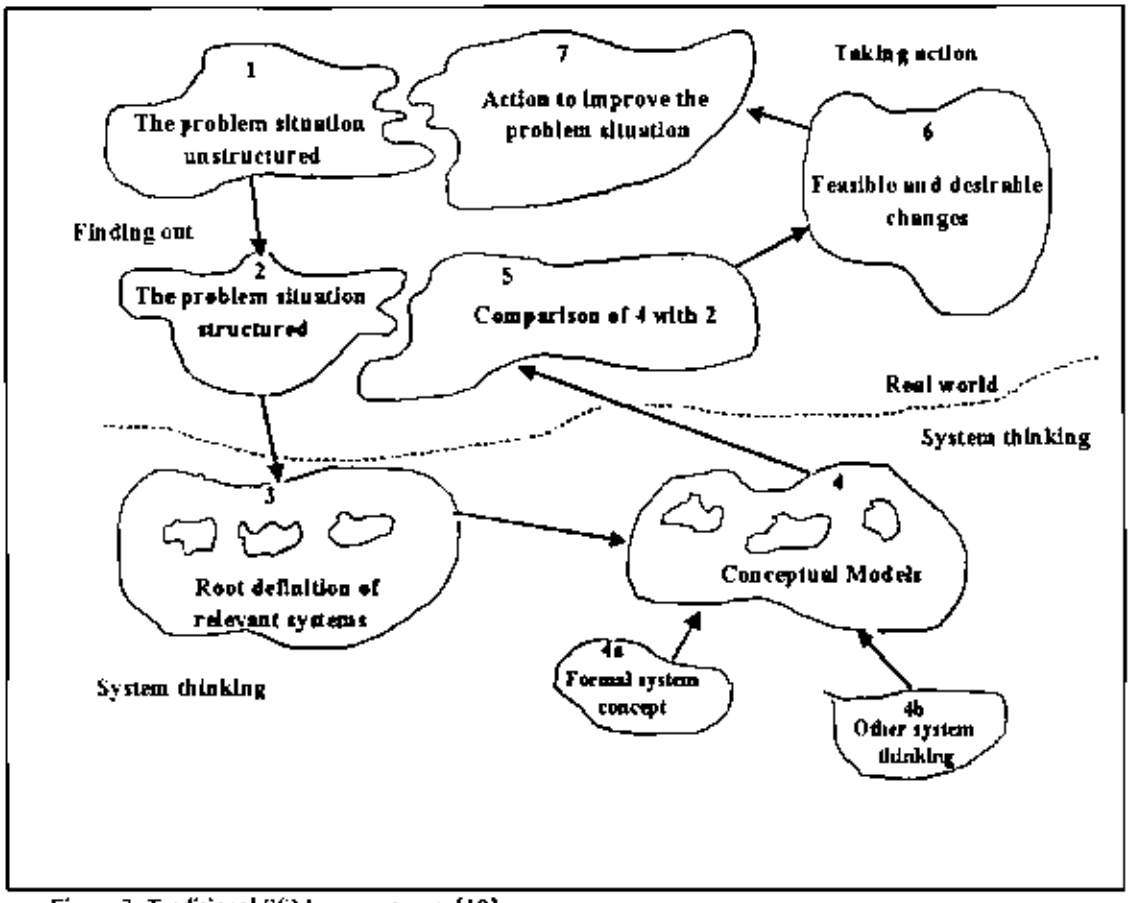

Figure 3: Traditional SSM seven stages. [10]

2.2.1.2. New Version (1990)

The 1975 version [10] is rather bald and it gives the impression that it is a sequential seven stages process that must be followed in order. The new version was introduced in 1988 by Peter Checkland as in (Figure 4). In this version, the SSM is an iterative learning cycle that ideally never stops. Also Checkland introduced the stream of cultural analysis which has three other types of analysis to be considered in order to structure the problem situation correctly. These analysis' will be implemented in the finding out stage which involves getting more information about the system politics and power structure. However the new version maintained the main concepts of the seven stages of SSM. The seven stages are now implemented within the new SSM. To see this, we can have a look on the new description of the SSM process which has the following phases:

1. Understanding real world situation of concern (stages 1 and 2 in checkland's 1975 version).
2. Develop relevant systems of purposeful activity (stages 3, 4 and 5 in checkland's 1975 version).

3. Compare these relevant systems which the real world and suggest different actions to improve the problem situation (stage 6 in checkland's 1975 version).
4. Implement the agreed actions (stage 7 in checkland's 1975 version).

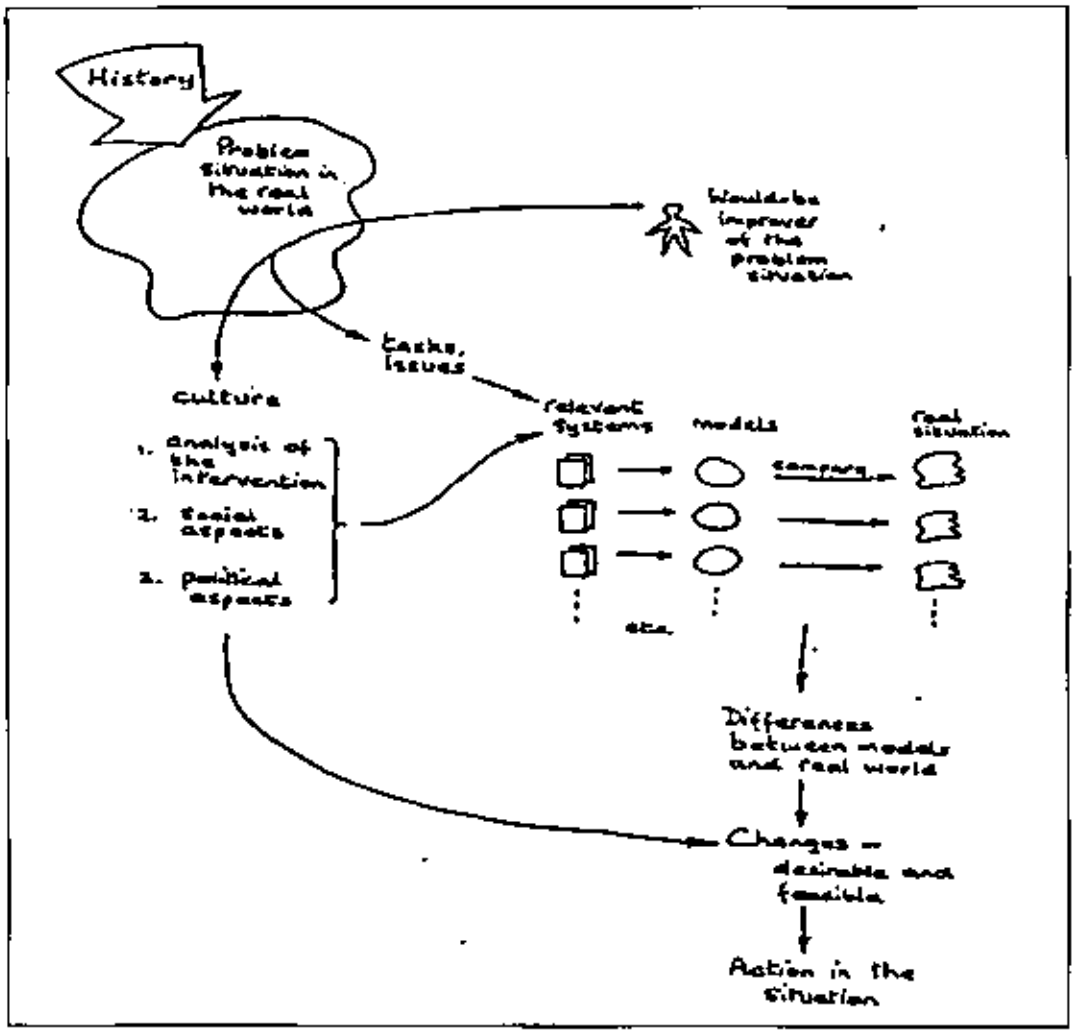

Figure 4: the 'developed form' of SSM (Checkland and Scholes 1990) [6]

As mentioned in this chapter we will exploit in detail the suggested methodologies studied in this research , and study every methodology step by step , Moreover to pinpoint the strengths and weaknesses of every methodology and to modeling the information systems that the social , political and cultural intervene , and study the use of (SSM , DFD and UML) in a united framework.

2.2.2 SSM Stages

2.2.2.1 Stage One: Problem Situation Unstructured

The purpose of this stage is to gain a general understanding and a wider view of the problem. Information is gathered about who is involved, what their perceptions of the situation are, what are the organization structures are, and what processes are going on. Also in this phase, the SSM practitioner in his efforts to gain a general description and understanding of the problem situation, he/she must understand the organization's culture and the internal policies. This usually involves talking to organization members and reading as much as possible of the organization documents. The practitioner will decide what questions should be asked to gain better understanding and whom should be asked intensively.

The procedure for this phase will include the following points:

1. Gather and examine as much as possible from the available information
2. Learn as much as possible about who and what is important in the organization
3. Understand as much as possible the organization specific language.
4. Pay close attention to the information about how things are done in the organization.

2.2.2.2 Stage Two: Problem Situation Structured

This stage helps to structure and express the information and the understanding of the organization problem situation to enable and facilitate the analysis that will follows especially in *stage 3* when we choose relevant systems.

The procedure for this phase can be based on the practitioner judgment but the basic rule is do not trust our judgment 100%, but rather use other tools to help we get better understanding of the features of the problem situation. These tools will involve other analyses, such as analysis one (analysis of the intervention), analysis two (social and cultural analysis), analysis three (political analysis), and the rich picture analysis.

2.2.2.2.1 Analysis One: Intervention Analysis

It is useful in thinking of the intervention of a problem as itself being problematic. In this analysis we have to think of three roles separately, the first one is the role of the client: which involves who is the client and what is the aspirations of this client. The second role is the role of the problem solver which involves who is the problem solver, what are the available resources, and what are the constraints. The third and last role is the role of the problem owner which also involves who is the problem owner and what are the implications of this problem owner. We can conduct analysis one by doing the following steps:

1. Define the client (the individual who causes the intervention to take place)
2. Define the 'would-be problem solvers' (those individuals who conduct the study)
3. The would-be problem solver then makes up a list of possible problems
4. For each of the problems on the list, the would-be problem solver then names one or more 'problem owners': those people with an interest in the problem situation as identified, and those who are likely to be affected by the problem.

The third role which is the problem owner is a very important role:

Problem	Problem Owner (s)

Table 1: Problem and problem owners. [10]

2.2.2.2.2 Analysis Two: Social and Cultural Analysis

It is used to know the internal policies of the organization and to think of the possible motives and factors that influences the perspective of an individual. This involves internal friendship, possible advantages to be gained or weaknesses to be covered.

Three important entities in this analysis:

1. The roles that the various individuals involved in the problem situation play.
2. The expected behaviors of each role.
3. The values that are used to evaluate the performance of the individuals involved.

These three entities forms a circle, which means that each one of them is defined and totally depended on the other two as shown in (figure 5).

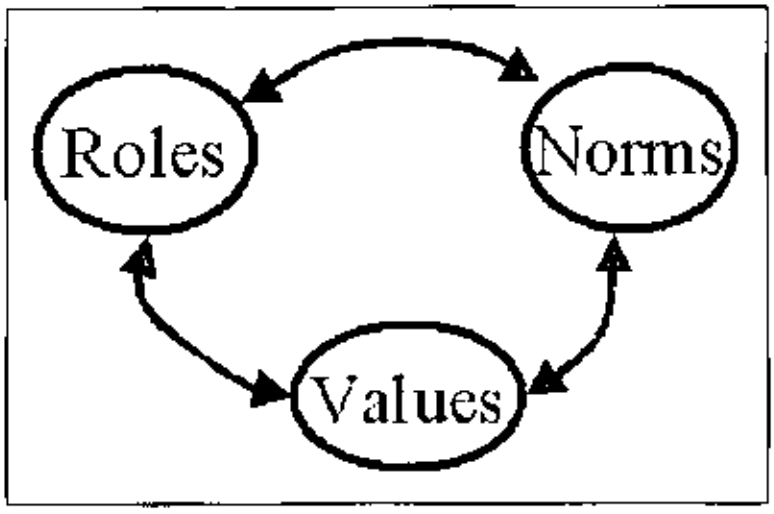

Figure 5: Social and Cultural analysis entities. [10]

2.2.2.2.3 Analysis Three: Political Analysis

It is also a cultural analysis but with respect of power. The SSM practitioners have to study the organization structure in order to understand the structure of power, and the implicit organizational believes. The culture of the organization is shown as how the members of this organization see it in relation to the environment and their places in the organization in relation to other members. We can conduct analysis three by: We can conduct analysis three by:

1. What makes an individual powerful within the organization?
2. What the symbols of power are, for example: accepted knowledge; a certain title or position, or access to specific individuals might be symbols of power within an organization.
3. Making notes of each of these analyses.

2.2.2.2.4 Rich Picture

Rich pictures are a graphical representation of our understanding of the problem situation. The rich picture analysis has no recommended styles and it has no right or wrong. The important thing in a rich picture is that the people will recognize this rich picture as being representative of the situation they find themselves in.

To draw the rich picture, we don't have to be draw it very well and we do not have to be an artist. For almost all of the rich pictures that I have seen, it is more like a child drawing. Also it is generally considered a good idea to use words sparingly in a rich picture, and to use symbols or pictures to carry meaning. This should make understanding the rich picture quicker and easier

Outputs:

By the end of this stage (problem situation structured), we should have a rich picture that sums up to the problem situation understanding, have a list of problems and problem owners, have notes on political, social, and cultural aspects, and most important feel comfortable about our understanding of the problem situation.

2.2.2.3 Stage Three: Naming of Relevant Systems

Now starting from this phase, we get to the system thinking activities. This phase is mainly concerned about formulating of root definitions to a number of relevant systems.

2.2.2.3.1 Root Definition

The root definition is one way of describing what is the system, how the system will work, and why we need this system. We should not confuse the how here with the how of implementation, the how in the root definitions gives a general frame work of how we are going to do this but it is not how that defines certain technology and certain steps to be taken. A root definition is expressed as a transformation process that takes some entity as input, changes or transforms that entity, and produces a new form of the entity as output. The transformation process here is a key word of SSM, it usually describes the action of transformation required to transform an input to an output.

There are two kinds of root definitions supported in SSM:

- Primary Task Root Definition
- Issue based Root Definition.

Primary Task Root Definitions concern processes which the organization being studied performs as a part of their regular activities. Issue Based Root Definitions concern processes which are rare or one-off occurrences (such as a management restructuring).

We can compose root definitions by naming a series of relevant systems using the formula:

"A system to.....By.....In order to....."

2.2.2.3.2 CATWOE Analysis

In this stage also, a CATWOE analysis is conducted. The basic idea here is also to formulate and structure the real world situation in a meaningful way and also to ensure that the RD written does really represent the relevant system. One of the major tasks in this stage is that after the SSM practitioner performs both the root definition and the CATWOE analysis is to consider each of them with respect to the other one, if there is any kind of inconsistency then this is a clue that there is something seriously wrong in the SSM practitioner understanding of the problem situation and he has to go back and iterate to stages one and two.

The CATWOE stands for:

- Customer - the immediate beneficiaries or victims
- Actors - the people who do the activities
- Transformation - What the event may achieve
- Weltanschauung – What view of the world makes this definition meaningful.
- Owner - who can ultimately direct the event and could close it down or stop it from happening
- Environment - the external environmental constraints that limit what we might do

2.2.2.4 Stage Four: Building the Conceptual Model

The conceptual model is the core of the SSM methodology because it is now required to establish a relevant system based on defining the minimum number of activities required for this relevant system to be the one described in the root definition. A conceptual model is a human activity models that is used to show each operational activity that is necessary to carry out the process described in the root definition. There must be at least one conceptual model for each RD.

To build a conceptual model, take the RD and think of the different activities that must be implemented to fulfill this RD then express each activity in a phrase containing one verb and finally associate these activities in a CM showing dependencies of the activities and the flow of the information. The SSM practitioner must incorporate some measure of performance for this conceptual model.

The technique for building conceptual model is based on very simple principles. A model of human activity system will contain a set of activities connected together. The basic language used for model construction is therefore all verbs in the analyst's speaking language. The model contains the *minimum* number of verbs *necessary* for the system to be that named and concisely described in Root Definition. These will need to be connected together in order represent the system as an entity, and the most basic this connectivity may take is a number of arrows which indicate logical dependencies. Where it seems essential to represent a flow (whether of material, money, energy, information) its nature must be indicated. The aim is to build an activity model *what* must go on in the system. Particular *hows* (including such things as roles, organizational structures and specific ways of carrying out the activities) must be included only if they are specifically named in the Root Definition. They may of course be included in subsequent more-detail models obtained by the expansion of the first-level model. [11]

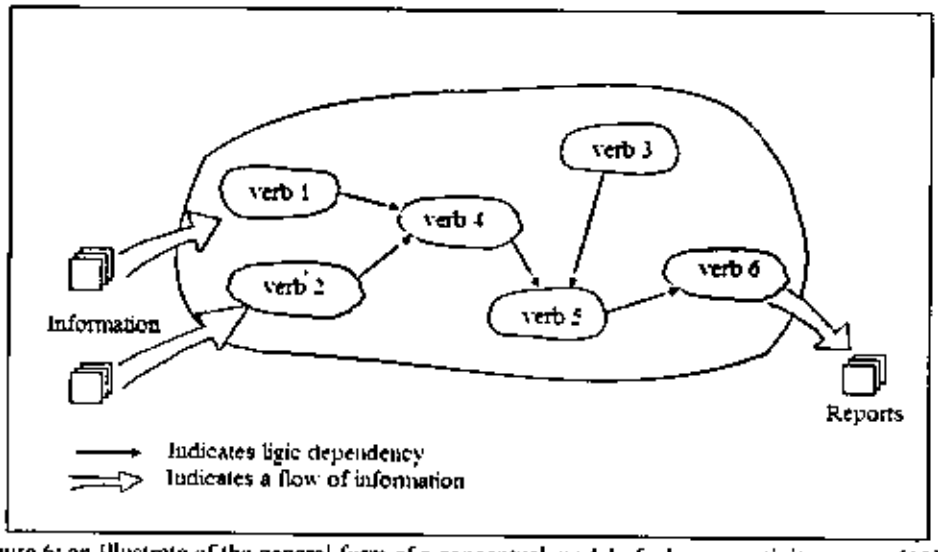

Figure 6: an illustrate of the general form of a conceptual model of a human activity system [11]

2.2.2.5 Stage Five: Comparison

This stage deals with the comparison between the conceptual model(s) developed in stage 4, and the structured analysis of the problem situation from stage 2. The purpose of this stage is to analyze the similarities and differences between the model and the real world in a thorough and structured manner. In this stage, the practitioner will likely find out where the models are unrealistic, as well as determining where the new ideas generated from the modelling might be of practical use in the situation being examined.

For the comparison table, the following questions can be answered.

- Does the activity occur in the real world?
- How does the activity occur in the real world?
- How is the output of this activity assessed and judged, and on what criteria?

The final column can be used to write any notes or observations that may be of use. In particular, notes related to possible changes are very helpful and can be used in the next stage.

Table 2 an example of a comparison table using in the Soft Systems Methodology (SSM) process. This table can be used to compare the conceptual model(s) generated in stage 4 (generate conceptual models) with the ideas generated in stage 2 (structure problem situation).

Activity	Exist?	How is it done?	Assessment	How is it judged?	Notes
1 2 3 4 5					
Links 1 -> 3 2 -> 4 3 -> 4					

Table 2: A comparison table between conceptual models (stage 4) and structure problem situation (stage 2) [10]

2.2.2.6 Stage Six: Definition of Desirable and Feasible Changes

The purpose of this stage is to define those changes that are most feasible and desirable. The possible changes from the previous stage are considered and weighed using several criteria, including the cost and benefit of the change, and the political feasibility. It is important that any problems that might occur as a result of the changes are considered. The

result of this stage is that those changes that seem likely, if implemented, to have a positive outcome in the situation are recommended.

Stage 6 includes a general framework for how to approach the weighing of the potential changes. It is quite flexible and so can be tailored for a particular situation. Other methods will likely have to be used in this stage, such as a method for estimating the cost of a change.

2.2.2.7 Stage Seven: Recommended Action

The purpose of the final stage is to help the practitioners recommend the change. The recommendations should reach the people who have the authority to approve the changes. This stage can also include the actual starting of the change process. It is important to note that the introduction of the action may change the situation so that new problems may arise. If possible, it may be a good idea to carry out the change in a temporary mock system to gauge the repercussions. However, this method of testing would have to be on a fairly simple system otherwise it could require a lot of resources. Once a temporary system is used and observed by an analyst, it could then be introduced into the real system.

2.3 Unified Modeling Language UML

In this part of the research we will introduce UML [12] as a assisting technique to the SSM methodology during analysis and design *the information system* build and converting it into a computer system , SSM' stage 4 (Building Conceptual Model) allows the developer to use other techniques and tools during applicating the Soft System Methodology . From other side we will clarify the relationship between the tools and plans that UML uses and its relationship with the techniques and tools that confronts it in the SSM method.

2.3.1 Use Case Diagrams

The use cases represent functionality of a system or a classifier, like a subsystem or a class, as manifested to external interactors with the system or the classifier.A use case diagram shows the relationship among actors and use cases within a system. Use case diagrams show actor and use case together with their relationships.

A use case diagram for a system consists of

a. Use case.
b. Actor.
c. Relationships between actors and use cases.

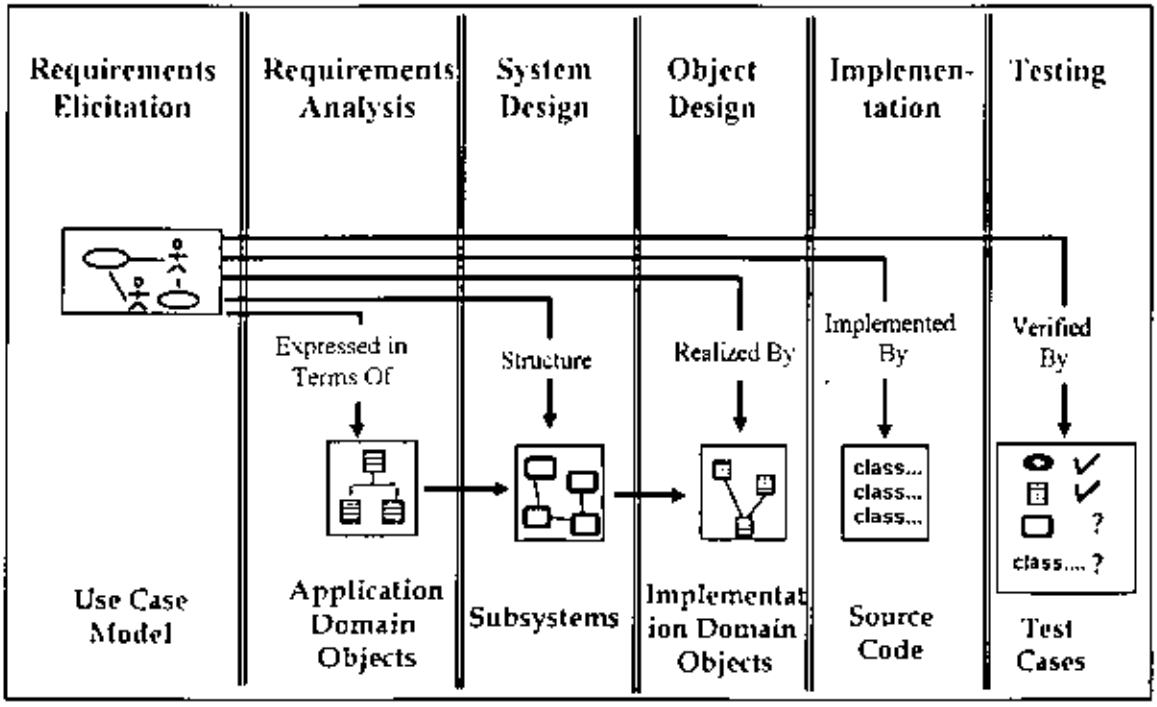

Figure 7: The system Requirements

From the previous diagram we notice that the system developing process in the *Object-Oriented systems* starts with diagram (Use case model) and is considered to be of the most important techniques that UML uses in describing and determining the systems requirements and from there the

process of system development is released. After describing the system requirements with the use of (Use case model), the developer can determine the environment and the systems limits and then move on to the design stages and analsis the system into *Sub systems* and build the rest of the plans we can build the conceptual models that reflect the system in the real world. In the SSM we find Rich picture) which does the same as *Use Case Model* in UML.

If we have compared and evaluated the techniques *Use Case Model* in UML and *Rich Picture* in SSM, We notice that the techniques agree in the function for both of them clarify the *System Requirement* and explain the relationship between people and the system. The difference between the two is that each model of *Use Case Diagram* describes a singular process that occurs inside the system and the actors that deals with this process, where Use Case Model doesn't consider the social and cultural factors of this process or the human activities resulting from these people the perform this process which makes this side of the system vague and not understandable , on the other hand with SSM for it analysis the system before it draws the rich picture it has to run a few analysis tasks *Social and Cultural Analysis , Intervention Analysis and Political Analysis*. Where these analysis define all the people that interact with the system (in and out of the system) and determine the role that all of the people could make and evaluate the performance of every role , and define privileges and the extend of the effect of every person on the systems activities . After complete these analysis the developer will have reached a complete picture of the social, political and cultural side of the people inside the system then drawing *The Rich Picture* will be the next step. The performance of *The Rich Picture* with the inheritance of the results that the developer reached from the previous analysis (*Social and Cultural Analysis, Intervention Analysis, and Political Analysis)* and presenting it in a diagram that expresses the social relationships inside the system , as well as clarifying the relationship between human activities with the technical and informational system activities , and these are the advantages of *The Rich Picture* and it is to understand and analyze and modeling the complicated social , cultural and political side of information system that hold back the performance like with Use case model of understanding and analyzing and distinguishing it from the rest of the systems activities.

2.3.2 Scenarios

A scenario is concrete, focused, informal description of a single feature of the system used by a single actor. In UML after drawing *Use Case Model* a scenario is defined for every model of the Use Case Models where every models scenario describes literally every process and its relationship with actors in the system and the *Use Case Model* can contain more then

one scenario , Every scenario represents a model or diagram this is called *Interaction Diagrams* , In UML the scenario technique (only describes how to achieve one process inside the system) , On other hand, SSM methodology uses *Root Definition* techniques that take the role of the scenario in UML language and it is the literally description of the system activities , where it describes all of the *Rich Picture* models , and the comparison with *Scenario Technique* so *Root Definition* does not describe small tasks inside the system , It describes what the system is , and how it functions , and why we need this system , and it describes the systems inputs and the processing operation and convert for the inputs to reach the description of the systems outputs . Root definition ends with introducing a full description in which the system analyzer to move to build *Conceptual Model* for the system, and this end the scenario technique which is Interaction Diagrams.

2.3.3 Class Diagram

A class diagram is a graph of Classifier elements connected by their various static relationships. Note that a "class" diagram may also contain interfaces, packages, relationships, and even instances, such as objects and links. Perhaps a better name would be "static structural diagram" but "class diagram" is shorter and well established. A class diagram is a graphic view of the static structural model.

2.3.4 Interaction Diagrams

2.3.4.1 Sequence Diagrams

A sequence diagram presents an Interaction, which is a set of Messages between ClassifierRoles within a Collaboration to effect a desired operation or result.

2.3.4.2 Collaboration Diagrams

A collaboration diagram presents a Collaboration, which contains a set of roles to be played by Objects, as well as their required relationships given in a particular context. The diagram also presents an Interaction, which defines a set of Messages specifying the interaction between the Objects playing the roles within a Collaboration to achieve the desired result.

A Collaboration is used for describing the realization of an Operation or a Classifier. A Collaboration which describes a Classifier, like a UseCase, references Classifiers and Associations in general, while a collaboration describing an Operation includes the arguments and local variables of the Operation, as well as ordinary Associations attached to the Classifier owning the Operation.

2.3.4.3 Statechart Diagrams

A statechart diagram can be used to describe the behavior of a model element such as an object or an interaction. Specifically, it describes possible sequences of states and actions through which the element can proceed during its lifetime as a result of reacting to discrete events (e.g., signals, operation invocations).

2.3.4.4 Activity Diagrams

An activity graph is a variation of a state machine in which the states represent the performance of actions or subactivities and the transitions are triggered by the completion of the actions or subactivities. It represents a state machine of a procedure itself.

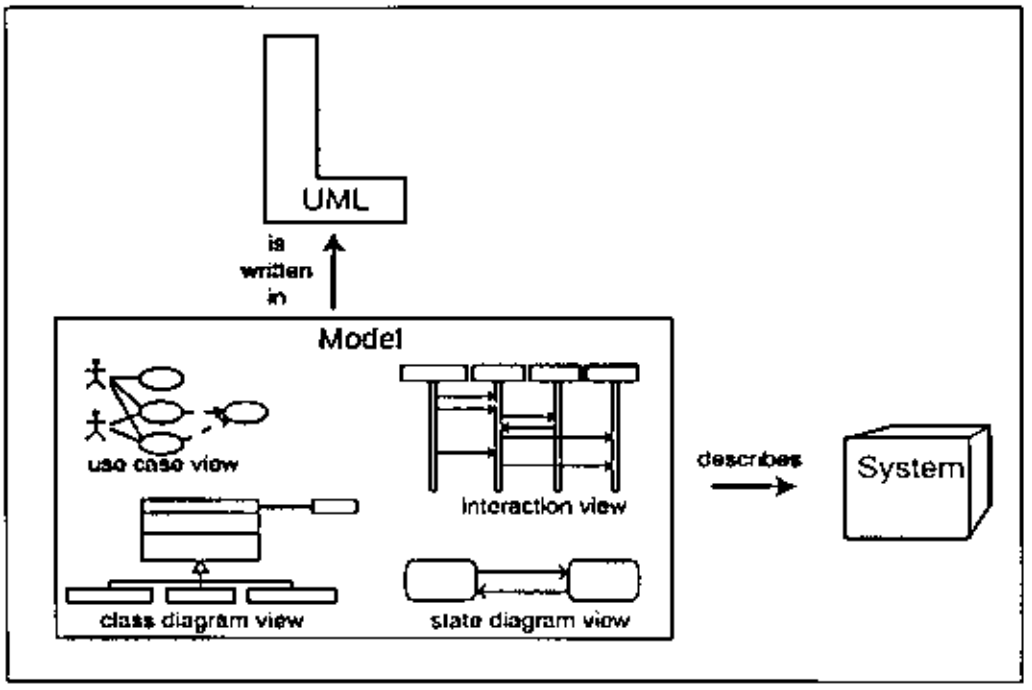

Figure 8: The UML modeling with system [12]

2.4 The Data Flow Diagram DFD

In this chapter, we will explore the major graphical modeling tool of structured approach the *Data Flow Diagram* [13]. The DFD is a modeling tool that allows us to picture a system as a network of functional processes, connected to one another by "pipelines" and "holding tanks" of data. The dataflow diagram is one of the most commonly used systems-modeling tools, particularly for operational systems in which the *functions* of the system are of paramount importance and more complex than the data that the system manipulates. DFDs were first used in the software engineering field as a notation for studying systems.

2.4.1 The Components of a DFD

2.4.1.1 The Process

The first component of the DFD is known as a *process*. Common synonyms are a bubble, a function, or a transformation. The process shows a part of the system that transforms inputs into outputs; that is, it shows how one or more inputs are changed into outputs.

2.4.1.2 The Flow

A *flow* is represented graphically by an arrow into or out of a process. The flow is used to describe the movement of chunks, or packets of information from one part of the system to another part. Thus, the flows represent data in motion, whereas the stores represent data at rest.

2.4.1.3 The Store

The *store* is used to model a collection of data packets at rest; the name chosen to identify the store is the *plural* of the name of the packets that are carried by flows into and out of the store.

2.5 Using DFD and UML with SSM as Framework

We have already suggested in this research we will use SSM in *Information System Development* where its distinction in analyzing and understanding the social side of the system where we use other methodologies like DFD and UML in the analysis and modeling the informational side of the system and data frame . If we evaluated these methodologies we will find that every one of them considers a certain side of the sides of the information system process. Notice that SSM distinction in analysis the social and political side of the system and the human activities as for DFD and UML distinction in the information system analysis from the data frame side and draw the diagrams and the methodologies to translate the information system into a computer system.

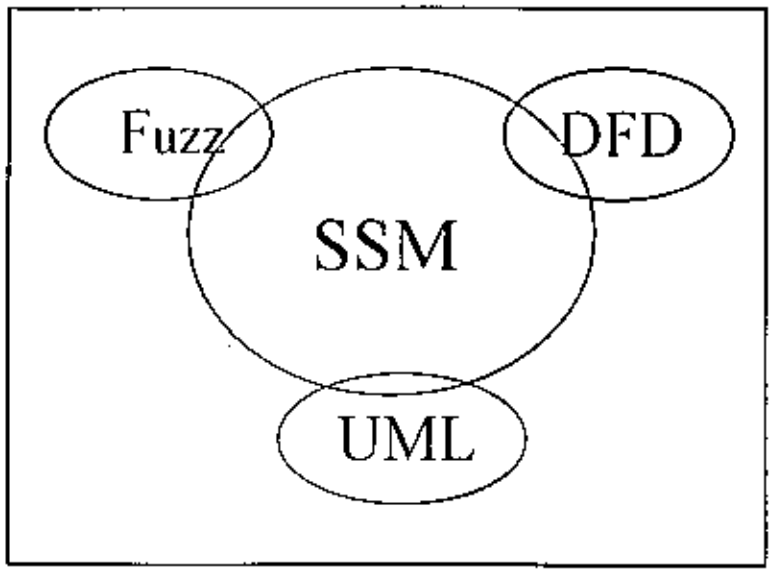

Figure 9: The SSM, DFD, UML, and Fuzzy Logic Framework

Coming we will evaluate the tools suggested by SSM in the analysis of the social, cultural and political side of the system:

1 Social and Cultural Analysis

Thou this analysis defines all the roles that actors play inside the system, more over to define the predicted function of every (Role) inside the system, and define the value that can be used in evaluating these roles so after the analysis we can choice the right element to discus in the understanding the system and define the elements in the system.

2. Political Analysis

This analysis considers the political study followed inside the association that work with this system, where after pointing the roles for every actor in

the system, we can point out the actors that can make the decision and effect the work of the system, in another form it helps this analysis in pointing the decision centers in the system.

3. Rich Picture

This tool is considered of the most important techniques of SSM, *Rich Picture* is the completion of the two previous analysis after defining the actors involved in the system and there roles in drawing Rich Picture that represents every actor inside the system and the role that every one of them plays and the thoughts that every one of them thinks towards the system, here we have presented a big part of the complicated social sides and the interaction with the information system.

From another side, Notice the *Use Case Diagram* in UML works similar to *Rich Picture* in SSM but the second benefits from the previous stages *Social and Cultural Analysis, Political Analysis*, and *Rich Picture* in analysis the social side inside the system and clarifying it during representing the system. *Use Case Diagram* explains partly or a small process happening inside the system and defines the actors that carries out this process without referring to the social and cultural sides related to this process or actor , like the DFD that defines the roles inside the system by the use of external entities to clarify the flow of data between these entities and different activities without analyzing any of the social or cultural entities or activities.

4 Root Definition

RD represents how the system works and what activities are inside the system, RD inherits the complete result of the previously three analysis (social and cultural analysis, political analysis, and rich picture) and analyze the information system taken in account the social surrounding which is represented during these stages at the same time of the analysis of data and the systems activities. It is clear the SSM supremacies greatly in the field of understanding problems even if the social, cultural and political factors intervene, Moreover SSM contains tools that allow it to analyze and understand this type of problems *Soft Problems* this is why we choose SSM to analyze the social side of the system, this is that SSM splits the followed information system from the social, cultural, and political factors that effect the understanding and analyzing process of the system.

But the SSM flaws must be mentioned because it is poor in classifying the plans and models that the studied *Information System*. Now comes the role of the other suggested methodologies in this research *DFD and UML* which contain many types of plans and models which surpasses greatly in modeling and representing data and activities and pinpoint the information systems structural frame. Due to the SSM principles it does not interfere

with the use and apply of other techniques or methods that's why we use DFD and UML according to its need in building the plans and methods that organize the information part of the system.

SSM's flexibility is shown while using techniques from other methodologies in the fourth stage of SSM *Building Conceptual Model Stage* in (Figure 10) we notice that stage four of SSM can achieve techniques and plans from other methodologies (4b other system thinking) and this supports our suggestion of the use of all of DFD and ULM and taking advantage of the techniques and plans of these two methods.

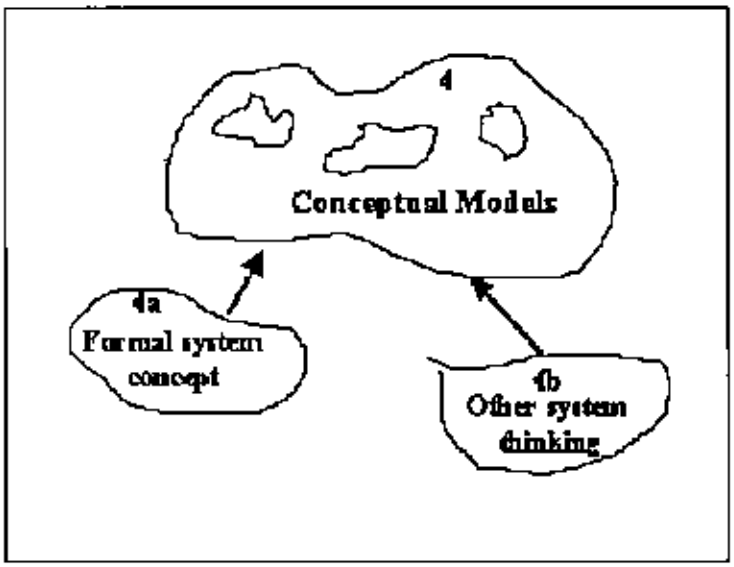

Figure 10: *The Stage Four* in SSM [6]

Chapter Three:

The Role of SSM in ISD and Fuzzy Systems

- Information System Development
- SSM, IS and ISD
- Fuzzy Sets and Logic

This chapter explains the possible role that SSM methodology can play in the field of *Information System Development*; we will show the relationship of SSM and information systems development as Peter Checkland explained. we will clarify how SSM allows the use of techniques and tools capable of understanding and analyzing the ambiguity of the accompanied social systems of the information systems and especially when the information system depends on the human activities and the surrounded social factors , these factors can convert some parts of information systems into *Undefined System*, in a system like the insurance system its environment is a group of social cultural and political factors and human activities so we can not neglect the factors during the system development process. In previous chapter mentioned we will use SSM as a methodology to solve this problem and in addition to other methods and tools like DFD and UML , the role of Fuzzy logic technique is to define the components of the vague social system , and define the elements that consist and do not consist with the system , the study of the foggy system environment that consists of social , cultural and political factors which are hard to measure or to deal with like (the threats the insured car , the damage that could occur to the car or the passenger , and the compensation of these damages) and study how far the systems environment follows , where the current techniques don't concern in the information system development to define or pinpoint the social , cultural and political design or the human surroundings of the system that is considered to be the important part of the system and the most vague and that has most effect on the system.

3.1 Information System Development

Information systems development is exceptionally well documented in the academic and practitioner literature and needs little elucidation here. It is characterized by the use of structured methods, sometimes in association with prototyping. Structured methods may be process and dataflow focused (DeMarco 1978, Gane and Sarson 1979) [14] or model the structure of data in terms of entities and relationships (Martin 1986)[15]. Later methodologies such as SSADM (Structured System Analysis and Design Method, Weaver 1992) [16] combined both approaches. More recent methods, responding to developments in object-oriented programming, model the world in terms of objects, which combine both process and data elements (Coad and Yourdon 1990). [17]

Every field has a set of conceptual apparatus which are part of its style and tradition. A dominant theme in the ISD literature revolves around method and methodology.

> 'An *information systems development methodology (ISDM)* is an organized collection of concepts, beliefs, values and normative principles supported by material resources. The purpose of the ISDM is to help a development group successfully change object systems, which is to perceive, generate, assess, control, and to carry out change actions in them.' (Lyytinen 1987) [18]

> 'Methodologies are normative in the sense that they organise sets of behavioural and technical rules into a coherent approach which prescribes how to address major development problems'
> (Hirschheim *et al* 1995) [3]

3.2 SSM, Information Systems and Information System development

Checkland's account of IS and ISD are primarily found in Checkland and Holwell (1997) [19]. Firstly the authors distinguish between data, capta, information and knowledge (figure 11). Once an observable phenomenon can be represented in some manner, it forms part of an available set of data, of which we may, or may not choose to take notice. Choosing to record that data in some form (capta), perhaps in a computerized IS, implies an act of selection by some criteria. However, for those represented and selected phenomena to become information requires an act of meaning attribution by their interpreter; context and history must be added to make them useful to thinking and acting. Larger structures of information shared between actors may be thought of as knowledge. [20]

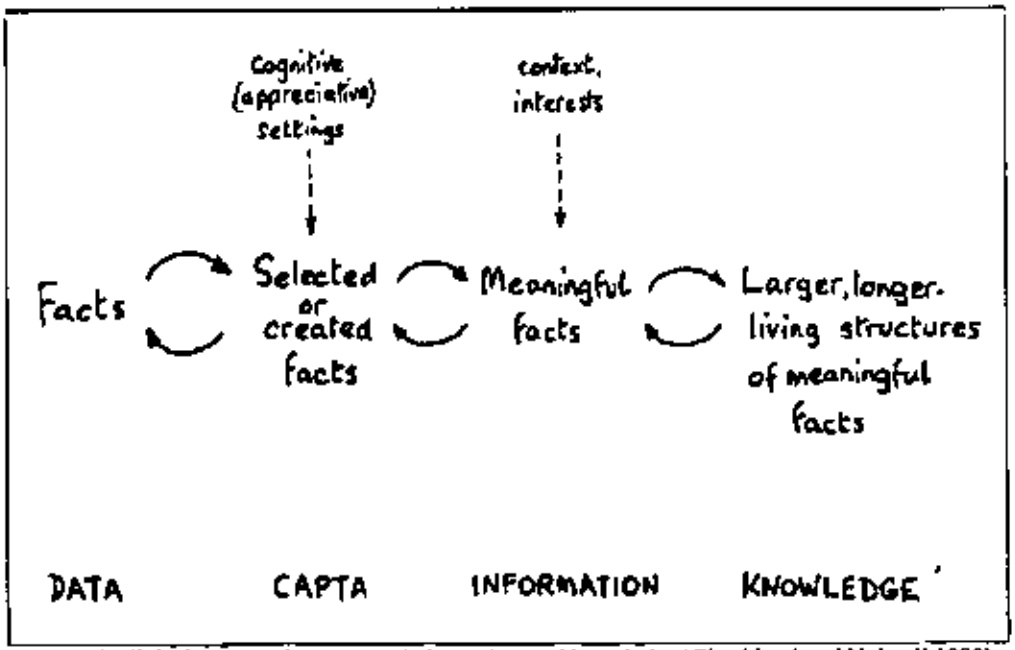

Figure 11: The links between *data, capta, information and knowledge* (Checkland and Holwell 1998) [21]

The implied notion that there is some form of one way linear process by which facts may be transformed into knowledge is unfortunate and probably not intended. Such categories (data, capta, information, knowledge) imply processes by which they are created and recreated.

The relationship between Checkland's view of information systems in their organizational contexts and information systems development (including the role of SSM) is explored in (figure 12)

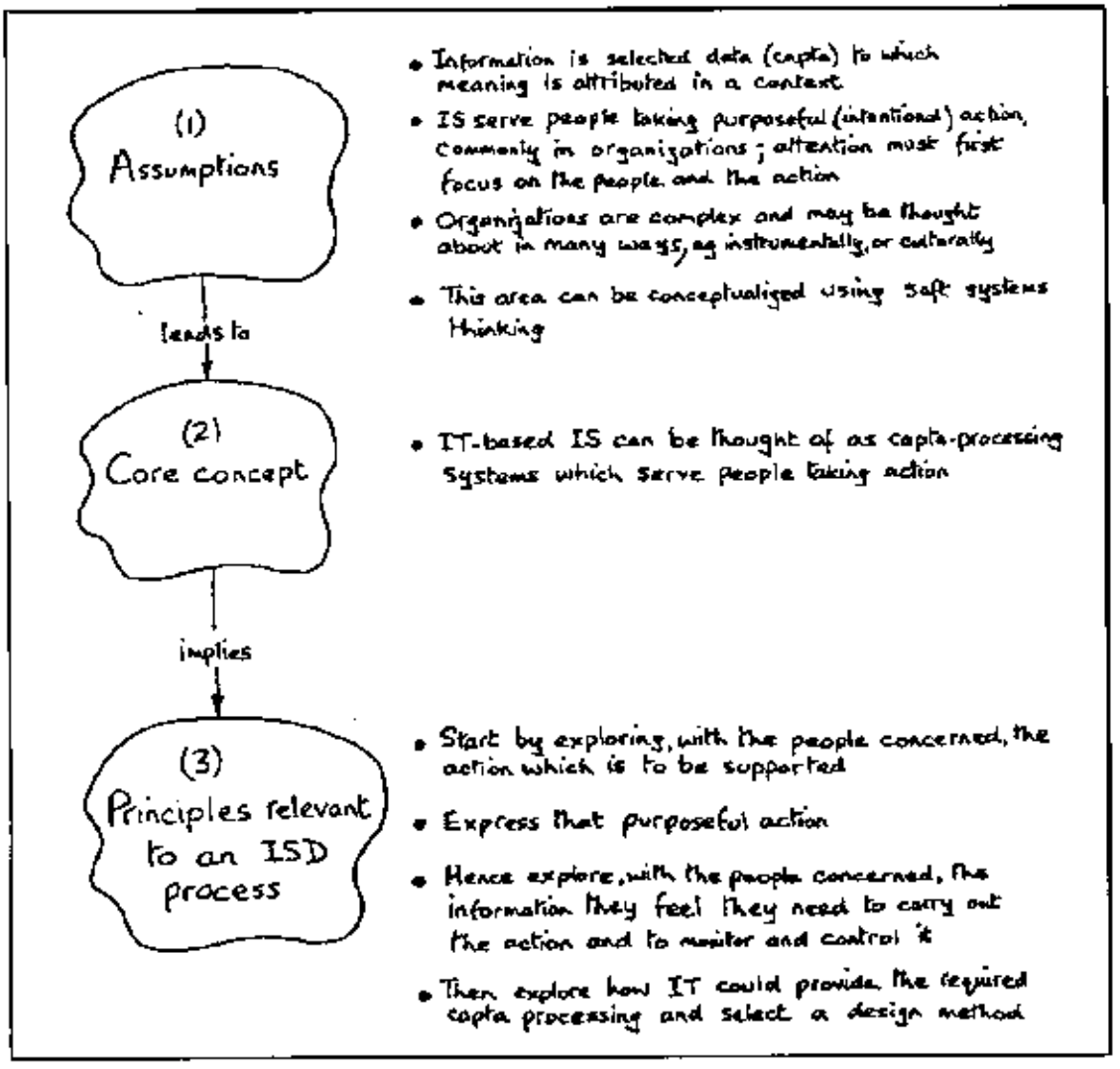

Figure 12: *'information system' and 'information system development'* (Checkland and

Checkland's concern is that information system development normally starts too far down the line, with a focus on data and data processing concerns, in arather mechanistic and functionalist manner. It ignores fundamental issues about the organizational activity that is supported, and most of the concerns normally associated with interpretive forms of enquiry. [20]

To flesh out this account, Winter *et al* (1995) [22] suggest as the process of ISD:

1. Understand what the organisation is taken to be.
2. Understand what the organization will therefore do.
3. Identify and define organizational performance criteria.
4. Identify and define operational information requirements.
5. Identify and define performance information requirements.
6. Analyse the data manipulation system.
7. Design the data manipulation system.
8. Construct the data manipulation system.
9. Test the data manipulation system.
10. Install the data manipulation system.

SSM is well accepted as a management problem solving methodology. its development shows a gradual re-orientation around the principle of the social construction of social reality – its espoused ontology. Difficult ontological questions concerning the 'real' world and the arbitrary dividing line of the seven stage model are gradually erased from the developing framework.

In the previous part we demonstrated Checkland's vision in the field of information system development and his interest in the social systems environment during the process of developing the system. Due to the social, cultural and political part of the studied system that have a great effect on the performance of the system and is considered to be an essential component in the information system. and for this reason we will conduct a system development process inside the complex social environment , we will conduct a study and analysis of the social systems environment and the culture and policies of the corporation , as we mention that there are unaccepted social , cultural and political factors and *Human Activities* that could effect the system greatly and could convert the system into a fuzzy system (When the systems inputs and the components it is part of the social , cultural and political factors , the process of identifying these inputs is very difficult for this the process of determining the outputs is not possible , In this state we will have reached a system with unknown inputs and outputs which is a fuzzy component of the system) this is the mistake of neglecting the these factors during the process of developing the system . In this chapter we suggest the use of *Fuzzy Logic* in identifying and understanding the complex social part of the suggested incurrence system in this study. moreover we will determine its components and measure the extend of its consistency with the system to reach a full understanding of the systems design and what is consistent with the system and what is not, we suggested the use of *Fuzzy Logic* as an analyzing technique for the ambiguity side of the system

because the traditional technique of information system development do not contain the tools or techniques capable with dealing with the complex nature of the social part.

Motivation to Put Fuzzy Set and Logic:

> "lotfi A.zadeh publish his paper on fuzzy sets in 1965, it talk about while traditional methods for system analysis are unsuited for dealing with systems in which relation between variables do not lend themselves to representation in term of differential or difference equations.such system are norm in biology, sociology, economics, and more generally, in field in which the system are hmanistic rather than mechanistic in nuture.
>
> Traditional methods of analysis are oriented toward the use of numerical techniques. By contrast, much of human reasoning involves the use of variable whose values are fuzzy sets. This observation is the basis for the concept of linguistic variable, a variable whose values words rather than numbers" [23]

However, in insurance system we have an environment such that the things are surrounding considerable conceptual nature like abstract notion. This environment may be created or consisted from subjective knowlege or relative states which usually uncertianty and impression, how we can take decision in such environment? , What is the modes of reasoning can be done in such environment? , One of most effective models is models building using fuzzy setss and ligic.
The fuzzy sets and logic used to but models that describe the pattern and the modes of reasoning which aim to take decision in impression and uncertianty environment. [24]

3.3 Fuzzy Logic

Fuzzy Logic, a multivalued (as opposed to binary) logic developed to deal with imprecise or vague data. Classical logic holds that everything can be expressed in binary terms: 0 or 1, black or white, yes or no. [16]

3.3.1 Fuzzy Sets

> *" A Fuzzy set A in [a given set] X is characterize by a membership [characteristics] function $F_A(x)$which associates with each point in x a real number in the interval [0,1]with the value $F_A(x)$ at X representing the grade of membership of X in A ".*[24]

Because the insurance system is considered to be vague and undefined for this reason we use the fuzzy logic technique to define these logics and define the components of the insurance systems environment, and recall the quote A.L. Zadeh that any economic or social system can present it components we variables through the fuzzy set and with the use of fuzzy logic rules we can do an organic study of all elements of the systems

environment that is represented inside the fuzzy set . while the suggested fuzzy set which contains all of the social and political factors and events that could occur in the system which can confuse the workers within , and we need to define if these factors consist with the system or don't , and measure the extend of its effect on the system , where the fuzzy logic technique allows the organic measurement of every part inside the fuzzy set (this set which we will study and measure every part of it . we will end with set will represent the insurance systems environment which contains all the system components) from the degree of consistency of these factors we will estimate the extend of the effect on the system , here we will have defined the design of the social , cultural and political part of the insurance system .

3.3.2 Representation of Fuzzy Sets

Any representation of fuzzy set [24] essentially requires a basic understanding of relationship among the fallowing different but related concepual symbles.

- Longuistic variable

  The problem is to try to make easoning in uncetainty or impression enironment. This environment in natural language, the quesion is how to abstract the meaning of nutural language in some form? The meanig of natural language represented by linguistic variables which is a key element to introduce such a system.

  Then, the linguistic variables v in a set of liguistic variables, a label for an attribute of elements

  $$v \in V$$

  Example:

  $V = \{Tall, Old, Fat \ldots\}$

- **A set of element**

  $$\theta \in \theta$$

- **Linguistic term**

To derive and applay the meaning of linguistic variable, to make it precise and to make matching with any object in environment, we need concept such linguistic term.

A linguistic term A an adjective or adverb

Example: The car is pricey

We can observe that the statement "The car is pricey" is a proposition, but we can't decide weather its true or false because it is

Fuzzy. We can see also that, if but predicate variable K rather than the noun. And get "K is pricey", the statement become predicate which his truth value (membership) depend on the value of the predicate. We can represent this predicate statement using set, and then the predicate statement becomes a rule that collect all objects.

How to represent the linguistuc term?

There are many mathmatical structures can use to represent liguistic term like topos, lamda calculus . . . and function. To make it easier representation, reasoning and computing, the function is the proper way represent the liguistic term which will have numeric value assigned to numeric degree.

$X \in [-\infty, \infty]$
$\mu_A: X \rightarrow [0..1]$

Example:

Nameric values: K is pricey, pricey = [20000 .. 100000] L.D.
Numeric degree: μ_{price}: price - value $\rightarrow$ [0..1]

Then we got good measurable concept called membership function used to make the assignment or the degree of belonging to fuzzy set which set based on the linguistic term.

Then,

.V predicate 0	$V: \theta \rightarrow X$
0 predicate to A	$\mu_A: 0 \rightarrow [0..1]$
A predicate V	$\mu_{A0} V: 0 \rightarrow X \rightarrow [0..1]$
$\mu_A(\theta)$	subjective numerical assignment

$\mu_A(0)$: is the degree with which the use of (A) agrees with the attribute V of an element $\theta \in \Theta$ according to the observer's understanding of A.

Here we have presented fuzzy logic technique to be one of the used methods in this research, if we go back to the previously mentioned methods and techniques that we mentioned in the second and third chapters would be as followed:

- Soft System Methodology is the core of this research, because the SSM method has high abilities and power in dealing with social and human systems, moreover SSM allows the use of other methods and techniques, for this reason SSM was the environment that gathered all of these following methods and techniques to work together in a united work frame. The purpose is to expand the concept of ISD, to embrace the information system development we take into consideration the social, cultural and political environment of the system.

- Data flow Diagram confines the role of this performance on drawing the diagrams that clarifies the relation between the systems activities and the flow of data through out these activities.

- Unified Modeling language the importance of the role that this technique plays in the field of information system development , this is why we use techniques and methods that privileged with UML in the understanding and scenario analysis and the complicated procedures that occur inside *The Insurance System* .

- Fuzzy Logic and Sets confine the role of this technique in the interaction with a fuzzy environment of the information system, and the study of the elements in the social system environment, and measure the extend of its consistency and the effect of every element on the systems performance.

Chapter Four:

Soft System Methodology in Action (Case Study)

- The Insurance Definition
- Libya Insurance Co.
- SSM and Insurance System in Libya

This chapter of the research represents the applied and practical part, and it is the insurance system: Libya insurance company – Benghazi Branch, the insurance system is a system where the technical information system interacts with the social, cultural and political factors which are hard to aspect their occurrence or understanding and analyzing with the use of the current traditional tools and techniques in the field of *Information System Development ISD.*

At the developing of a system like the *insurance system* we need developed tools and techniques which are dealing with *Human Activities* and social and cultural factors even the political events that occur in the systems environment must be taken into consideration during the system development, to solve the problem of the intervening of these factors we used Soft system methodology. on the other hand it is currently shown that the routine information system technique as part of the incurrence system its for this reason we used the tools and techniques that are currently used in information system development like (DFD and UML) as this is to draw the plans and the models of data and an activity system.

(a) The technical and information side.
(b) The social and cultural side.

Both of them depend on each other to construct a *insurance system*, it is prescribe while developing an insurance system not to neglect any of them , from here we have found a united framework , and through it we have economize all of the tools and techniques that cover all our needs during the information system development even if the social , cultural and political factors infect , and also concern with the technical and information side of the information system. Because of the soft system methodology interest with the social side of the system it allows the system developer to use tools and methods and other concepts during the developing process. And for this reason, the traditional tools of system development (DFD and UML) were cautious while dealing with this application, and we fall back on the mathematical theories used in the field of fuzzy system that identify the components of the complex social system.

4.1 The Insurance System Definition

Insurance is social system designed to minimize the phenomena of uncertainty that insured feels, by transferring burden of certain risks to the insurer who undertakes compensating the insured all or part of sustained financial loss. [7]

Types of Insurance Policy

There are three types of insurance policies:

1. *Individual Insurance Policy*, Which covers a specific individual against particular risk such as medical insurance of particular person.
2. *Combined Policy*, That covers a particular person against multiple and dissimilar risks as insuring house against theft, fire, calamities and earth quakes where the insured pays only one premium to cover all those risks.
3. *Collective Insurance Policy*, Which is issued by the insurance company to a group of persons against define risk, this type of insurance policy is applied to the universities students who are insured and covered by one single *collective insurance policy*.

4.2 Libya Insurance Company

Libya Insurance Company was founded in 1964 [25], considered the first national insurance company in the country. By Libyan and Iraqi contribution, after those other insurance companies was founded among which *Sahari Insurance Company* which was established in 1967, *El Mukhtar Insurance Company* which was founded in 1968, and *North Africa Insurance Company* in 1969.

On October 11th 1971 a low issued aiming nationalization law of insurance companies on the entire soil of Libya then this nationalization law was followed by a decree to corporate both insurance companies North Africa and El Mukhtar in one single insurance company (El Mukhtar).

The Libyan insurance market continued to function by tow companies *Libya Insurance Company* and *El Mukhtar Insurance Company* till December 28th 1980 when both companies were incorporated in one company and constituted one company (*Libya Insurance Company*).

4.3 SSM and Insurance system in Libya

As we mentioned in the introduction of this chapter , that we have used the SSM method to analyze and understand every side of the managing work and organize the data inside the current system (the period from 1 of January to the 30 of April 2008) *in the Libya Insurance Company – Benghazi* , and analyze the social , cultural and political components that are a important part and effect on the systems performance, where the SSM are applied that contain a lot of techniques and tools that have high performance in analyzing and understanding information system and the accompanied social systems , because the insurance system consists of data which is possible to translate into a computer system and with addition to the social , cultural and political sides , and the human activities that are considered to be an important part of the system , for this reason we chose the insurance system in this study to show the capabilities of the SSM method in dealing with these kind of complex system .

SSM in Action

4.3.1 Stage One: Problem Situation Unstructured

Overview of Stage One:

The purpose of this stage is to gain a general understanding and a wider view of the problem. Information is gathered about who is involved, what their perceptions of the situation are, what are the organization structure are, and what processes are going on.

Important of Stage One:

1. General understanding of the problem.
2. Organization structures.
3. What processes are going on.

(Libya Insurance Company) is one of the biggest insurance companies in the Libyan insurance market, and the work nature of this company is like any insurance company in the world and it is to protect the client from dangers that may occur then compensate the losses resulting from these dangers. The insurance company sells safety and security to the client in return the client makes finance installments to the compensating company if the client has a registered injury in the insurance policy, and insurance policy vary from one to another (Insurance Branches).

4.3.1.1 Insurance Branches

1. Life insurance includes all insurance operation that pertains to prospects of life, death, or incapability.
2. Fire insurance branch, usually covers damages caused by explosion, disturbance or natural phenomena.
3. Road, maritime and air insurance branch including vessels and airplane bodies and the transported goods on those vessels and planes.
4. Car insurance branch, intended by that to cover all risks that may rise by using a motorcar, including damages that may afflict other.

There are no specific or predefined tools to be used in this stage. The only tool is the SSM practitioner senses and experience and it is up to him to decide what type of questions should be asked, whom to ask, and what documents and materials he should read to understand the organization language.

For example but not all the requested questions asked in this stage:

- What is the structure of the organization management? then determine the extent that will be studies .
- Whom are the effect persons (Employees) and the supervisors of the insurance process?
- What is the organizations *(Libya Insurance Company)* work nature?
- What are the types of car insurance?
- How many insurance policies did the company deal with in 2008?
- How are the clients insurance applications accepted?

These questions are directed to:

1. Chief of Auto Insurance Department.
2. Chief of Supplementary Issuing Office.
3. Chief of Supplementary Compensation Office.
4. Chief of Compulsory Compensation Office.

Many documents have been observed like (insurance policies, renew card, insurance installment computation cards, compensation computation cards).

4.3.1.2 Organization Structures:

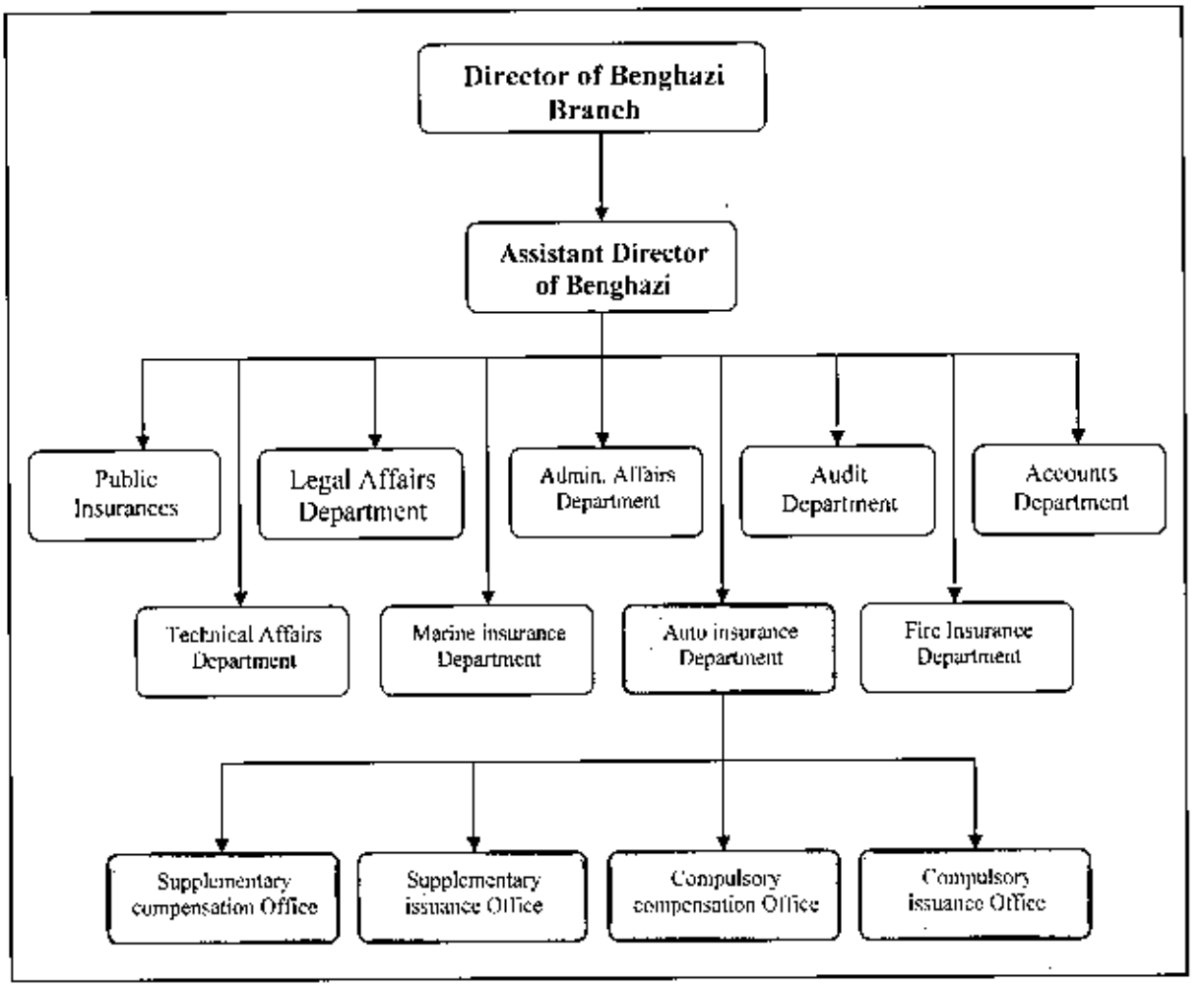

Figure 13: The Structure of Libya Insurance Co.

4.3.1.3 Auto insurance Department

The Auto insurance Department issues the insurance policy according to the client's request, and pledge to cover the car damage and compensate the client in case of an accident within the insurance policy. *The Auto insurance Department* is divided into four offices:

1. Compulsory Issuance Office.
2. Compulsory Compensation Office.
3. Supplementary Issuance Office.
4. Supplementary Compensation Office.

Mention here that the insurance process begin with the request of insurance where *Libya Insurance Company* issues applications for the request of insurance , the client fills in the application as a first step for car insurance , where the company by the use of issuing offices to accept or decline the insurance application .

- According to the *Compulsory Issuance Office* this office deals with accepting all the insurance applications sent to it, where the traffic law in this country does not allow the use of cars on the roads before issuing the Compulsory Insurance Policy. And this policy covers the damages that inflect the persons (Human Damages) on the other side of the danger (accident).

> **An Example**: If the client's car is in an accident with another car, the company by *Compulsory Issuance Office* compensates the damages of the persons in the other car, and this compensation is over the lives of the persons in the other car not the damages to the car itself.

- In *the Supplementary Issuing Office* the accept or rejection of the insurance request is accounted on a lot of social, cultural and political factors and data , from this data the head of the office can determine whether the client is serious in the insurance on there car or the client is someone who is trying to fraud and manipulate the company (fraud and manipulate is that the client is trying to get compensation that is not deserved) in stage 2 , 3, 4 of SSM will study and analyze these factors. in the state of accepting the issued car insurance policy and during that insurance period that the insurance policy covers (the insurance policy period is usually one year) if any of the mentioned accidents in the insurance policy occurs the company is compiled by law to cover the damages and compensate on the damages of the car .

we notice that the accept or rejection of the insurance application is a delicate process , if the company was to accept all of the insurance applications without studying and personal analysis of the client and defining there sincerity in applying for car insurance , the company will occur problem with the persons who are trying to fraud and manipulate to get compensation they do not deserve which means paying large sum and that is a threat of bankruptcy and collapse , the opposite if the company rejecting all of the insurance applications the company will lose Libya insurance company its clients to other insurance companies in the market.

4.3.2 Stage Two: Problem Situation Structured

Overview of stage Two:

This stage helps to structure and express the information and the understanding of the organization problem situation to enable and facilitate the analysis that will follows especially in *stage 3* when we choose relevant systems.

Importants of stage Two:

This stage contains of five techniques:

1. Analysis One: Intervention Analysis.
2. Analysis Two: Social and Cultural Analysis.

3. Analysis Three: Political Analysis.
4. Rich picture.

4.3.2.1 Analysis One: Intervention Analysis

We can conduct analysis one by doing the following steps:

1. Define the client (the individual who causes the intervention to take place)
2. Define the 'would-be problem solvers' (those individuals who conduct the study)
3. The would-be problem solver then makes up a list of possible problems
4. For each of the problems on the list, the would-be problem solver then names one or more 'problem owners': those people with an interest in the problem situation as identified, and those who are likely to be affected by the problem.

The Client

In this study the *Libya Insurance Company* represents the client, this client (*Libya Insurance Company*) straggles of some technical problems in the organization of great deals of data and the means of benefiting from this data and information in elevate the systems performance, where the insurance system has its own social, cultural and political specialties in the information systems and data side that need a processing to benefit from them.

In the previous stage (*Stage One: Problem Situation Unstructured*), we defined the system and determined the company's structure managing frame and acknowledged the types of insurance the company provides, we mentioned that this study will be on *Auto Insurance Department*, as shown in (figure 13) the effect employees in this department are :

1. Director of Libya Insurance Company - Benghazi Branch.
2. Assistant Director of Libya Insurance Company - Benghazi Branch.
3. Chief of Auto Insurance Department.
4. Chief of Compulsory Issuing Office.
5. Chief of Compulsory Compensation Office.
6. Chief of Supplementary Issuing Office.
7. Chief of Supplementary Compensation Office.
8. Administrative staff (Operators of The Computer).
9. Car maintenances technicians and the damages that follow.
10. Chief of Legal Affairs Department.
11. Chief of Technical Affairs Department.

Would-be Problem Solver

This study is part of a master's research of (El TAHADI– University) in Sicrt-Libya, where the researcher studied the role that the SSM methodology could play in the field of *Management Information Systems MIS*, and specially when the social, cultural and political factors intervene and its effect on the systems analyzer where the ambiguous system data increases and harder to expect its reaction. Here the researcher borrowed the SSM methodology as a new environment which allows to use of other methods and tools to deal with systems that are affected by the social, cultural and political factors and human activities.

The Possible Problems:

1. The company issued the great number of insurance policies in one insurance year, and each insurance policy need its own file that has a number of incumbents like (insurance installments computation cards, dangers application, renewing card atc).

2. The large size of data that delays the information gathering process and this require for a computer system capable on delivering all the enquiries quickly.

3. Insurance policy need to be renewed (yearly) where the value of the car changes and the insurance installments change.

4. Losing many clients to other competing companies.

5. Regression of company profits.

6. The continuation of the accepting of insurance applications for some con clients, what causes legal issues with these clients.

7. Compensation to non deserving clients.

8. The appearance of continuing legal loop holes in the conditions of the insurance policy which is taken advantage by some clients.

9. The intervenes of some social, cultural and political events (Unexpected) which confuses the system.

10. The absents of norms to measure and evaluate the data and inputs in the insurance system , which increases in the difficulty of understanding and analyzing the system and this calls for the use of other methods and developed tools .

11. Social Relations (kinship) which used by some clients to press on insurance employees in the company.

12. The Bribery which face the insurance employees in the company.

We notice that while relation these problems , there is a information system (The large size of data) needs a system and frame which converts it into a computer system capable of economizing all of the information quickly to reach the information on the side this represents the hard problem from the system , Moreover the presents of cultural and social

problems that increase the difficulty in understanding and analyzing the system in its social , cultural and political environment , because the insurance system in under the influence of these factors (cultural , social , political and economical) . It is wrong to deal with this system as a information system that contains data that needs organizing and converting into a computer system only.

The problem and its owners

Problem	Problem Owner (s)
- The loss of many customers of the company for the benefit of corporate competition in the market	- Director of Libya Insurance Company-Benghazi Branch. - Chief of Auto Insurance Department. - Chief of Technical Affairs Department.
Dwindling of the company's profits.	- Director of Libya Insurance Company- Benghazi Branch. - Assistant Director of Libya Insurance Company - Benghazi Branch. - Chief of Technical Affairs Department.
Continue to accept insurance requests from some fraudulent customers, which led to judicial problems with these customers.	- Director of Libya Insurance Company-Benghazi Branch. - Chief of Auto Insurance Department. - Chief of Supplementary Issuing Office. - Chief of Legal Affairs Department
Payment of non-worthy compensation to some customers	-Director of Libya Insurance Company-Benghazi Branch. . - Chief of Auto Insurance Department. - Chief of Supplementary Compensation Office. - Chief of Compulsory Compensation Office
The appearance of some legal loopholes in the conditions of the insurance policy and constantly exploited by some people to obtain an undue compensation	-Director of Libya Insurance Company - Benghazi Branch. - Chief of Technical Affairs Department - Chief of Auto Insurance Department. - Chief of the Legal Affairs Department

Interference of unexpected some social and cultural and political events, which disrupt the system, and this represents part of the third-defined (Undefined system) from the insurance system, would entail the following problem	- Chief of Technical Affairs Department. - Chief of Auto Insurance Department. - Chief of Supplementary Compensation Office. - Chief of Compulsory Compensation Office
The lack of clear criteria for measuring and evaluating the input insurance system, which increases the difficulty of dealing with the data so the system can hardly be expected output system (the reaction)	- Director of Libya Insurance Company-Benghazi Branch. . - Chief of Auto Insurance Department. - Chiefs of compulsory and complementary issuing and compensation offices.
The enormous amount of data to delay the process of obtaining information quickly enough	- Chief of Auto Insurance Department. - Chiefs of compulsory and complementary issuing and compensation offices. - Computer operators
The periodic renewal of insurance policy and the impact of changes in prices and the value of that portion	- Chief of Auto Insurance Department. - Chiefs of compulsory and complementary issuing and compensation offices.
- Social Relations (kinship) which used by some clients to press on insurance employees in the company.	- Director of Libya Insurance Company-Benghazi Branch. - Chief of Auto Insurance Department. - Assistant Director of Libya Insurance Company - Benghazi Branch. - Chiefs of compulsory and complementary issuing and compensation offices.
- The Bribery which face the insurance employees in the company.	All employees whom relate to auto insurance operation.

Table 3: Problems and problem owners in *Insurance System*

4.3.2.2 Analysis Two: Social and Cultural Analysis

Three important entities in this analysis:

1. The roles that the various individuals involved in the problem situation play.
2. The expected behaviors of each role.
3. The values that are used to evaluate the performance of the individuals involved.

Role	Norm	Value
Client	• Check on his car and obtain insurance. • Request insurance and sign a document with the insurance company. • Payment of premium. • In case one risks set forth in an insurance customer to obtain appropriate compensation with the size of the damage. • Renewal of the insurance policy. • Attempt to obtain compensation is not payable (fraud)	
Director of Libya Insurance Company - Benghazi Branch.	• Adoption regulations and controls that would enhance the efficiency of the institution (the company Libya insurance). • Reorganize the administrative structure of the institution to reach the goal of the previously announced (raising the efficiency of the institution). • To accept or reject requests for insurance does not specify where the ceiling price of the car, including the documents private insurance companies that cover a large number of cars in a single document. • Deciding in complex cases (cases where the difference between the elements of the institution) for example, the company's recognition of its obligation for compensation or not	
Assistant Director of Libya Insurance Company - Benghazi Branch.	• Implementation and follow-up regulations and controls issued by the Director of the Foundation. Receipt	

	functions of the Director-General during his absence.	
Chief of Technical Affairs Department	• To accept or reject requests for insurance, provided that no more than the price of the car on 50000 LD • Determine whether the incident was accidental or deliberate incident for the purpose of obtaining compensation. • Check the validity of data such as vehicle to be insured, structure and engine No. • Provide highly qualified professionals in determining the prices of cars, as well as estimating the value of compensation in the event of an accident.	
Chief of Legal Affairs Department	• Implementation and follow-up regulations and controls issued by the Director of the Foundation. • To fill the legal gaps in the insurance, which could be exploited by some people to obtain non-worthy insurance • Follow-up of cases filed by or against the company. • Developing the conditions in the insurance policy for the company right reservation as well as the right of the customer	
Chief of Auto Insurance Department	• To accept or reject requests for insurance, provided the price of the car that no more than 25000 LD • To oversee the process of calculating the price of the car and the value of the installment. Follow-up to the renewal of various insurance (compulsory supplementary). • Supervise the customer compensation process and calculating the value of compensation commensurate with the damage. • Conducting negotiations with the client for the purpose of accessing successful deal.	

Chief of Compulsory Issuing Office	• Accept the insurance request in all cases. • Renewal at the end of a policy according to the desire of the customer. • Providing data and information to the Office of compulsory compensation and the rest of the institution	
Chief of Compulsory Compensation Office	• Receipt of notification of accident from the customer. • Check the validity of existing data in insurance policy. • Verification of insurance policy. • Verification of people affected by the incident (compulsory insurance only covers compensation for life or human injuries such as blindness or disability) • Estimating the value of appropriate compensation (discussing the amount of compensation for injuries that might cause a person insured in the next phases of this study)	
Chief of Supplementary Issuing Office	• To accept or reject requests for insurance provided the price of the car that no more than 13000 LD. • Customer reception and to begin preliminary negotiations to assume responsibility for the dangers that might cause a car customer. • Verification of the sincere intentions of the customer in car insurance, and not a manipulation of the company to obtain compensation. • Mandated technical competent to inspect the vehicle and determine the price. • To identify potential threats to the vehicle. • Determine the value of the premium. • Sign an insurance policy with customer, the insurance is not valid until the customer to pay the premium.	
	• Receipt of notification from the customer before an incident. • Check the validity of existing data in	

Chief of Supplementary Compensation Office	insurance policy. • Verification of insurance policy. • Mandated technical competent to inspect the vehicle and inventory damage from the incident. • Determine whether the incident was accidental or deliberate incident for the purpose of obtaining compensation. • To oversee the process of estimating the value of appropriate compensation with the injury.	
Administrative staff (operators of the computer)	• Organize the enormous amount of data section of the auto insurance. • Introduction of insurance data computing after the signing of a document. • Provide data by demand for the renewal of the insurance policy or when any incident of car insurers. • Provide various reports to all departments and sections of the institution.	
Vehicles Professionals Inspectors	• Vehicles inspection. • Determine the price of the car. • Define the parameters of the danger that might be caused by car. • Assistance in estimating the value of the premium. • In case of an accident identify whether it is accidental or deliberate incident for the purpose of obtaining compensation. • Estimating the value of compensation.	

Table 4: Table of Role, Norm, and Value of social Analysis

4.3.2.3 Analysis Three: Political Analysis (Cultural Analysis)

We can conduct analysis three by:

1. What makes an individual powerful within the organization?
2. What the symbols of power are, for example: accepted knowledge; a certain title or position, or access to specific individuals might be symbols of power within an organization.
3. Making notes of each of these analyses.

The Role	Its Power
Client	• acceptance or rejection of the insurance items, including the value of the premium and the price of the car determined by the company
Director of Libya Company for Insurance - Benghazi Branch	• Capability to deal with insurance policy for cars costing more than 50000 LD.
Assistant Director of Libya Company for Insurance - Benghazi Branch	• The same authorities for director of the company provided in the absence of the Director of the company
Chief of Technical Affairs Department	• Capability to deal with the insurance policy for cars price not more than 50000 LD.
Chief of Legal Affairs Department	• The deletion or addition of new items on the insurance applications for the company.
Chief of Auto Insurance Department	• Capability to deal with the insurance policy for cars price not more than 25000 LD.
Chief of Compulsory Issuing Office	The ability to deal with the insurance policy for cars that are not paid for more than 13000 LD.

Chief of Compulsory Compensation Office	• To determine whether the customer deserves compensation or not. • Determining the amount of compensation. Note: Only for compulsory insurance.
Chief of Supplementary Issuing Office	The ability to deal with the insurance policy for cars that are not paid for more than 13000 LD.
Chief of Supplementary Compensation Office	• To determine whether the customer deserves compensation or not. • Determining the amount of compensation. Note : only for the private and trade insurance supplementary
Administrative staff (operators of the computer)	• Developing the Data Bases, data structures to become the search process in easy and speedy.
Vehicles Professionals Inspectors	• Determination of the value of the car. • Determine whether the incident was accidental or deliberate. • Determine the value of the damage (the price of spare parts and maintenance).

Table 5: The Role and Its Power in *the Insurance System*

4.3.2.4 Rich Picture

Overview:

Rich pictures are a graphical representation of our understanding of the problem situation.

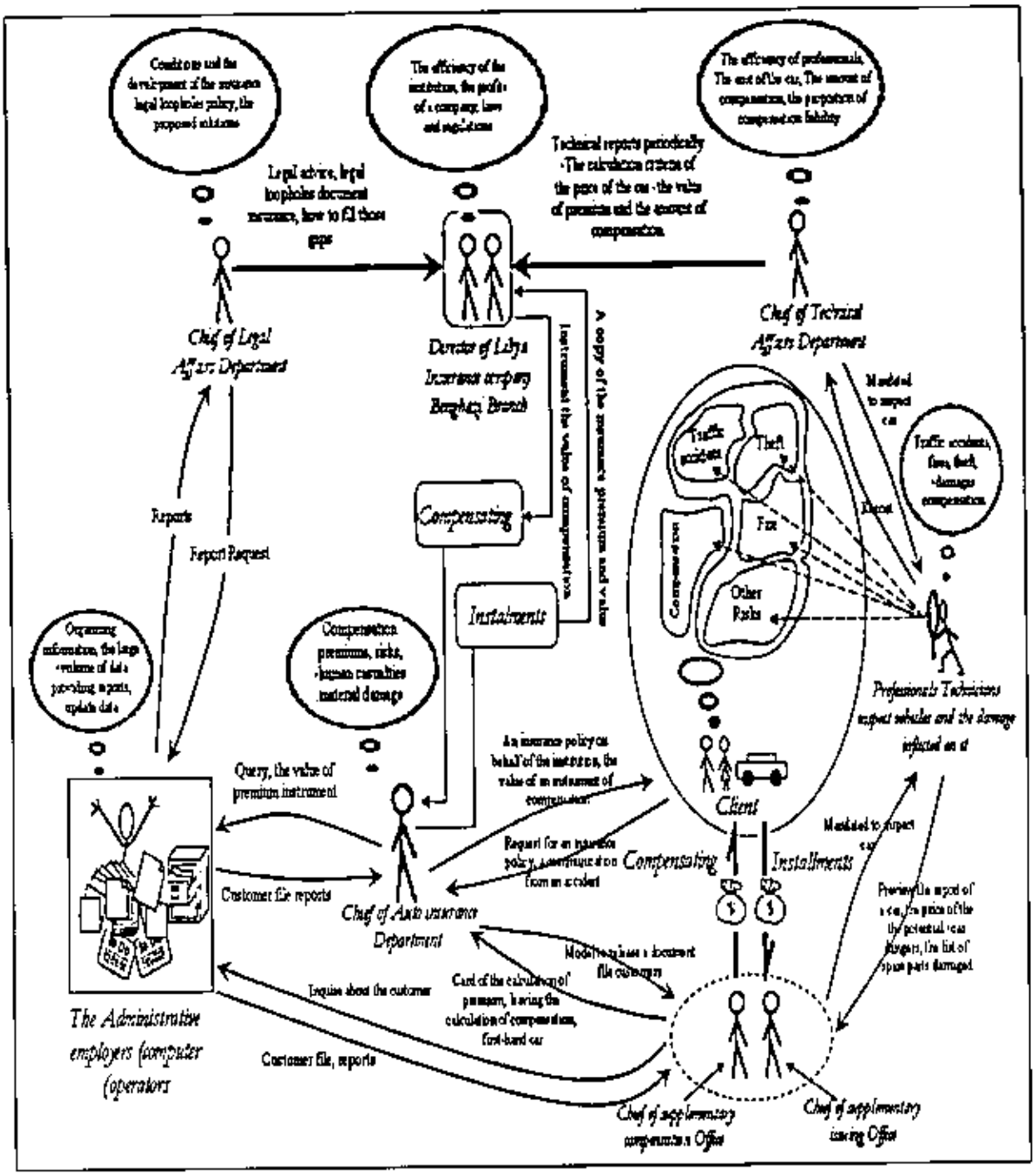

Figure 14: The Rich Picture 1- The Insurance System in Libya

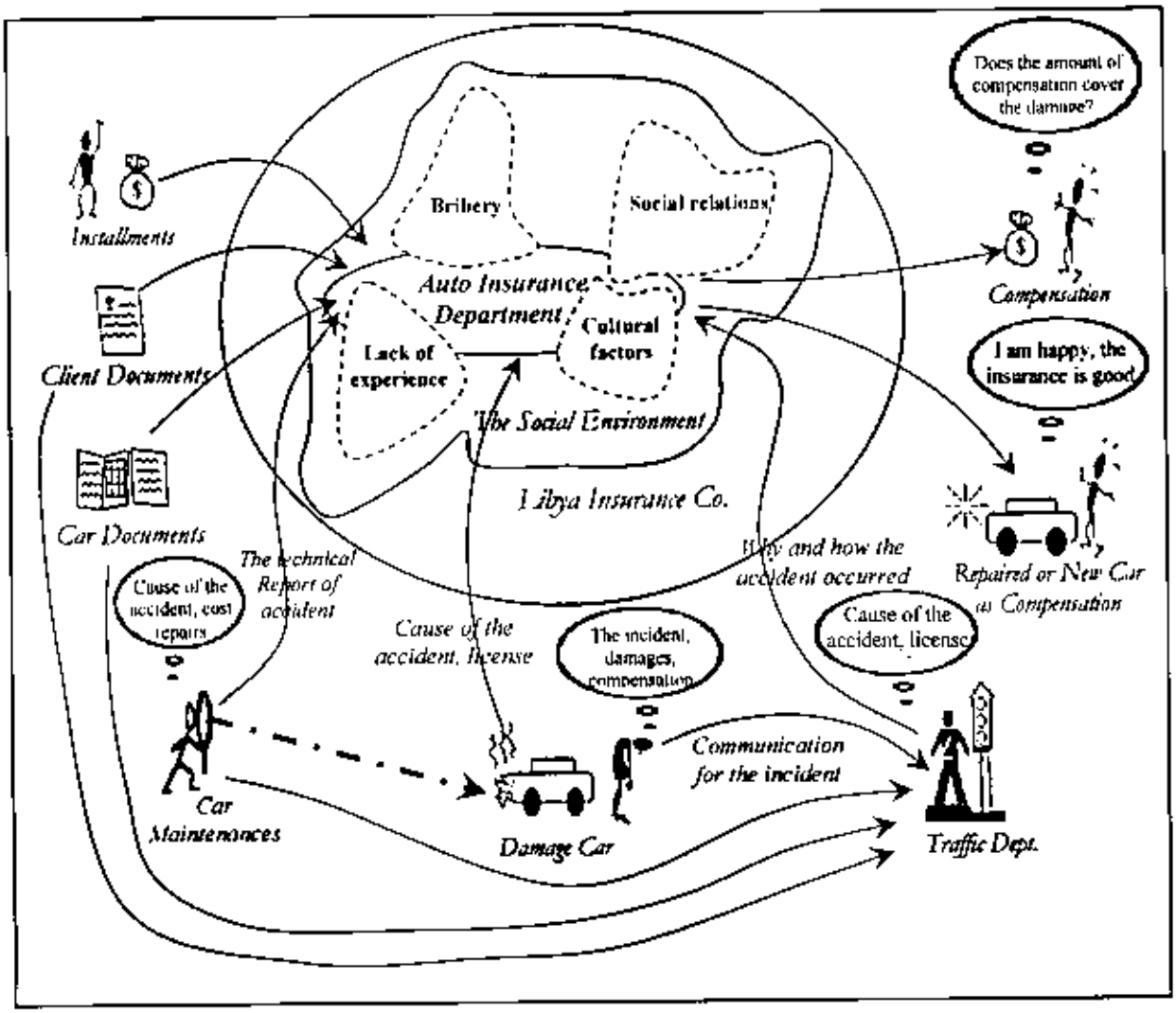

Figure 15: The Rich Picture2- The Social Environment of Auto Insurance Department

4.3.3 Stage Three: Naming of Relevant Systems

Overview:

Now starting from this phase, we get to the system thinking activities. This phase is mainly concerned about formulating of root definitions to a number of relevant systems.

Important of stage Three:

1. Root Definition.
2. CATWOE Analysis.

4.3.3.1 Root Definition

The root definition is one way of describing what is the system, how the system will work, and why we need this system.

There are two kinds of root definitions supported in SSM:

- Primary Task Root Definition
- Issue based Root Definition.

Primary Task Root Definitions concern processes which the organization being studied performs as a part of their regular activities. Issue Based Root Definitions concern processes which are rare or one-off occurrences.

4.3.3.1.1 Root Definition One (*Primary Task Root Definition*)

Root Definition One

An Information system which provide insurance to clients paying insurance premium , taking into consideration cultural, and humanitarian factors in order to provide security to clients.

This study examines information system with an economic and social the characteristics and intervene cultural factors and humanitarian actors, this system is auto insurance. We expect the system to provide security and reassurance to our clients. In this system the customer is paying the premium in return for an undertaking the insurance company to bear the damage and pay compensation for any damage done to the customer car Client, Where risks are identified, which the company undertakes to reform the resulting damage, such as (traffic accidents, fire, theft, etc.).

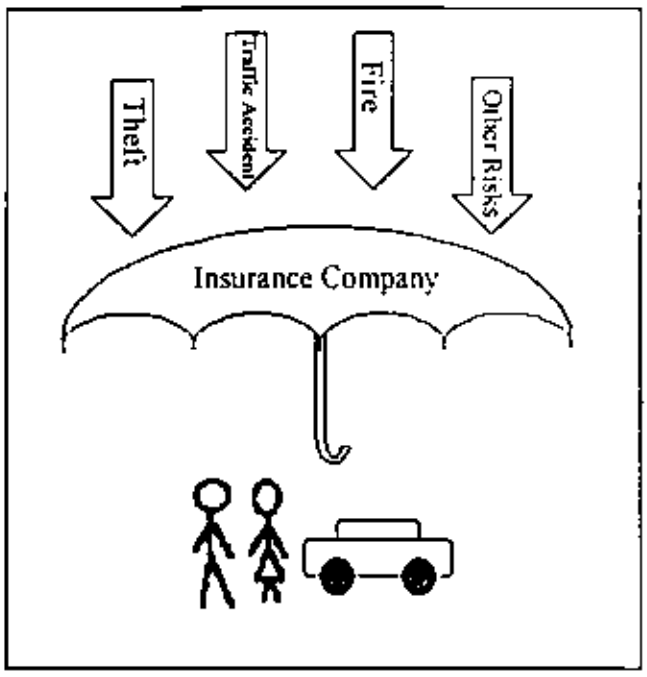

Figure 16: Some risks that cover by Insurance Company

Since the insurance industry attributes of modern societies, this industry reflect the extent of progress and economic stability of the society, where insurance system prevents to engage in economic crises or financial setbacks for the people (for individuals) or companies, which usually contain a large number of cars, and because any on the road driving car is vulnerable to the dangers of the above also the difficulty of expected time of such risks. But not always the insurance operation be safe because it sometimes some customers tries to defraud the company and attempting to happen when they try to obtain non-worthy insurance.

In this case highlights the role of the "*Insurance Man*" and this name called on the staff and people working inside the system " *Libya insurance Company* " only specialized staff in issuing insurance policy to compensation calculation, and the specialists were able to determine whether the company is obliged to pay compensation or that the client does not deserve compensation (i.e. that the damage due to the risk of not covered by the insurance policy).

As it shown in the Rich Picture One we find that Insurance operation is very big and complicated and the purpose of this operation is the economic support for persons and people in general inside society. Insurance Companies do save large sums of money to eliminate worries and problems which happen to people by paying sums of money as compensation to persons as mean to overcome some of their problems.

In the period between the clients pay insurance payments and compensation to his company to invest that money and contribution to economic development within the State. The insurance laws in the state will determine the insurance process constraints, which is organizing the relationship between the client and insurance companies. There is the company's *Legal Affairs Department*, specializing in the liberation of Ha section and the development of the insurance company and we have to pay legal loopholes in the policy, which could be exploited by some people to get an undue compensation, as well as to follow up the cases brought against the company or vice versa. We can deduce from that that the insurance companies linked socially, culturally, economically and legally with the surrounding environment. That imposes on us when examining the insurance system to give attention to that complex environment, intervening in the system and affect it substantially.

4.3.3.1.2 Root Definition Two (Issue based Root Definition)

RD Definition Two:

An Insurance Company System that makes decisions based on the facts of cultural, economic and social environment.

RD2 is focusing on misty environment which around insurance man (all staff within the insurance) and because the staff within the *Libya Insurance Company* they make those decisions based on the facts of cultural, economic and social development. SSM shows its strength in the detection of those factors that interfere with the unexpected And changing the reaction system and technical RD is the most efficient technologies that can detect the social, cultural and humanitarian events that affect the functioning of the system, and all interested RD analysis that took place in the first stage, second and inherit all the information and data from this analysis and data are:

- Structure of the company, identifying the department *(Auto Insurance Department)* determines the limit of study.
- Identifying potential problems and chart every problem faced by the person (Problem and Problem Owner).
- Identify all persons within the system (Roles) and study of work expected of each role and performance evaluation within the system.
- Determine the terms of reference (The Power) for each of roles within the system
- A Rich Picture of the system which is a comprehensive concept that all data from this analysis.

It was clear, the studied persons who have the greatest impact on the system are:

- Director of Libya Company for Insurance - Benghazi Branch
- Head of Technical Affairs Department
- Chief of Auto Insurance Department
- Chief of Compulsory Issuing Office, Director of Compulsory Compensation Office.
- Chiefs of Supplementary Issuing Office, Chiefs of Supplementary Compensation Office.
- Vehicles Professionals Inspectors.

The study of the role, work expecting, and the powers of each staff system in the previous phase is the most important thing of insurance man:

- Wide scientific understanding of the insurance industry (Specialization).
- Love Profession.
- Professional and national affiliations for the institution (Libya Company for Insurance).

We recall here that the insurance man always under the influence of pressure and factors (social, cultural, and political). On one hand, if the insurance man to accept all insurance applications without check and investigate of customer intentions of a process of insurance that would lead to acceptance of some customers who are trying to defraud the company by obtaining illegal and an undue compensation, entail the payment of any sums of money, material losses of the association. For this reason usually insurance man embarrassed during accepts or reject requests for insurance. On the other hand, if insurance man rejects all requests for the insurance company, it will lose customers to favor other competition companies in the market.

The Chief of Supplementary Compensation says "we are always under pressure from our customers." It will be recalled that when the car inspected after the accident (traffic accident or fire) and the insurance policy of car does not cover the damage, some customer presents bribery, compared to insurance man identifying that the damage to the car deserved compensation.

Some clients resort to social relationship and use of friends or even insurance man family member to influence him to determine that the danger cause of the accident was stipulated in the insurance policy, which means that the client deserves compensation. When the insurance man

experience inadequate this might lead to pass some tricks of the customer in order to obtain compensation.

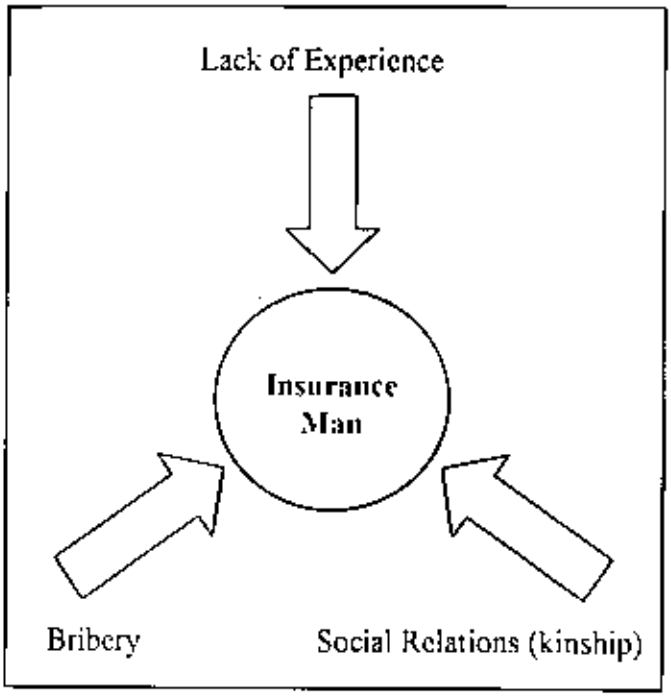

Figure 17: The Pressures which effecting on insurance employ

This pressure on the insurance man, and show some other social factors that affect a decision on insurance man, we find that the company's respect for a particular client may oblige *Libya Insurance Company* to secure the payment of compensation not provided for by the insurance policy (meaning that the company is not obliged to pay such compensation). The reason is because the company does not want the loss of this Client, in a culture of insurance is treated as Client history with the company, mention here that this situation occurred with the Italian consulate in Benghazi:

As stated in the terms of an insurance policy the *Libya Insurance Company* is not responsible for damages resulting from "*Unrest* or *Uprising policy*", Therefore in this case the amount of compensation = zero. However, when reviewing the system in the real world we have noted that the company compensates clients for losses resulting from the above-mentioned threats, "*the Uprising* or *Political Unrest.*" We recall when some protesters demonstrated on the publication of cartoons depicting the Prophet Muhammad and smashing some vehicles belonging to staff at the Italian Embassy in Benghazi. We recall that under the items mentioned in the Insurance Policy, the insurance company is not obliged to pay compensation for the damage to the car that has not happened since the company to pay compensation for some of those damages. The reason is because this client (the Italian Embassy) of the oldest clients of the company and never for more than 30 years, which the company

needed a moral, not a legal obligation to compensate the client on the part of those damages and the principle "culture" of the insurance industry, and make due on the company is to maintain the This unique client and losing to another insurance company that is one of cultural factors that affect the system and lead to unexpected reaction from the system because of social and cultural factors.

"Working day" Descriptions

- Issuing an Insurance Policy:

1. *The Chief of the Auto Insurance Dept.* receipted old customer, but this customer bought a new car, then the client provides application to extract an insurance supplement to his car. Then *Chief of the Auto Insurance Department* request the file of the client in the company from the archive and when the file shows that the customer has a good history and the records do not contain any attempt at manipulation or fraud. That is the good reputation of the client at the company's staff and history records devoid of the problems with the insurance company.

2. This is why *the Chief of the Auto Insurance Department* decide issue insurance policy for the customer where he referred the application request to *the Chief of Supplementary Issuing Office.*

Note: Once customer informed that the Chief of the auto insurance approval in principle to the request of the insurance company morally obliged to cover any damage to the car even if it was not extracting and policyholder final.

3. *The Chief of Supplementary Issuing Office* receives car and the customer procedures, and then prepares applications for issuing an insurance policy:

- An insurance application.
- Car inspection report, which contains technical data of the car and the dangers that might affect them.
- Supplement No. (1) Contains some additional conditions.
- Application of the release instructions. It contains final data for issuance.
- Application of the (human) physical damages that may affect persons inside the car.

Then *The Chief of Supplementary Issuing Office* contact with the *Chief of Technical Affairs* commissioned *Vehicles Professionals* for a date to inspect the car.

4. After verification procedures from car ownership to the customer, the inspection team was composed of: *The Chief of Supplementary*

Issuing Office, *Vehicles Professionals Inspectors*, (if the car is expensive attend sampling *Chief of Auto Insurance Department*).

5. The process of sampling the car began on the ground and by filling *the car inspection report* that contains statements such as : name of the owner of the vehicle, kilometer age from the car meter, whether the car containing Radio, whether the car containing an air conditioner, steering wheel system (hydraulic, normal etc.).

6. Filling *the application of Release instructions* contains data such as: the type of car and car value and loading capacity etc... These data help in devising the dangers surrounding the car.

7. By providing the car value and dangers surrounding the car, the value of premium determined and prepares *the premium calculating card.*

8. After the customer approval on the insurance premium the process of issuing an insurance policy, and in case that the customer does not agree the premium the n go through negotiations to amend the premium (and try not to loss the client for another insurance company).

- Compensation Process

1. The client report the incident in a maximum period of 48 hours from the date of the incident according to what is stipulated in the insurance policy.

2. The notification is received by *the Chief of Supplementary Compensation Office*, where query on the customer file and verification of the occurrence of an accident during the term of the insurance policy, and verify the number of incidents that had occurred with the customer.

3. *The Chief of Supplementary Compensation Office* commissioned *Vehicles Professionals* for inspect the real accident reasons.

4. If the accident was traffic accident, the customer being asked to provide car inspection team with *the report of the traffic police* for the incident, thereby ensuring that the incident accidental and deliberate, here must determine whether the incident resulted from one of the risks covered by insurance policy.

5. The car inspection team (*Vehicles Professionals*, *The Chief of Supplementary Compensation Office*, and *Chief of Auto Insurance Department*) determine the percentage to be borne by the company from the total value of the compensation.

6. Then the process of calculating the compensation began (the company has the right to buy another car for a customer or repair current

damage of the car), whether the vehicle is determined to repair, *the Vehicles Professionals* fill *The Compensation Calculation Card*, which contains all the spare parts needed by the car, in addition to the value of repairs, thus calculating the amount of compensation.

Note: At the same time, *the Supplementary Compensation Office* appreciated the responsibility of the institution to assume for inflicted car material damage, on the other hand *the Compulsory Compensation Office* appreciated the responsibility of the institution for assessing the physical (human) damage to car occupants on the other side of the incident.

7. After calculating the amount of compensation and determine the responsibility percentage of the institution of the compensation, then an amount of compensation is issued in check and adoption by *the Assistant Director of Benghazi Branch.*

8. *The Compensation Calculation Card* and a copy of the instrument of compensation are appended in the customer file for conservation.

Note: Premiums, Compensation, Risks, and The Damage being inflicted on the car, the most important component parts of the environment of the insurance system, and during the conduct of the study on complex information system as insurance system, which consists of some of the non-counting and defined factors, the system depends on the appreciation while dealing with such factors as : during the process of insurance compensation can be calculated in absolute value, but here is another factor highlights (percentage of liability insurance company of the value of compensation). We note in step No. 7 of the compensation process is the calculation of the proportion of the value of the institution responsible for compensation, in this study we will use technology of (Fuzzy Logic) in a study to determine the percentage of responsibility for the company's financial compensation caused by car customer, as well as to determine the institution's responsibility percentage of compensation to cover the damage being inflicted on the passengers during the incident (damage to physical or human).

4.3.3.2 CATWOE Analysis

Customer	Insured, clients, people who want to check on their cars and secure from the dangers on the roads by issuing insurance policy to their cars.
Actors	All employees of the Foundation who have influence on the auto insurance (Director of the Company, Assistant Director of the company, Chief of Technical Affairs, Chief of Legal Affairs, Chief of auto insurance Department, Chief of the compulsory issuing Office, Chief of the compulsory compensation Office, Chief of the of supplementary issuance Office, Chief of the supplementary compensation Office, administrative staff (the computer operators), Vehicles Professionals Inspectors
Transformation	client has fears of some of the risks that might affect his car; these fears turn into comfort, since premiums becoming to compensate the damage fill volume (mass), which might be caused to the car because of one of those risks
Weltanschauung	Insurance company obligate to cover damages resulting from the notification provided for in the insurance and payment of appropriate compensation to the client, thus preventing crises and setbacks which impede economic march in full.
Owner	Libya company for insurance, That represented by the company's chairman.
Environment	Libya company for insurance is one of the economic institutions that provide services to people and some factors intervene in the insurance system such as : the insurance laws of the State, the laws of traffic police, safety standards in cars, and social factors, the nature of car use (for example : ordinary or commercial use).

Table 6: The CATWOE Analysis

4.3.4 Stage Four: Building the Conceptual Models

Mention here that the SSM methodology does not abound in many and diverse schemes or models to analyze the system, and if we consider this one of the defects of this methodology, the flexibility built Soft System Methodology at this stage *Building the Conceptual Models* where SSM methodology allows developers to use the tools, techniques and models of other methodologies for the analysis and utilization and development of the system and will use both the DFD & UML tools to analyze the technical side of the information system, on the other hand, we use technical Fuzzy Logic in the understanding and analysis of partial responsibility for estimating the damage (the proportion of the compensation liability company). As we mentioned earlier that the company is assessing its rate of compensation, based on certain factors and criteria, those standards will use the complex technical Fuzzy Logic to understand, analyze, in addition to the study and analysis of human damage caused to passengers.

4.3.4.1 The Conceptual Model

Overview:

The conceptual model is the core of the SSM methodology because it is now required to establish a relevant system based on defining the minimum number of activities required for this relevant system to be the one described in the root definition. A conceptual model is a human activity models that is used to show each operational activity that is necessary to carry out the process described in the root definition. There must be at least one conceptual model for each RD.

The conceptual model of *Insurance policy Issuance*

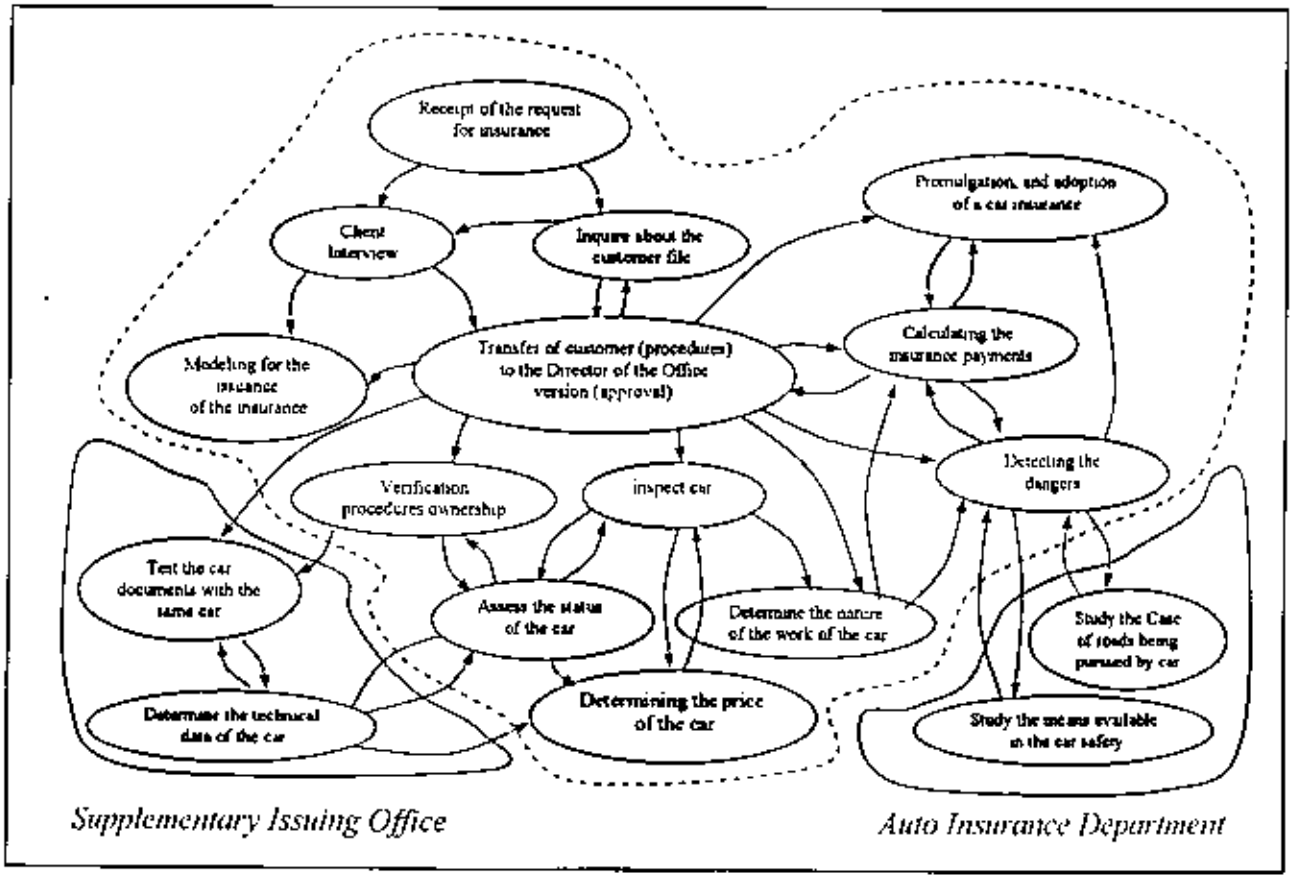

Figure 18: The conceptual model of *Insurance policy Issuance*

The Conceptual Model of *Calculating the Compensation*

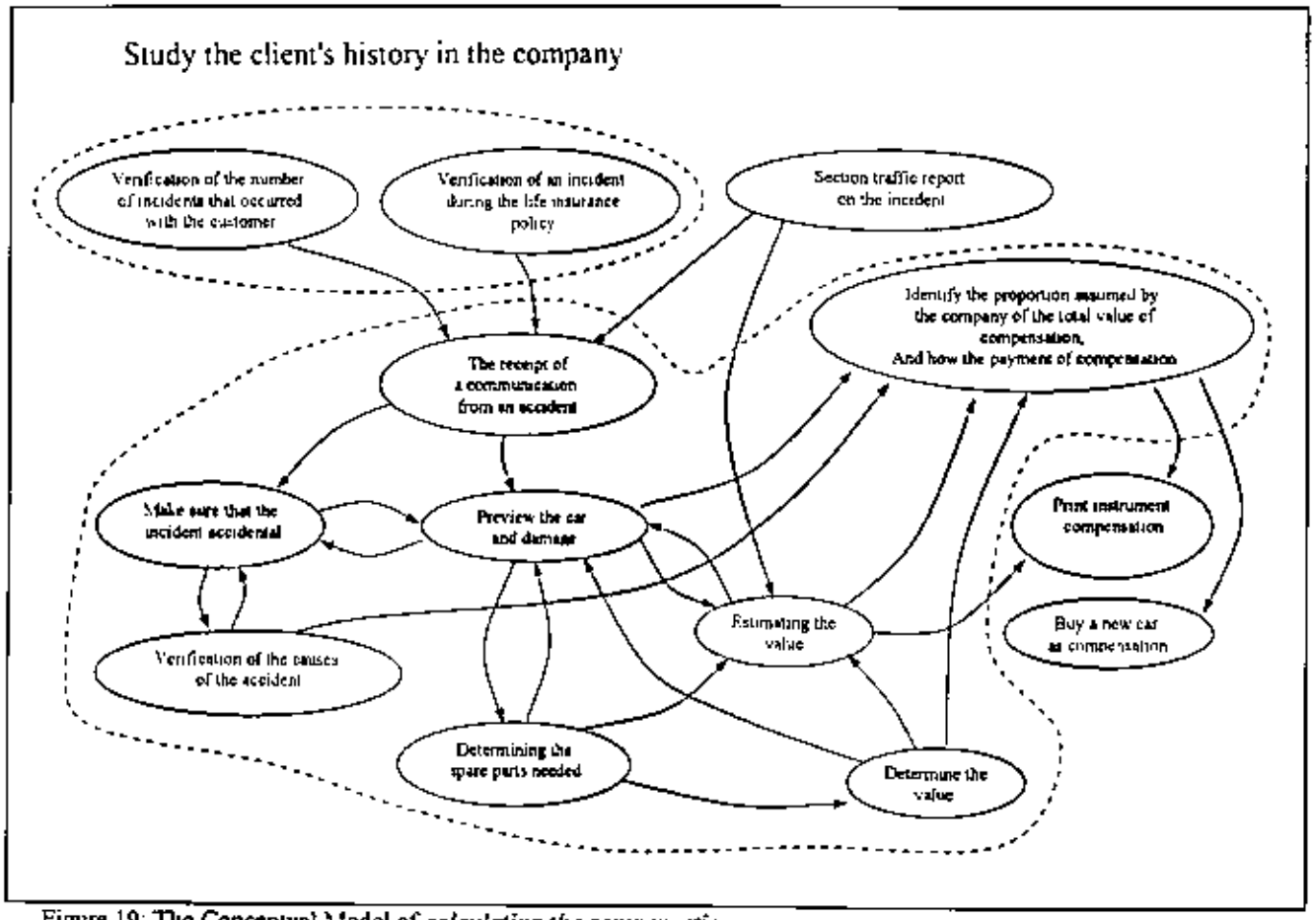

Figure 19: The Conceptual Model of *calculating the compensation*

The Conceptual Model of *Compensation Operation*

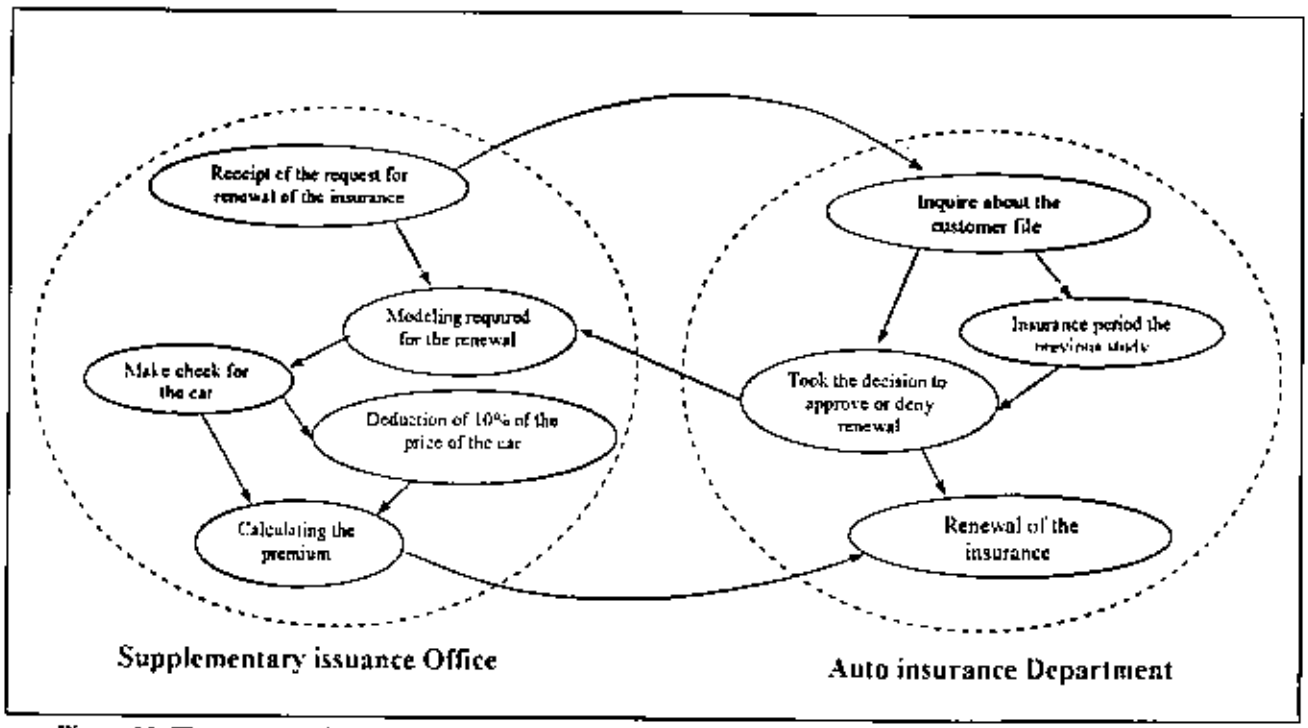

Figure 20: The conceptual model of *compensation operation*

4.3.4.2 Using the UML language with SSM as *Other System Thinking*

The UML language contains many plans and tools which from the system developer can represent the activities and complex processes that occur inside the system and converting them into models and plans easy to understand, from the important techniques of UML:

1. The Scenario Technique.

2. Use Case Diagrams.

3. Sequence Diagrams.

4. Class Diagrams.

5. Activity Diagrams.

4.3.4.2.1 The Scenarios

First Scenario: Insurance Application:

1. The client applies for a insurance policy.
2. *The Chief of Auto Insurance Department* has a personal interview with the client, and investigates the true motives in applying for the insurance policy.
3. After investigating the clients motive for applying for the insurance policy and this is from the personal interview and review the client prior insurance policies from the company (if found) , *The Chief of Auto Insurance Department* turns over the process to *Chief of the Supplementary Issuance Office* .
4. *The Chief of Supplementary Issuing Office* prepares the needed applications to issue an insurance policy.
5. *The Chief of Supplementary Issuing Office* investigates the car ownership documents after that a date is made for *Vehicles Professionals Inspectors* to review the car.
6. During reviewing the car papers are filled the reviewing applications that contain technical data of the car.
7. The risks that surround the car are determined and so is the price of the car.
8. From this data the insurance car Installments are determined.
9. After the clients agreement on the insurance Installments the issuance of the insurance policy is processed, in case of the client not agreeing with the Installments negotiations are put in motion to adjust the insurance Installments.

Second Scenario: Report of an Accident:

1. The client notifies the company of the insured cars accident.
2. *The Chief of Supplementary Compensation Office* receives the accident report, where the accident is investigated in the period that the insurance policy covers and so is all the managing documents for the client and car in the company.
3. *The Vehicles Professionals Inspectors* investigate the reasons of the accident and investigate all of the technical sides of the accident and determine the spare parts needed to repair the car.
4. After determining the spare parts needed to repair the car the compensation value is determined, where the supplementary compensation contains the spare parts cost + the car repair cost.
5. A check is issued for the compensation and assured from *The Director of Libya Insurance Company - Benghazi Branch*, and given to the client.

Third Scenario: The Renewing Insurance policy Process:

1. The client applies to issue a new insurance policy.
2. *The Chief of Supplementary Issuing Office* investigates the clients file from the archive.
3. *The Chief of Supplementary Issuing Office* and addition *The Chief of Auto Insurance Department* study the previous insurance period and determined if the company will continue to insure the client car from accidents or not.
4. If the decision is made to renew the client's insurance policy, *the Chief of compulsory issuing office* prepares the needed applications to process a renew insurance policy.
5. With the help of *Vehicles Professionals Inspectors* team *The Chief of Supplementary Issuing Office* to review the car (10% is deducted from the value of the car when renewing the insurance policy due to the consuming of the car during the period of the previous insurance policy.
6. *The Chief of Supplementary Issuing Office* calculates the insurance Installments.
7. If the client agrees to the insurance Installments the insurance policy is giving and assured from *The Chief of Auto Insurance Department* and the car will be insured by the company.

4.3.4.2.2. Use Case Diagrams

In this stage the previous scenarios will translate to some *Use Case Models*, and then apply the UML plans in SSM environment as *Other System Thinking*.

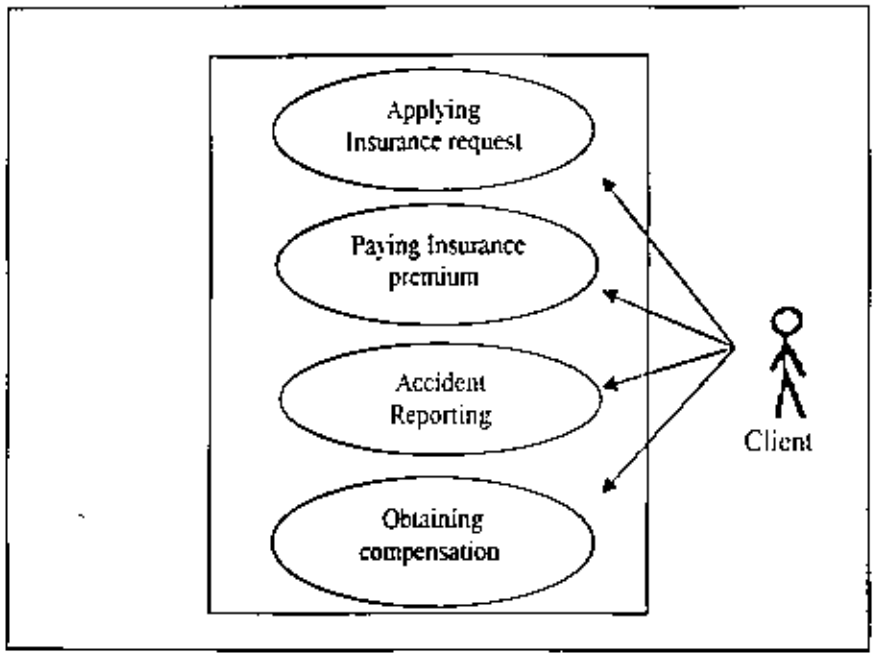

Figure 21: The Use Case model for *Client* Actor

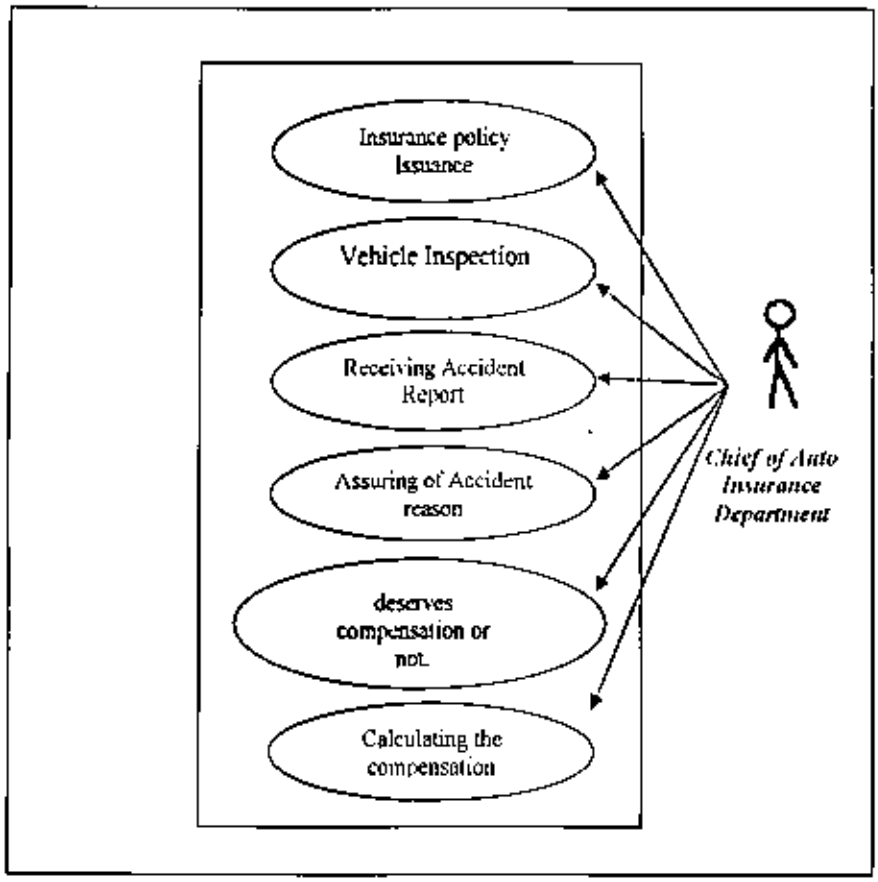

Figure 22: The Use Case model for *Chief of Auto Insurance Department* Actor

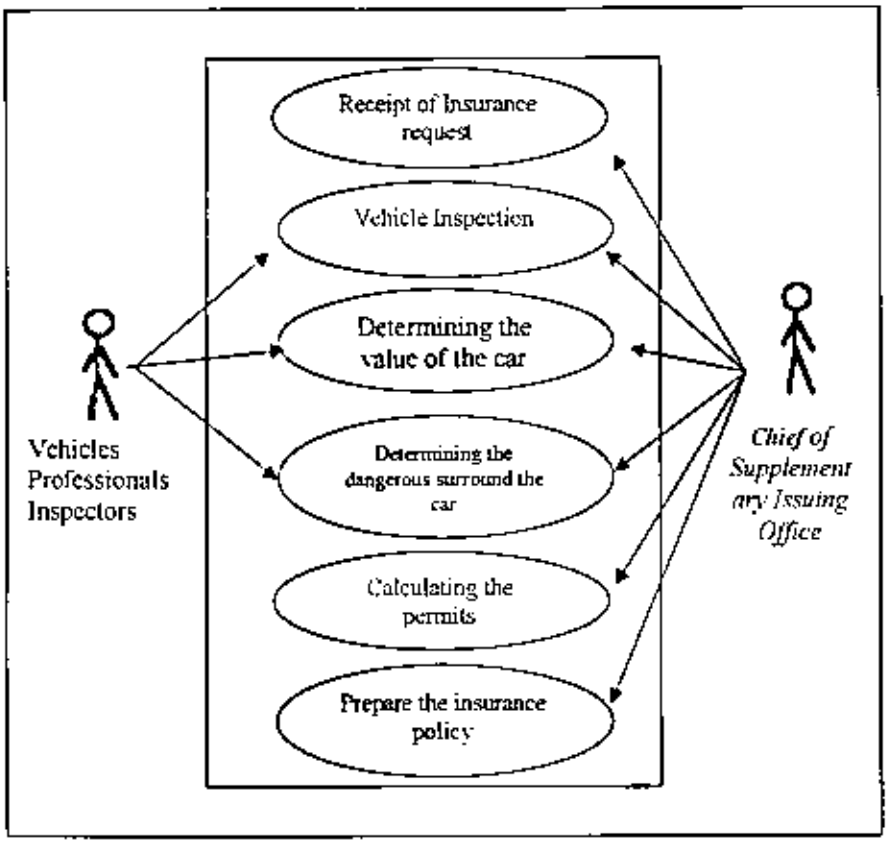

Figure 23: The Use Case model for *Chief of Supplementary Issuing Office, Vehicles Professionals Inspectors*

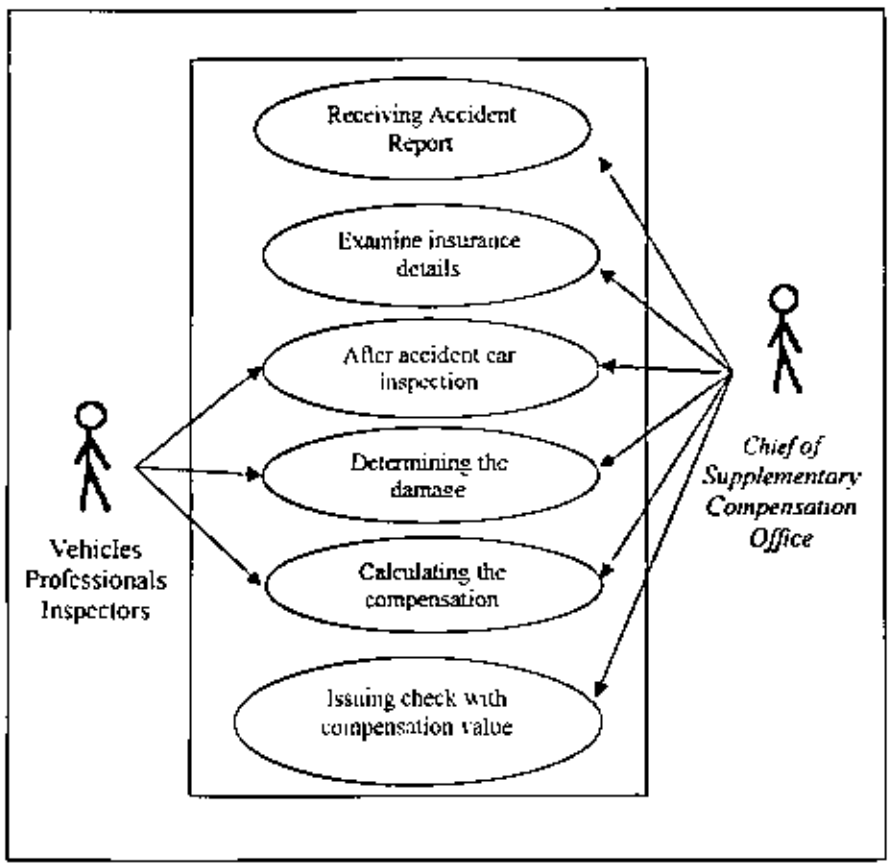

Figure 24: The Use Case Model for *Chief of Supplementary Compensation Office, Vehicles Professionals Inspectors*

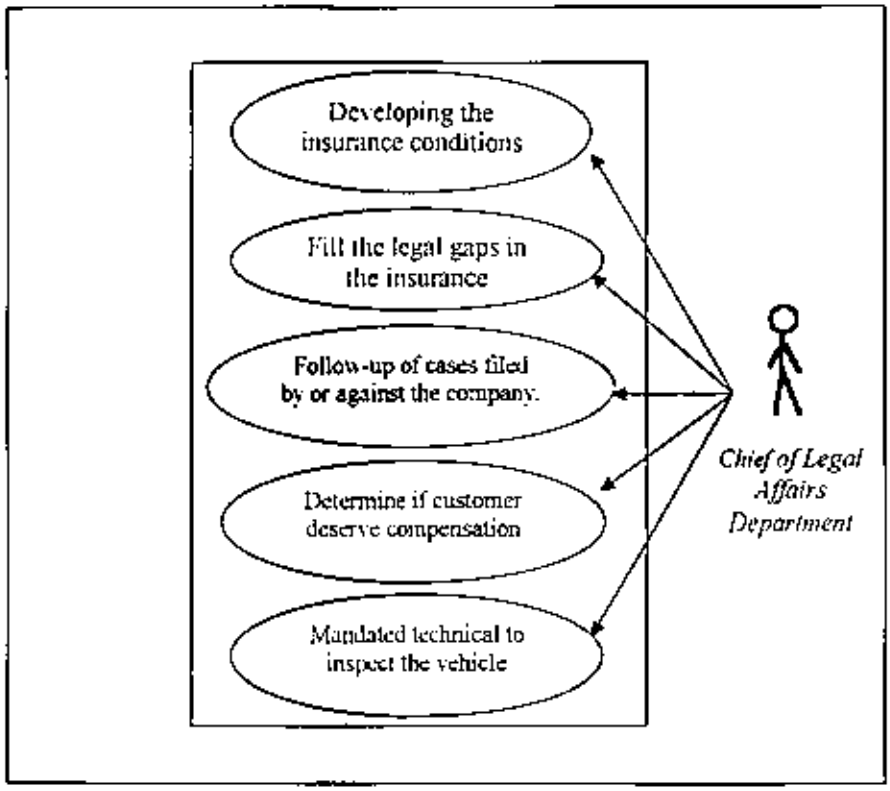

Figure 25: The Use Case model for *Chief of Legal Affairs Department* Actor

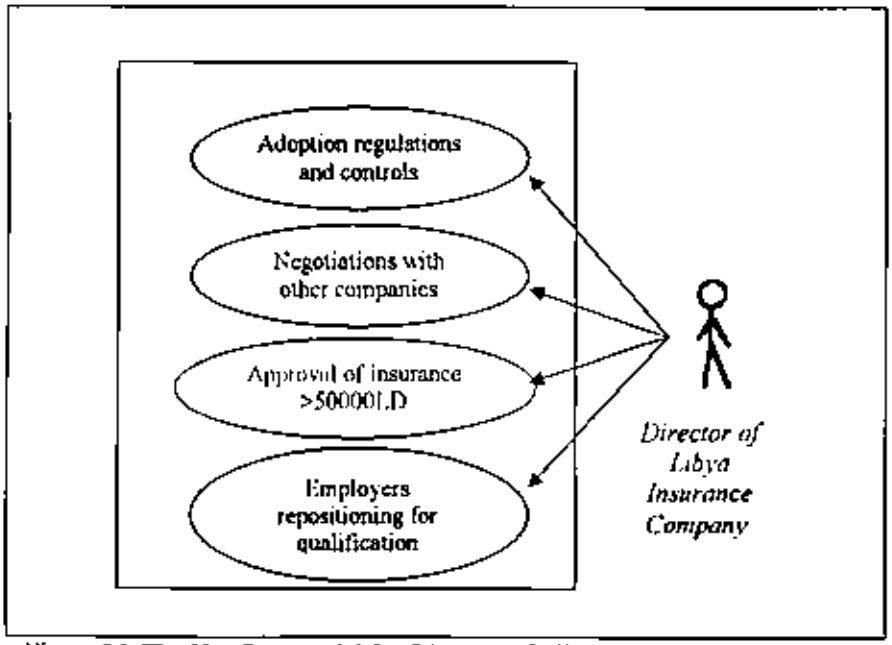

Figure 26: The Use Case model for *Director of Libya Insurance Company* Actor

4.3.4.2.3 Class Diagram

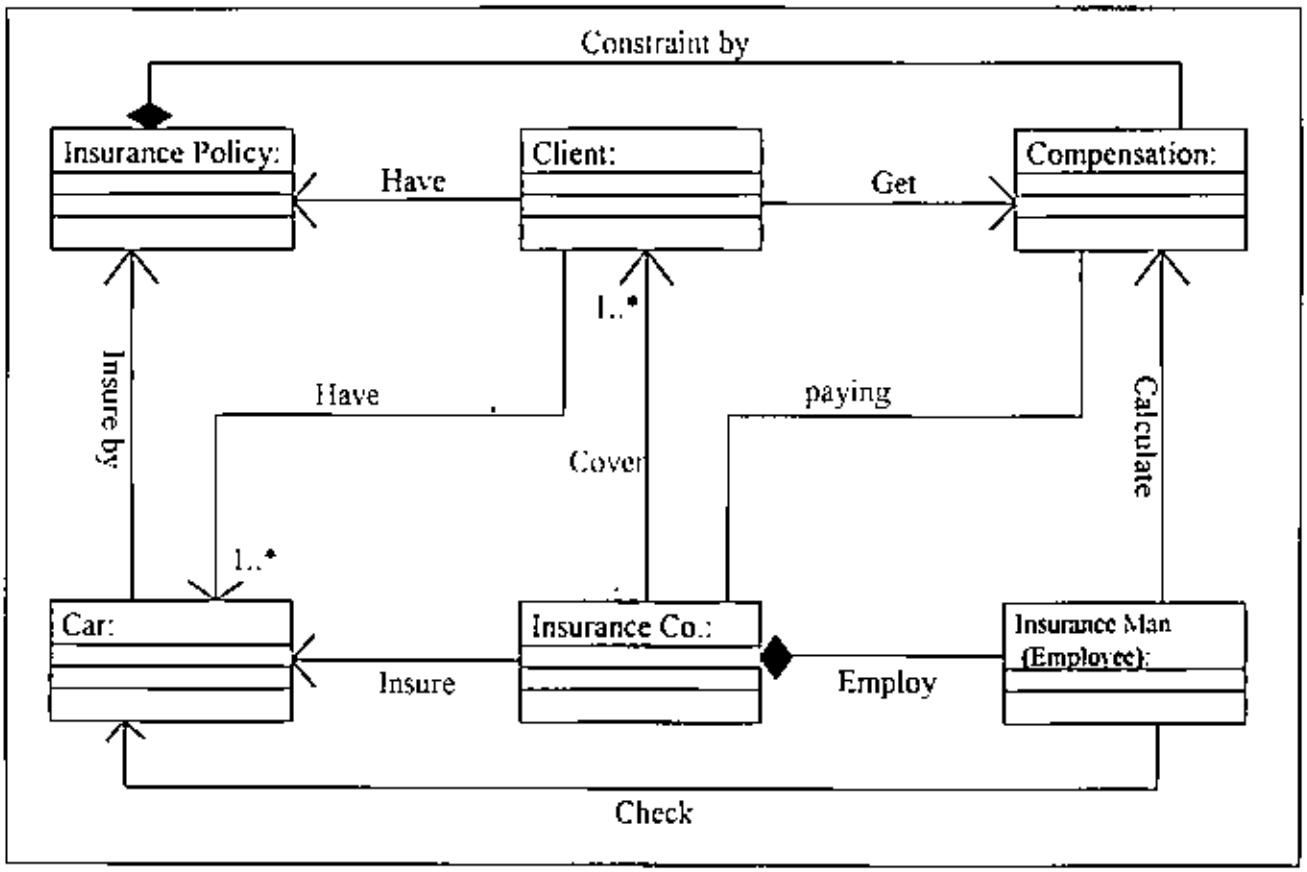

Figure 27: Class Diagram

4.3.4.2.4 The Activity Diagram

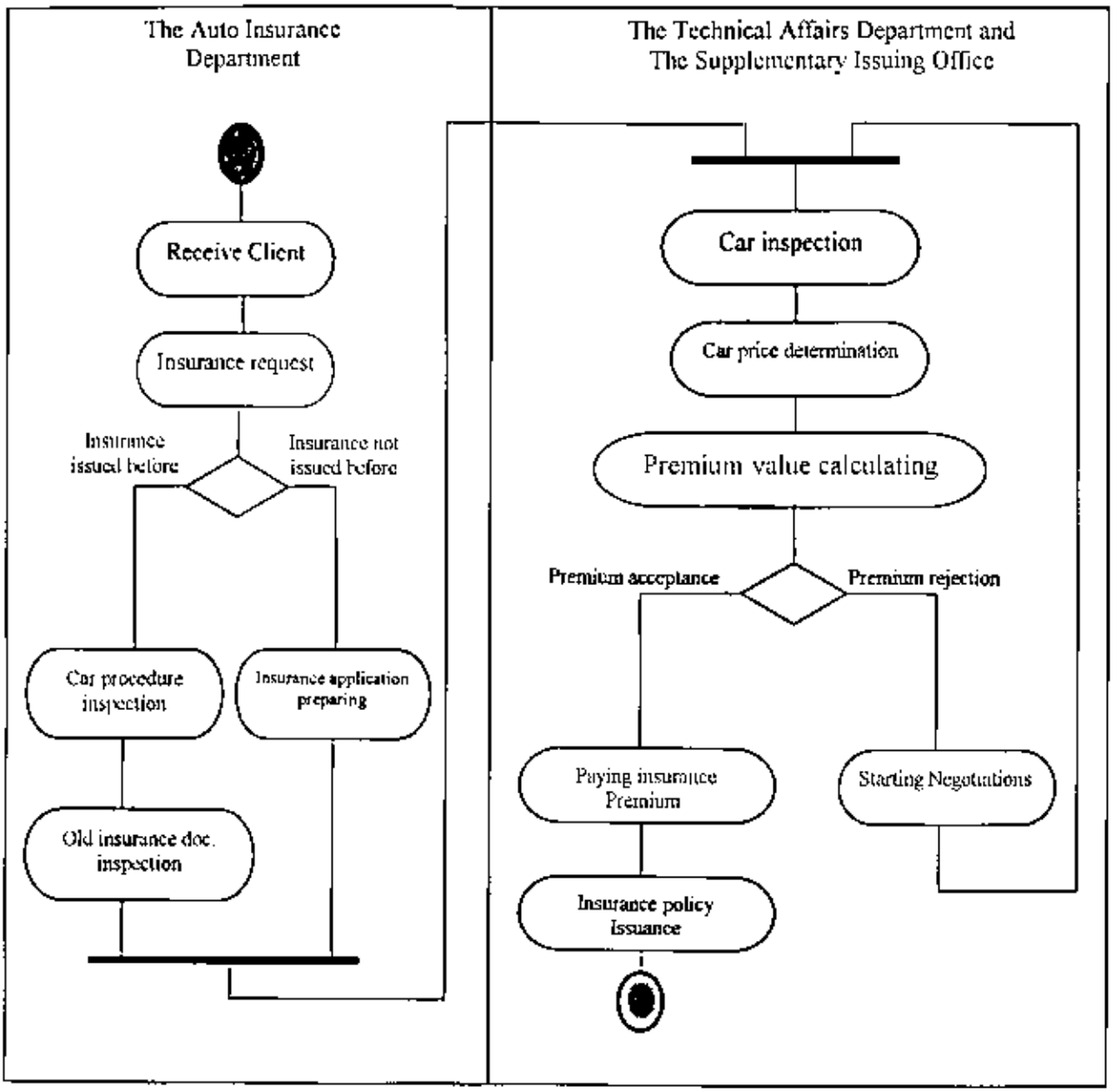

Figure 28: The Activity diagram for *Insurance policy Issuance* activity

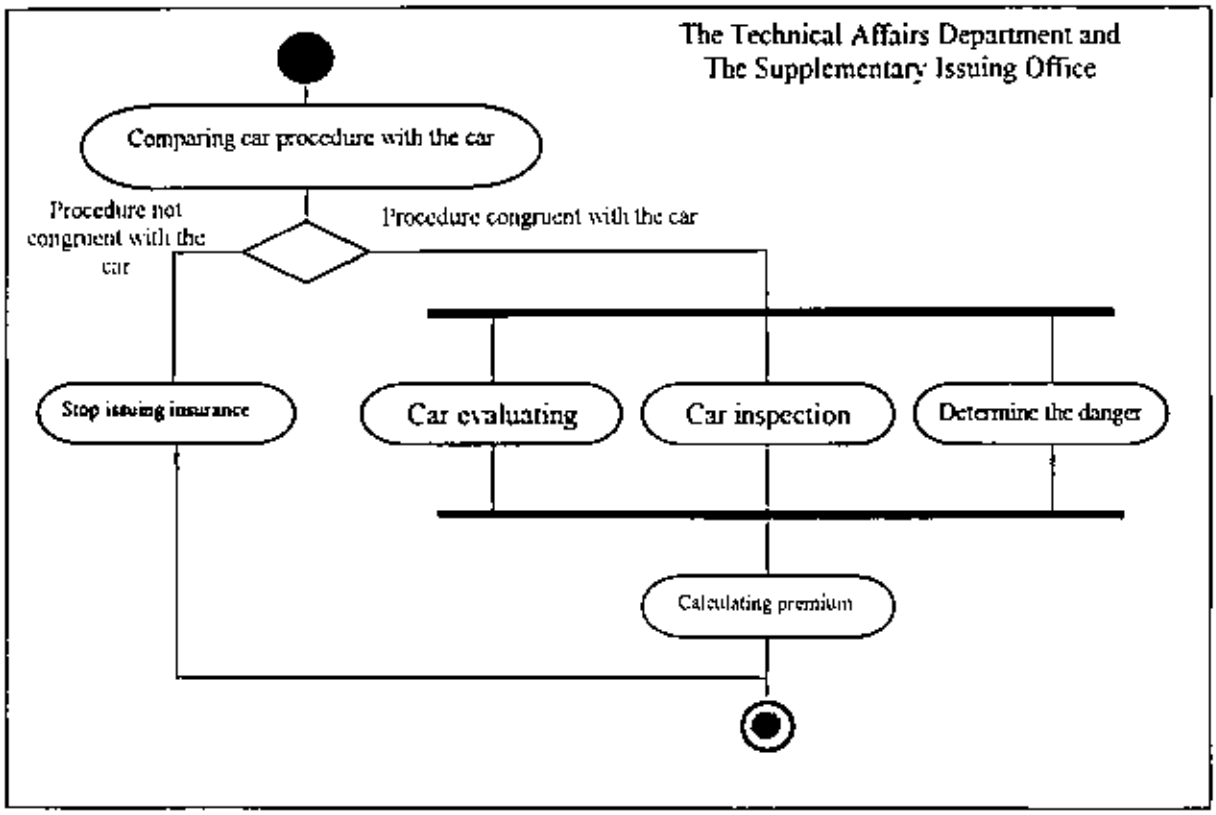

Figure 29: the Activity diagram for *Calculating premium* activity

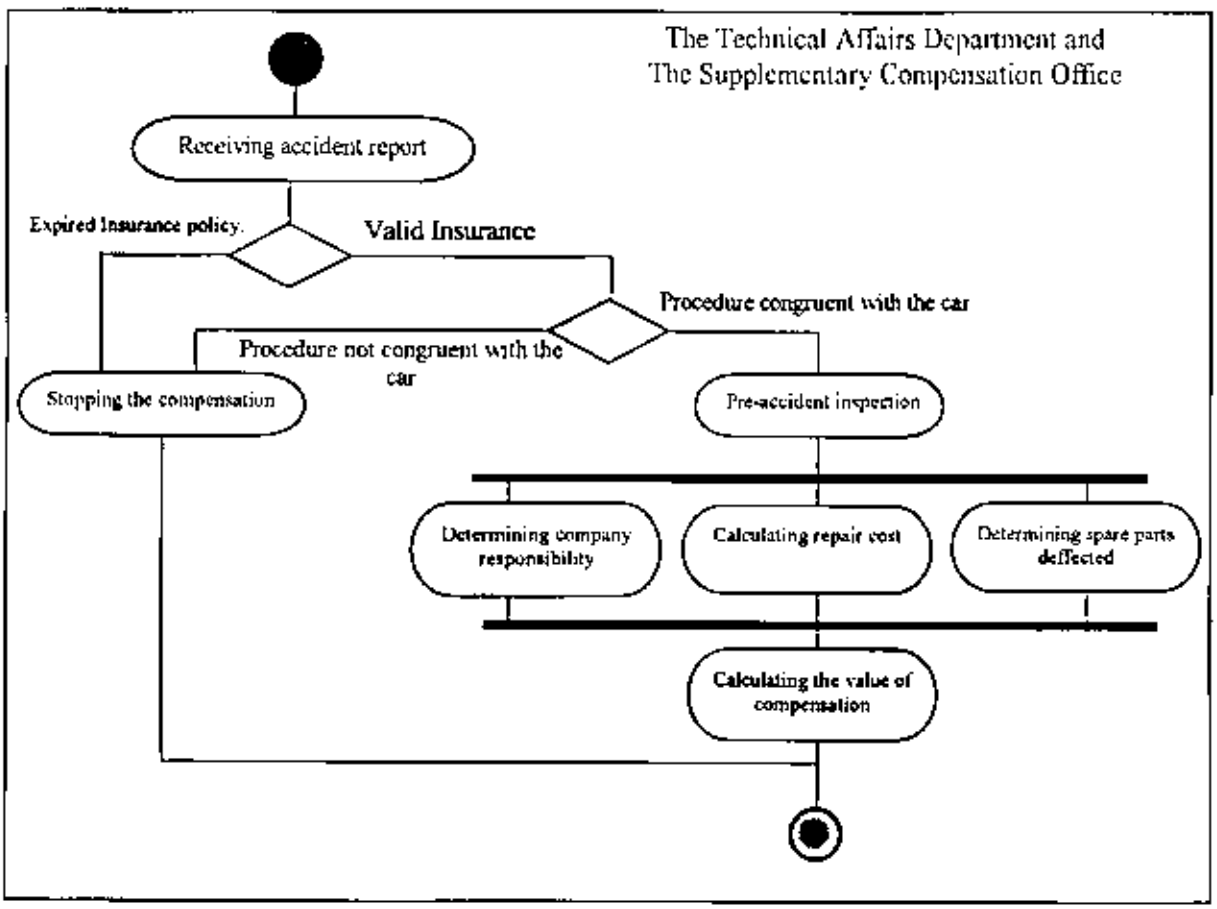

Figure 30: The Activity diagram for *calculating the value of compensation* activity

4.3.4.2.5 Sequence Diagrams

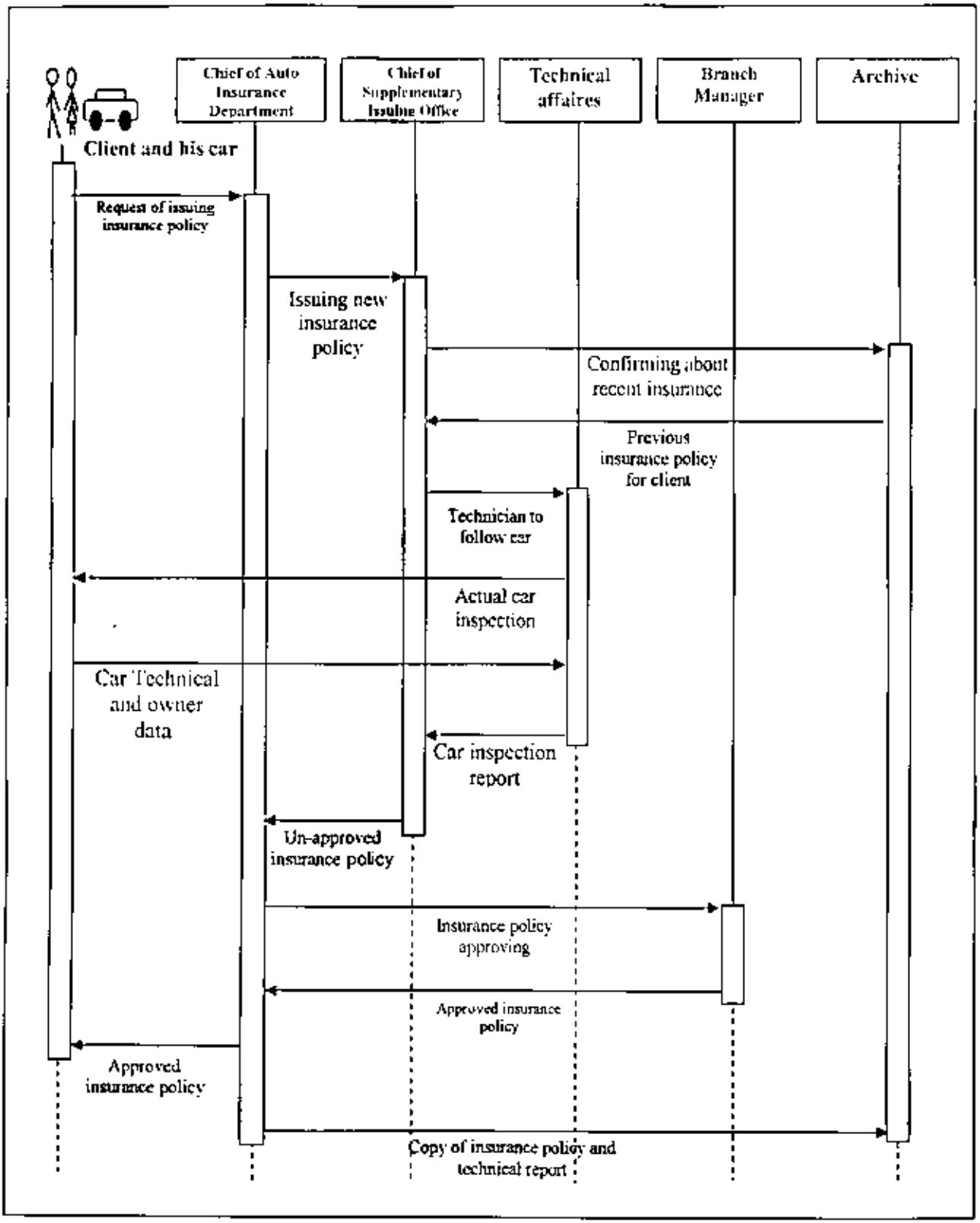

Figure 31: The Sequence Diagram for *Insurance policy Issuance* activity

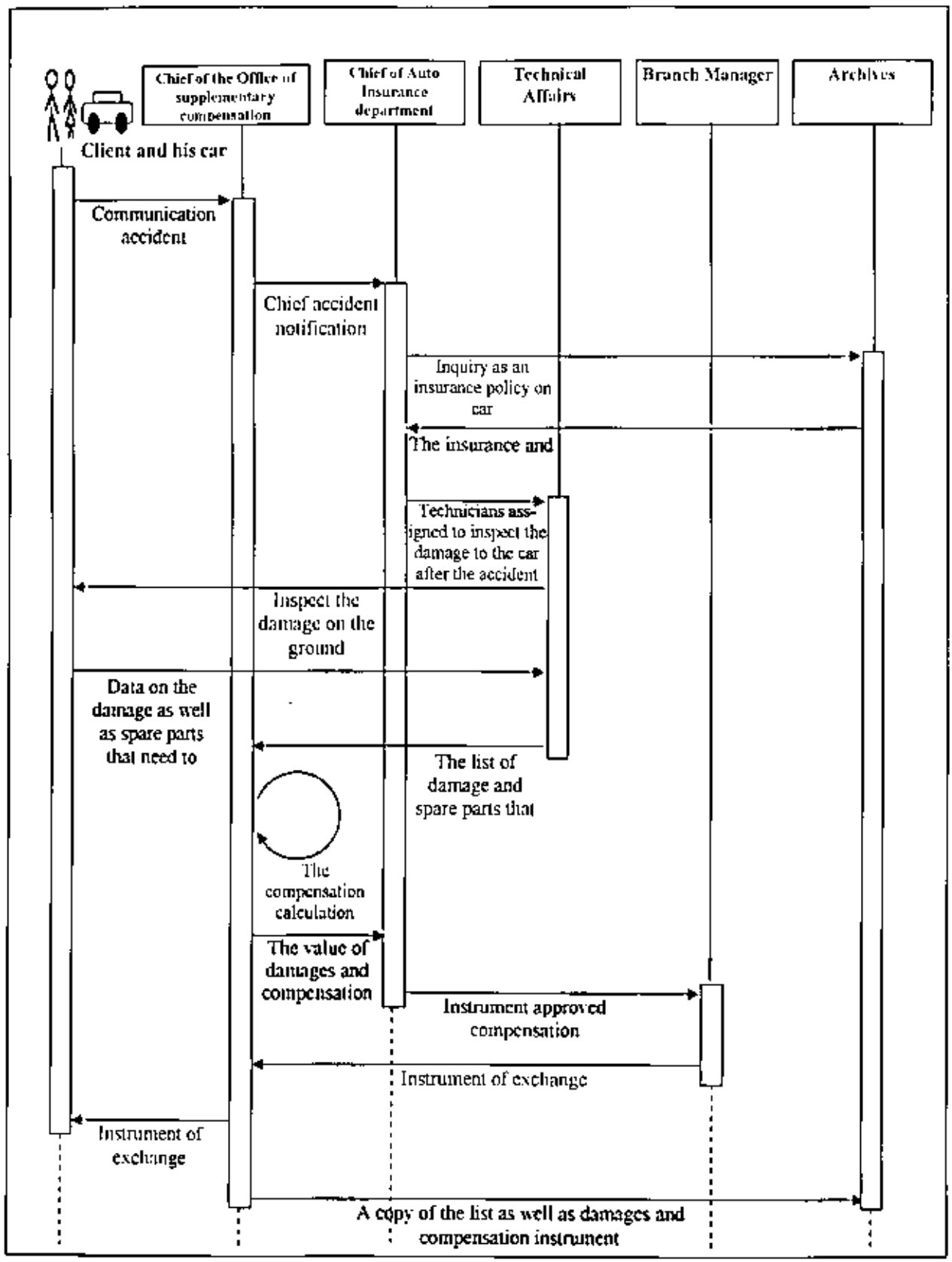

Figure 32: The Sequence Diagram for *calculating the value of compensation* activity

4.3.4.3 Using the DFD with SSM as *Other System Thinking*

UML have useful techniques in analysis that concern about the activities and procedures inside the system, whereas DFD technique concern about the Data which flows among that activities, the require data of each activity to achieve its work, and the data place (file) of each data in the system. In this section we will use the DFDs models to understanding how the data flow through the system.

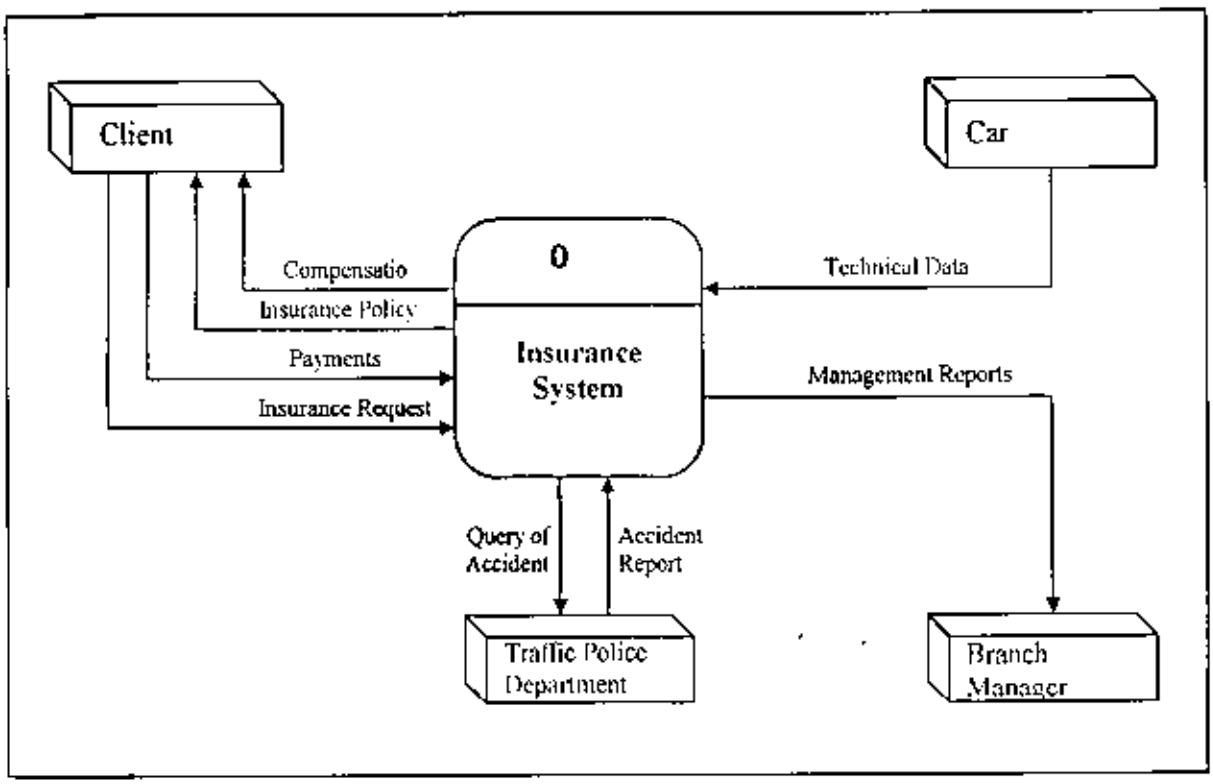

Figure 33: DFD Level 0

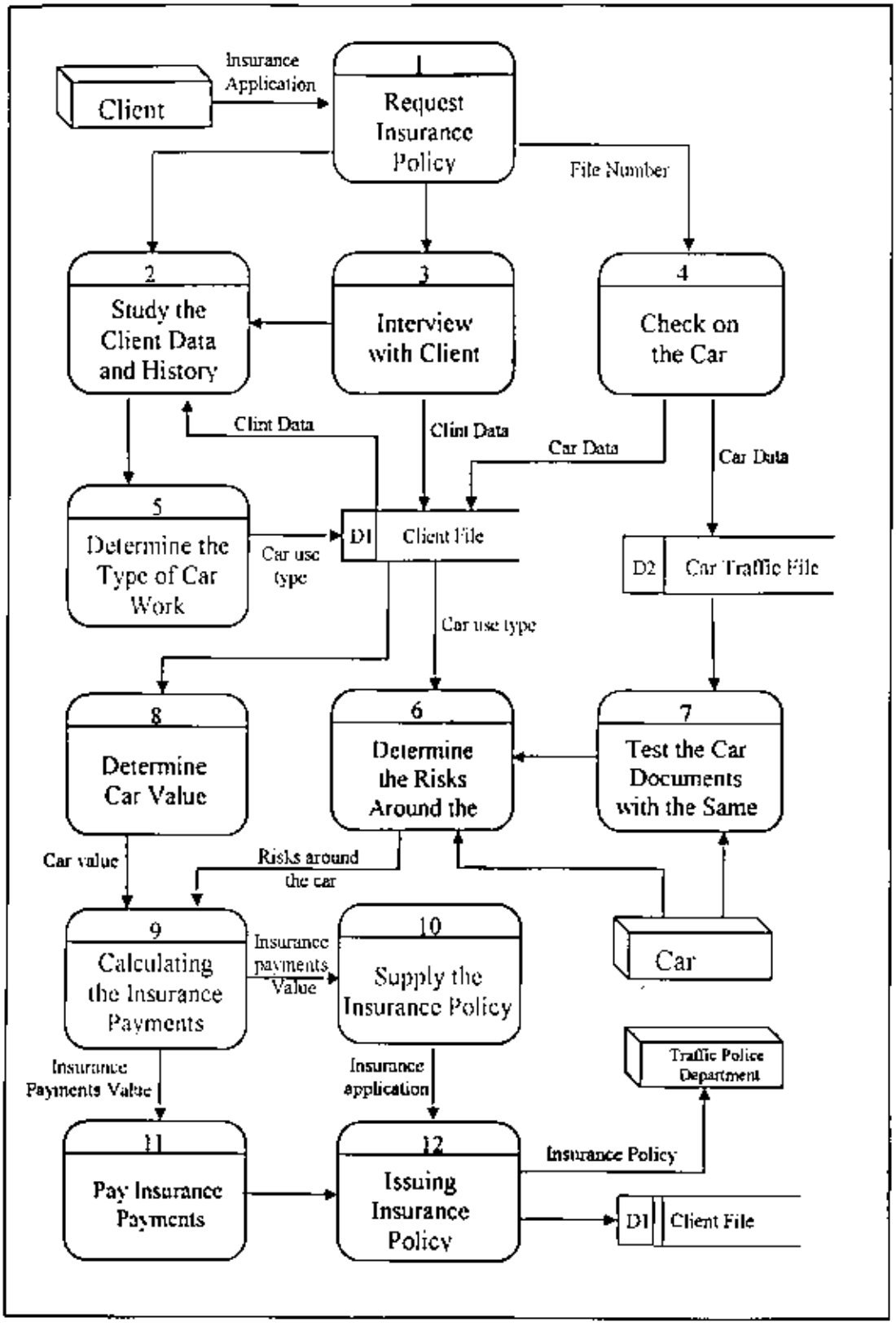

Figure 34: DFD Level

4.3.4.4 Using the Fuzzy Logic with SSM as *Other System Thinking*

During applying stage four of the SSM methodology on the insurance system we faced many problems *(Soft Problems)* and it is the difficulty to represent the systems social and cultural nature that depend on human activities inside the system in the estimating of the systems reaction to some cases that occur now and again , which makes the representation process of these estimations and concluding every case of the cases if it part of system or no, that are the systems process in its difficulty and spicily in case a estimate the risk , or evaluate the companies responsibility in covering the compensation . In the insurance system there are sides difficult to represent or to express them with any of the UML, DFD, or SSM tools and techniques, where the SSM methodology is the main method used in this research. because during applying SSM it allows us to use other techniques and methods , for we use *Fuzzy Logic* in analyze and represent evaluate the percentage of the company's responsibility (*Libya Insurance Company*) of the compensation value in two types (compensation of human injuries , substantial compensation).

As we mentioned previously that the Installments, the damage, the compensation, and risks are the most important components of the insurance system environment , the insurance Installments are determined by the price of the car , from another view , the process of determining the compensation value and the percentage of the companies responsibility (Libya insurance company) of the total compensation value includes many factors and the most important estimate the compensation value by the insurance man (Human) and the involvement of all the damage and the cause (The Risks) to the insurance policy (The insurance policy contains set of damages and risks that the policy covers and a set of compensations that the company will cover when any of the risks occur). It is possible that the company will not pay the full compensation it will pay part or a certain percentage of the compensation depending on how much risk is listed in the insurance policy , we will determine what damages are compatible with the system and what are not compatible , because a lot of the time we can not assert if the damage or risk is compatible with the system or not , so we will use Fuzzy Logic technique in determining the percentage of compatibility of all of these cases for the system . As known the insurance policy covers two types of damages: Human damages (that occur to passengers), Substantial damages (the damage to the car).

4.3.4.4.1 First: Estimate the company's responsibility of the compensation value on physical damages (Human Damages).

In this part of the research we will use the *Fuzzy Logic* technique to represent the estimate of the percentage process of the company's responsibility (*Libya insurance company*) of the compensation value on physical damage (Human Damages), we will show the damages that are possible to occur to the passengers that are insured while inside the car during the accident (fatality, loss of sight, the amputation of an arm or leg and so on). After showing all the possible damages we will use the *Fuzzy logic* technique in determining the compatibly of all the damages with the system , where the *Fuzzy Logic* is capable on representing these ambiguous factors (which we can not answer if they are part of the system or not) and to convert them to mathematical equation that can help us in representing and measuring the compatibility of these damages with the insurance system and with that we will know the environment is a big part of the complex cultural systems environment , if we can covert the human and cultural sides of the insurance system and representing it with mathematical equation that we can calculate and measure .

Note: To know *the Fuzzy Logic* techniques look at Chapter three.

From the injuries in the *Insurance Policy* , in case of an extreme physical injury like (fatality , loss of more than one limb per person , total loss of sight) the compensation value is complete it is 5000 L.D , the compensation varies depending on the size of the injury the lowest compensation is 50 L.D, the injuries and compensations in the insurance policy our ambiguous data only the insurance men can value the extent of its compatibly with the insurance policy (the whole insurance system) what is the right compensation for each injury , with *The Fuzzy Logic* technique we can convert these complex data into numbers (Values) and mathematical equations which we can understand and measure the extent of it compatibly with all the systems cases. The injuries are:

Note: These items (injuries) movable text of insurance policy, for the amount of compensation are as of each of (*Chief Auto Insurance Department. Chief of compulsory compensation Office*)

Injury One: Fatality is considered to a high injury and the compensation is full.

So That:

"Fatality deserves compensation"

The sentence becomes:

"K deserves compensation"

However:

$X \in [-\infty, \infty]$
$\mu_A: X \rightarrow [0..1]$

In spite of:

Numeric Values: "**K deserves compensation**", compensation = [0 .. 5000] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value $\rightarrow$ [0..1]

: $\mu_{compensation}$: 5000 – value $\rightarrow$ [0..1]

Then we got good measurable concept called membership function used to make the assignment or the degree of belonging to fuzzy set which set based on the linguistic term.

Then,

V predicate 0	$V: 0 \rightarrow X$
0 predicate to A	$\mu_A: 0 \rightarrow [0..1]$
A predicate V	$\mu_{A0} V: 0 \rightarrow X \rightarrow [0..1]$
$\mu_A(0)$	subjective numerical assignment

$\mu_A(0)$: is the degree with which the use of (A) agrees with the attribute V of an element $0 \in \theta$ according to the observer's understanding of A.

Injury Two: The loss of sight in both eyes and incurable (compensation value 5000 D.L.).

So That:

"The loss of sight in both eyes and incurable deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 5000] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 5000 – value → [0..1]

Injury Three: The loss of both hand or both feet or one hand or one foot from the wrist or heel or from above complete amputation , total loss incurable. (Compensation value 5000 D.L.).

So That:

"The loss of both hand or both feet or one hand or one foot from the wrist or heel or from above complete amputation, total loss incurable deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 5000] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 5000 – value → [0..1]

Injury Four: The loss of one hand or one foot from the wrist or heel or from above complete amputation with the loss of sight in one eye total loss and incurable. (Full compensation value 5000 D.L.).

So That:

"The loss of one hand or one foot from the wrist or heel or from above complete amputation with the loss of sight in one eye total loss and incurable deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 5000] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 5000 – value → [0..1]

Injury Five: The total loss of sight in one eye and incurable (compensation value 2500 D.L.).

So That:

"The total loss of sight in one eye and incurable deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 2500] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 2500 – value → [0..1]

Injury Six: The loss of one hand or one foot from the wrist or heel or from above complete amputation (compensation value 2500 D.L.).

So That:

"The loss of one hand or one foot from the wrist or heel or from above complete amputation deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 2500] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 2500 – value → [0..1]

Injury Seven: No compensation value for temporary deficiency (compensation value zero)

So That:

"Temporary deficiency does not deserve compensation. (Compensation value zero)"

The sentence becomes:

"K does not deserve compensation"

Numeric Values: **"K does not deserve compensation"**, compensation = [0 .. 0] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..0]

: $\mu_{compensation}$: 0 – 0 → [0..0]

4.3.4.4.2 Second: Estimate the company's responsibility in covering the financial damage (Damages of the Insured Car).

In the previous part we used the *Fuzzy logic* technique in defining and clarifying the complex ambiguous part of the insurance system which depends on the factors and standers that are difficult to calculate or even express. Where the *Fuzzy logic* technique help in expressing these ambiguous cases (Human Injuries) which express an important part of the studied system (*Insurance System)* for which we can represent these cases and convert there into mathematical equations that contain convertibles and which we can deal with and calculate and evaluate the extent of its compatibly and it influence on the system.

And now we will apply the *Fuzzy logic* technique on the second type of damages that the insurance system has and they are the financial damages that occur with car.

Injury One: The Company's maximum responsibility is: "if the car becomes unusable because of the full destruction that written in the policy is that the company covers 20% of the repair cost"

So That:

"The full destroying of the car deserves 20% of the compensation value"

The sentence becomes:

"K deserves 20% compensation value"

Then the deserved compensation value = the full compensation value * 0.20

Numeric Values: **"K deserves 20% compensation value"**, compensation = [0.. 0.20 * repair cost] D.L.

Numeric Degree: $\mu_{compensation}$: (compensation × 0.20) - value → [0..1]

Injury Two: The Company's maximum responsibility for ware on the things inside the car accepts the owned things (10000 D.L.).

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 10000] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 10000 – value → [0..1]

Injury Three: This insurance doesn't cover ware and tare and accidents or the civilian responsibility that occurs outside the geography limit noted in the policy (geography limit- Libya country).

So That:

The ware and tare and accidents or the civilian responsibility that occurs outside the geography limit noted in the policy doesn't deserve compensation.

The sentence becomes:

"K doesn't deserve compensation"

Numeric Values: **"K doesn't deserve compensation"**, compensation = [0 .. 0] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..0]

: $\mu_{compensation}$: 0 – 0 → [0..0]

Injury Four: This insurance doesn't cover ware and tare and accidents or the civilian responsibility that occurs because any of these factors: storms, hurricanes, volcanoes, earthquakes, foreign invasion, foreign enemy actions and war actions.

So That:

"The ware and tare and accidents or the civilian responsibility that occurs because any of these factors: storms, hurricanes, volcanoes, earthquakes, foreign invasion, foreign enemy actions, and war actions doesn't deserve compensation"

The sentence becomes:

"K doesn't deserve compensation"

Numeric Values: **"K doesn't deserve compensation"**, compensation [0..0] D.L

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..0]

: $\mu_{compensation}$: 0 – 0 → [0..0]

In *The Stage Four* of the SSM methodology we used more than one tool and technique and that is to develop the systems activities, and to express it in diagrams and conceptual models , For Another Side , An ambiguous side of the system appeared that contain factors that can not be measured (the terms , injuries , compensations that the insurance policy contains . in the previous part by using *The Fuzzy logic* technique we were able to express the ambiguous sentences that contain immeasurable factors like :"The total loss of sight in both eyes and incurable deserves compensation "or" temporary deficiency does not deserve compensation" that sentence convert into mathematical equations that contain values and variables which we can evaluate and measure and deal with mathematically . for the management side we used DFD and UML language in the drawing of diagrams and models that explain expendably the systems activities , where the SSM methodology during application it allows the systems analyzer to use techniques and tools from other methodologies , as we mentions this feature of the SSM methodology in chapter two.

In this section we will discuss the impact of some unexpected social factors on system performance and decision-making:

1. Client delayed just a few days to renew the insurance policy, knowing that this customer would have the car for more than 25 years with the for *Libya Insurance Company*, accident happened before to renew the insurance policy of the New Year, in this case the company is not legally bound to pay compensation to the customer because it was not renewed The insurance policy, but we find that the company accept the principle of compensation (morally) and the company paid 1300 D. L. as part of the value of a full compensation 2100 D. L. ,This One of culture insurance principles.

So That:

"Damages deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 2100] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value $\rightarrow$ [0..1]

: $\mu_{compensation}$: 2100 – 1300 $\rightarrow$ [0..1]

2. Client with a traffic accident and deserves compensation for damage to the car (a term insurance policy covering the incident as well as the Client to pay the payments), but the company did not compensate for the damage the Client, and the reason is that the customer was using the car for commercial purposes from time to time without the knowledge of the company.

So That:

"Damages doesn't deserves compensation"

The sentence becomes:

"K doesn't deserve compensation"

Numeric Values: **"K doesn't deserve compensation"**, compensation [0..0] D.L

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..0]

: $\mu_{compensation}$: 0 – 0 → [0..0]

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3. A customer with a traffic accident and deserves compensation for damage to the car, but the company has paid 700 d. L. Of the value of a total compensation in 1900 (with knowing that the Client uses the car for the purpose of a commercial cargo company and has the flag been issued an insurance business), but the customer did not mention that the material with which the material is flammable, as is well known that the risk factor of influence In risk assessment and then in estimating the premium.

So That:

"Damages deserves compensation"

The sentence becomes:

"K deserves compensation"

Numeric Values: **"K deserves compensation"**, compensation = [0 .. 1900] D.L.

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..1]

: $\mu_{compensation}$: 1900 – 700 → [0..1]

: $\mu_{compensation}$: 0.36842

4. Client with a traffic accident and deserves compensation for damage to the car company will not pay compensation, after contact traffic police found that he was someone other than the customer driving the vehicle during the incident.

So That:

"Damages doesn't deserves compensation"

The sentence becomes:

"K doesn't deserve compensation"

Numeric Values: **"K doesn't deserve compensation"**, compensation [0..0]
D.L

Numeric Degree: $\mu_{compensation}$: compensation - value → [0..0]

: $\mu_{compensation}$: 0 – 0 → [0..0]

4.3.5 Stage Five: Comparison

Overview:

This stage deals with the comparison between the conceptual models developed in stage 4, and the structured analysis of the problem situation from stage 2.

Comparison Matrix

Not all the conceptual models were compared to reality, using the matrix as a formal method of questioning. In those cases were the comparison between the conceptual models and reality would provide no additional data, the matrix was left out.

4.3.5.1 The comparison matrix of *Insurance policy Issuance operation conceptual model*

	Activity	Exists when	How is it done	Support	Comments
1	Receipt of the request for insurance	All time	Orally by the customer	Insurance application (Document)	
2	Inquire about the customer file	In the case of an old client	Getting information from archives	Leaving reports of incidents (Document)	
3	A personal interview	When needed	The meeting between the client and company employees	Non	
4	Conversion to the Office Release	When the resolution approving the issuance policy	Through the Ok, head of Auto insurance approval	Verbal approval	
5	Verification procedures ownership of the car to the client	During the interview	Comparing client's data and car's Documents	The client's driver's license (Document)	
6	Preview car	Every time there is a renewal or issuance	Technical data that he would take the car on the ground	The report of Preview car (Document)	
7	Identical procedures car on the same car	During the inspection car	By comparing the body No. and motion of	Car action (document) and the car itself	

			the car on the same car		
8	Determine the technical data of the car	During the inspection car	To identify the advantages and specifications of the car	The report of Preview car (Document)	
9	Assess the status of the car	During the inspection car	Determine the age of the car	The report of Preview car (Document)	
10	Determining the price of the car	During the inspection car	Estimating the price of the car experienced by professionals	The report of Preview car (Document)	
11	Determine the nature of the work of the car	When needed	Determine the type of license	The report of Preview car (Document)	
12	Study the area around the car work	When needed	The quality of the roads being pursued by car	The report of Preview car (Document)	
13	Study of safety car	When needed	The brake system warning system against theft	The report of Preview car (Document)	
14	Detect the dangers surrounding the car	When needed	Determine the nature of the work of the car and personal driver	the calculation card of the premium (Document)	
15	Calculating the premium	After determining the price of the car as well as the nature of work	A calculation takes into account the price of the car and dangers surrounding	the calculation card of the premium (Document)	
16	Promulgation, and crediting of the insurance	After all above	Crediting of the insurance model by the branch manager	The insurance policy (document)	
LINKS:					
1→3→4→15→16			Issuance of an insurance company I have an old customer		
4→6→9→10→15→16			Calculating the insurance payments		
4→11→14→13→14→12→14			Detecting the threats of the car		
2→4→5→7→8			Verification of the data found in the car documents were valid		
4→6→9→8→9→10→6			Preview the car on the ground		

Table 7: The Comparison matrix of *Insurance policy Issuance operation conceptual model*

4.3.5.2 The comparison matrix of the *compensation operation conceptual model*

	Activity	Exists when	How is it done	Support	Comments
1	The receipt of a communication from an accident	All time	Written by the customer	accident application (Document)	
2	And verification of the incidents that occurred with the customer	When needed	Access to customer history with the company	the card of accidents and compensation paid	
3	Verification of an incident during the life insurance policy	The moment of the communication has been received	Boiling to see the insurance policy	The insurance policy (Document)	
4	Section traffic report on the incident	When needed	By inquiry with traffic department	Section traffic report (Document)	
5	Preview the car and damages	After verifying the accident occurred in the period covered by the insurance	To identify all the damage to the car because of the accident	Card of calculation of compensation (Document)	
6	Make sure that the incident accidental	In case of repeated incidents with the same customer	By examining the accident scenario	Section traffic report (Document)	
7	Verification of the causes of the accident	When needed	Through the study of substantive and technical reasons for the incident	Non	
8	Determining the spare parts needed	After verification of all previous tests	By identifying parts of the crashed car	Card of calculation of compensation (Document)	
9	To determine the value of the car reform	After verification of all previous tests	By bringing offers to repair the car	Non	
10	Estimating the value of compensation	After determining the spare parts and the value of reform	A calculation including the value of spare parts and the value of reform	Card of calculation of compensation (Document)	
11	Identify the	After	Where a complex	Non	

	proportion assumed by the company of the total value of compensation and how the payment of compensation	verification of all previous tests	process involving many factors, such as the extent of commitment to customer traffic and safety rules		
12	Typing instrument compensation or other compensation to buy a car	In the case of recognition of the company responsibility to cover the damage	Payment of compensation owed to the customer	Instrument the value of compensation (Document)	

LINKS:	
2→1→5	To ensure that the customer deserves or does not deserve compensation offset
3→1→5	
4→6→1	
1→5→8→9→10	The calculation of the amount of compensation

Table 8: The Comparison matrix of *the compensation operation conceptual model*

4.3.5.3 The comparison matrix of *the Insurance Policy Renew operation* conceptual model.

	Activity	Exists when	How is it done	Support	Comments
1	Receipt of the request for renewal of the insurance	When the term of the insurance	Written by the customer	Renewal application (Document)	
2	Inquire about the customer file	When needed	Getting information from archives	Client File	
3	Insurance period the previous study	When needed	Leaving access to accidents and compensation	Card of accidents and damages (Document)	
4	Took the decision to approve or reject the renewal	In the process of renewing an insurance policy	Through the verification of the client's intentions, as well as study the history of the customer have the insurance company	Client File	
5	Modeling required for the renewal	When the resolution approving the issuance	The mobilization of technical data of the car as well as customer data	Model to renew the insurance (Document)	
6	Comparing the car	When the resolution approving the issuance	Technical data that he would take the car on the ground	Model to renew the insurance (Document)	
7	Deduction of 10% of the value of the car	After comparing the car	Non	Non	
8	Calculating the insurance payments	After determining the price of the car	A calculation based on the price of the new car (after deduction of 10%)	Card of calculation of the premium (Document)	
9	Renewal of the insurance	After all above	crediting of the insurance model by the branch manager	The insurance model (Document)	

LINKS:	
1→2→3→4	Assess the insurance period prior to the customer
1→5→6→7→8→9	The process of renewing an insurance policy for good customer
6→7→8	Re-evaluate the price of the car

Table 9: The Comparison matrix of *Renew the Insurance Policy operation conceptual model*

4.3.6 Stage Six: Definition of Desirable and Feasible Changes

The purpose of this stage is to define those changes that are most feasible and desirable. The possible changes from the previous stage are considered and weighed using several criteria, including the cost and benefit of the change, and the political feasibility. It is important that any problems that might occur as a result of the changes are considered. The result of this stage is that those changes that seem likely, if implemented, to have a positive outcome in the situation are recommended.

The Result	Its Desirable and Feasible Changes
1. There was no contact between Libya Insurance Co. and the rest of society institutions such courts of law, traffic police departments to coordinate certain issues such as: - Definite investigation of information validity of vehicle and client and Development of both car and client documentation in a manner that cannot be forged. - In case of accident, making sure that the scenario actually describes the instance. - Coordination among judicial bodies to bridge the gaps existing in current laws that dictate the relationship between the insurance company and the client.	Creating a division and appointing personnel to carry out the tasks mentioned in result 1 outside the company headquarters.
2. The participation in decision-making is restricted in little number of managers which make it more centralized. As the study revealed, the social and cultural factors have impact on the system. When there are a few employees capable of making decisions, the pressure would be greater on them thus on their decisions.	Expanding decision-make foundation and adopting the principle of participation in decision-making process.
3. The staff lack insurance skills save those few highly experienced aged (mostly in fifties) individuals who relied on to run the operations. Fresh employees, however, do not enjoy such experience suggesting that the organization will most likely face a problem (within 10 years) after the retirement of these experts.	Providing means like seminars to transmit skills and experience among generations of different ages.
4. Job culture of some employees in Libya insurance company suffer from lack of job affiliation and poor morale which in turn leads to decline of workforce efficiency thus the institution productivity.	Crucial steps must be taken in order to change existing negative employees' culture.
5. There are legal gaps in insurance policy though it has been subject to development and updating over 30 years. Nevertheless, the firm executives admit the insurance policy gaps which render some clients get undeserved	Developing insurance policy with firm articles protect it from deceitful methods and examining all cases of which the company feels it paid undeserved

compensation.	compensations.
6. The employees (those who are directly involved in the insurance process) in Libya insurance company rely much more on oral information than documents because client personality is highly important. The employer/client interview decides whether submitted insurance application would be accepted.	Evolving the efficiency of those in charge of interviewing customers to enable them of extracting as much as possible data from the client to recognize his or her actual motives as this data help in whether to accept such deal.
7. The company still accepting applications for insurance of fraudulent customers which result in involvement in lawsuits and payment of undeserved compensations.	Development and promotion of the efficiency of employees dedicated to carry out the interviews with clients to extract as much as possible data from the client to recognize his or her actual motives as this data help in whether to accept the customer application.
8. There are no devices and techniques to detect technical facts such as serial number of the car body and engine and match it with the documents as well as the tools that discover the car damages and their causes.	Bringing advanced techniques into Libyan insurance market to promote insurance industry.
9. Libya insurance company's information management is newly established, long after foundation of the firm itself, when the company underwent several issues concerning the vast quantities of customer-related data that made obtaining such data so difficult.	Providing more effective methods for attaining data (e.g. designing smart, efficient database capable of providing required quick and accurate information).
10. There is no controlling system by which documents took from files can counted and followed so that can be returned instead of misfiled.	Company archive must set regulations that ensure collecting back all documents and files used by other departments.
11. Each client file is overloaded with documents amount to 150 papers making it so difficult for direct search especially in absence of any instrument assists in identifying content and location of these documents.	Provision of more reliable ways of obtaining information (e.g. designing smart, efficient database capable of providing required quick and accurate information).
12. The company has lost many of its customers who shifted to other competitive insurance firms therefore decline of profits.	Rendering more services to the customers and adopting the measures that build up the client confidence in the company.
13. Libya insurance company's information management did not realize high level of utilization from the techniques in spite of their availability because managers of each department are unconvinced with keeping documents in other management (information management) for seriousness of such documents and subsequent compensations paid to clients.	Altering department managers culture and convincing them that all documents of clients' cars are in save hands and available as requested.

4.3.7 Stage Seven: Recommended Action

The purpose of the final stage is to help the practitioners recommend the change. The recommendations should reach the people who have the authority to approve the changes. This stage can also include the actual starting of the change process. It is important to note that the introduction of the action may change the situation so that new problems may arise. If possible, it may be a good idea to carry out the change in a temporary mock system to gauge the repercussions. However, this method of testing would have to be on a fairly simple system otherwise it could require a lot of resources. Once a temporary system is used and observed by an analyst, it could then be introduced into the real system.

The Recommendations:

1. The company should create specialized department for coordination with other social establishments like traffic police and judicial authorities in terms of legal issues that settle legal disputes between Libya Insurance Company and its clients. This is particularly important to learn about the legal judgment in certain issue as the management has no such division undertakes the external work (the nature of legal department work is internal).

Concerning traffic police, there are six points should be considered:

- Verification of the customer and vehicle documents;
- Verification of the vehicle possession;
- Confirmation that the insured driver was indeed driving the vehicle

When the crash took place;

- Investigation of crash causes;
- Establishment of the accident scenario; and
- Making sure of the nature of the vehicle function during insurance

coverage.

2. The company must place the development of human resource at of its priorities such:

- Set up a training center for (Insurance Industry) in which the company personnel receive training and acquire the skills of insurance industry, focusing on newly recruit persons to uplift their efficiency.

- Pay more attention to internal human resource as the organization size depends on preplanned of employment and there is rather significant proportion of staff unutilized.

- As Libya Insurance Co. is the biggest of its kind in the insurance marketplace and the parent of the rest firms, it should delegate some of its employees in order to contribute to development of local industry though the novel skills they obtained abroad.

3. The company ought to take major steps in altering the staff job culture to enhance personnel allegiance and raise their morale by:

Offering advantages and incentives to promote the staff performance.

- Providing entertaining activities for the employees and their families (e.g. clubs and other meeting places).

- Making earnest attempt to know staff feelings toward the organization.

- Improving payment system as much as possible in order to meet employees' satisfaction.

- Sharing the company's stocks with its personnel to make them feel as stakeholders with joint prospect.

- Arranging symposiums with particular focus on professional principles so as the staff gain affiliation values.

4. Appraising those holding critical positions and capable of making decisions within the organization.

5. Exerting more efforts to solve issues of incompetence and redundancy.

6. Be more concerned with managerial aspect by organizing systematic equal opportunities for hierarchical promotion.

7. Providing modern techniques and tools to detect car accidents and subsequent damages as well as making sure that papers are valid and no deceit has been committed.

8. The study revealed social and cultural factors of significant impact which are the insurance environment. Given the organization restricts making its decisions in hands of few managers, the inferior employees would be under greater stress which, in turn, increase the effect of those social factors on them. To get to the bottom of this issue, the foundation of participation in decision-making process must be extended and a collective pattern of leadership be adopted in order to make this process decentralized thus avoiding the impact of these factors on any employee that may, as a result, let a erroneous course of action get by.

Chapter Five:

Conclusion

- Problems and features in use SSM in ISD
- Conclusion
- References
- Appendices

In this chapter we will shed light on the faults and privileges of soft system methodology in the ISD filed, as we suggested the development of the work frame in which the SSM method work in developing and analyzing the Insurance System of Libya, and this difficult system that sometimes have a technical and informational aspects , and other times suddenly the system converts into a ambiguity social system where the human activities and social factors control that effect the system performance, In this case, the system depends on these factors and activities in determining the system reflexes when processing some cases and accidents, we will evaluate this practical part of the research which is applying the SSM method on the Insurance System. SSM method studies the studied organization policies, therefore takes interest of every person inside the system (Libyan Insurance System) and the extend of the effect of all these people on the systems performance, after that the method will study the power point of the system (Decision Centers) the role which anyone inside the system can play and evaluate this role, from determining the problem that every person encounters in the system. We were able to draw a (*Rich Picture*) explaining basically the relationship between the people inside the system and the work expected of them, from the *Rich Picture* we can write some analysis like: Root Definition , CATWOE Analysis , and "day-in-the-life-of" Descriptions.

This analysis can list the systems elements and contents and its interaction inside the system, which eases the transfer to the next stage which is *Building the Conceptual Models* and this stage is considers the most important stage of SSM where the suggested frame work the second chapter that was by using techniques from other methods like DFD and UML and Fuzzy Logic to draw the diagrams and forms that explain the systems activities. And from here we move to the fifth stage is to compare these forms and diagrams to the real world.

5.1 Problems and features of use SSM in ISD

When applying SSM in the field of *Information System Development* we notice exceed in many sides as its cares for the policy of the studied organization and an interest in the role of each element (or person) inside the system. From another view, some dereliction appeared in the methodology performance especially in the system construction and the needed diagrams.

5.1.1 The Problems of using SSM in ISD field:

1. The SSM methodology assumes that the people inside the system know all the information associated with the systems activates, this principle is not right. That is occurring in some analysis of stage two: *Problem Situation Structured.*

- *Intervention Analysis*
- *Social and Cultural Analysis*
- *Political Analysis (Cultural Analysis)*

The information witch output from previous analysis is the foundation of the construction of the models and conceptual models that explain how the systems works , if we suggest that the people that the method depended on in understanding political and activities of the system did not have the right information of what happens inside the system (Deliberate or not) , this assumption will lead to wrong information, because the SSM is sequential methodology during application (step by step), as we know all of the mentioned previous analysis is part of the second stage of the method , for all of the stages that follow this stage will be built on wrong foundation.

2. The SSM does not favored variety in diagrams and models that describe the system's components and activities , as we notice the first three stages of the methodology provides the systems analyzer a complete description of the systems environment ,the structure, and the deep understanding of problems , when passing to stage four from SSM we notices the methodology is poor in design and construction of information system ,the methodology's designers found a solution to this problem by allows to developer to use this theory and use of other techniques and tools from other methods , this advantage in *the stage four: Building Conceptual Models-Other System Thinking.*

3. The methodology supposes that the managers inside the system have the upper hand. In other words, the managers inside the system (Organization) handle the matters and decide the system reaction and this

is what really doesn't happen. This appears in the results we got from the first and second stages of methodology are:

- The structure management frame that we achieved from the first stage of the method.
- The decision centers or casting on the people's roles inside the system that result from *Political analysis (cultural analysis)* in the second stage of the method.

We noticed what happens in the real world inside the organization offices *Libya Insurance Company* is not as it appears in the structures and analysis, In *The Auto Insurance Department* that the core of this study we find that *the Chief of Auto Insurance Department* is responsible for the acceptance and rejection of the clients deals (the insurance policy for the client). This is from the theoretical and structure's frame side, but from the practical side what happens inside the system we find that who determines the completion of the deal is *The Chief of Supplementary Issuing Office* for his wide experience in the car insurance filed . When we draw a special timetable to disrepute the roles and powers of each these roles have inside the system (page 66) for this table does not reflect truthfully the culture inside the organization.

4. the designers and engineers of the information system field not happy with the open ending of the methodology, the SSM ends with a iterative process and it is comparison , developing , and upgrading the conceptual models that are reached in *The Stage Four* , moreover the conceptual models are always modifiable and upgradeable and this is what concerned the engineer in charge of the system construction , and the system engineers prefer constant models and diagrams that can not be altered so they can be relayed on as a foundation for the system constriction .

5.1.2 The Features of using SSM in ISD field:

1. The SSM method gives a great concerning in understanding and analyzing the problem situation and the study of the systems environment, where the advantages of this method are the techniques and the exceeded analysis in interacting with the social side of the system. *The analysis One* in the second stage: *Analysis one: Interaction Analysis*, Enumerates every problem on determining then determining the people that are effected by all these problems inside the system and the systems analyzer can create a clear and complete picture of the systems problem.

2. The ability of methodology to take the concerning to all the political and social considerations and the power of all the contributors in the system and these sides of the system as represented in a cultural timetable in theses analysis:

- Analysis Two: Social and Cultural Analysis
- Analysis Three: Political Analysis

3. The methodology gives the system analyzer (Different Views) to the systems problem in the second stage, the *Rich Picture* technique allows the systems analyzer to draw more than one form according to the point of view of every *actor* associated with this problem, in the second stage the *Root Definition* is written for every *Rich Picture* drawn and this allows the system analyzer to take more than one view of the systems problem.

4. The flexibility of the SSM methodology, because the principle of SSM doesn't inflect with the use of techniques and forms or applications of other methods and this is according to the need, and using it in building forms and plans that organize the information part of the system and the flexibility of the methodology shown in the use of techniques from other methodologies in the forth stage of SSM *Building Conceptual model stage*, In Figure (35) we notice in the forth stage of SSM it can acquire forms and plans from other methods (4b other System Thinking) which allows the use and exploitation of techniques and plans and forms in addition to SSM techniques and tools.

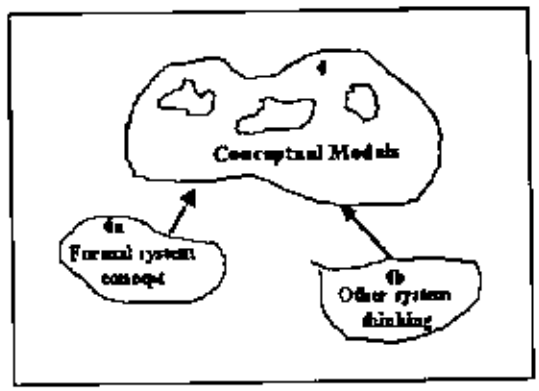

Figure 35: stage Four in SSM

5. During applying the SSM methodology on the information system gives the system analyzer expectations of expected solutions to overcome some problem in the system which allows the system analyzer to organize the suggested solutions on the system owners and to benefit from these expectations for the first step to the solutions is determining:

- The Problem Situation
- And Requirements

6. The stage Five of the methodology *Comparison* is the study of forms and RDs that are drawn and written in the last four stages and compare it with the system in the real world, where determining and improvement these forms until the analyzer reaches a form that reflects the system in the real world, and the process of drawing a comparison timetable that determines the processes and factors of the system in the real world and represents it in a drawn form from the analyzer, after the forms are evaluated which allows suggesting and applying the modifications in the coming stages to reach the reflected expectation of the system in the real world.

Activity	Exist?	How is it done?	Assessment	How is it Judged?	Notes
1 2 3 4 5					
Links 1 -> 3 2 -> 4 3 -> 4					

Table 10: A comparison table between conceptual models (stage 4) and structure problem situation (stage 2)

5.2 Conclusion

The SSM methodology can use and sufficiency in the field of *Management Information System MIS* development and the development of the frame work where SSM methodology works with other tools and techniques and that in to take into consideration all of the social, cultural and political sides of the system, the research is summarized in:

1. Develop the SSM methodology models to work with competence in the field of MIS.
2. Build a frame work to develop information systems, which is convenient to all of the social, cultural and political circumstances that surround the system.
3. Develop the ISD concept so to include the *Soft Problem* definition that represents the complicated cultural environment of the system.
4. Clarifying the flaws and advantages of the SSM methodology during the appliance in the field of MIS.

These four points clarify the research idea and essence, because the information system is an important part of computer science, so it important to develop the methodologies used in analyzing and understanding information systems therefore to overcome the complicated Soft problems that face the systems analyzer or the workers inside the system *Actors*. We find the SSM as Peter Checkland focuses on solving the administration problem during developing the information's system.

> In the case of Checkland, an alternative approach is offered – soft systems methodology, though this methodology was originally focused at managerial problem solving. (Rose j. 2000) [26]

In MIS, There are two challenges face the systems analyzer, which are:

First: problem in analyzing the information system form the traditional side which the system contains a set of data and activities.

Second: is a problem analyzing the Soft side of the information system that is considered an important part of the system and effects greatly on the systems performance, and in this research we used SSM as a solution to face the second challenge which is analyzing the soft problem of the information system and the attention to the social and cultural part in the information system.

> SSM can play a useful part in problematisation – clarifying and prioritizing unclear situations. Social theory might play a useful part in

> sensitizing information system development to social, political and cultural issues. The chosen form of social theory is structuration theory.
> (Rose j. 2000) [26]

For analysis and understanding the organized and clear administration side of the information system we used traditional techniques and methods as a part of the forth stage of the SSM methodology, Therefore the SSM provides a suitable environment to work more than one method and technique that the systems analyzer needs during the information system development, Therefore to take into consideration the administrational, informational, social and cultural sides of the system.

A united framework was used for all the methodologies, techniques and tools in the analysis of *Insurance System* in Libya therefore taking the Libyan insurance company as a case study for the research, so in the first three stages of SSM the analysis and understanding of the complex social, cultural and political part of the organizations system (Libyan Insurance Company) because the forth stage allows the systems analyzer to gather other methods and techniques to understand and analyze a part of the system, UML was used to analyze the procedural part and draw the plans that reflect the processes the occur inside the *Insurance System* of accepting or refusing the insurance applications and review the car and determining the insurance payments and compensation.
The tools used:

1. The Scenario Technique.
2. Use Case Diagrams.
3. Class Diagram.
4. Activity Diagrams.
5. Sequence Diagrams.

The role of the Fuzzy Logic technique in determining the ambiguity area of the system and that is converting the incoming in the *insurance policy* and translating it into equations and variables which can to dealing with it and measuring it, and in the fifth stage the comparison process and then the testing if the conceptual models reflect the system in the real world or not.

Summary of Chapters:

1. Chapter One:

In the first chapter the concept and goals of the research were explained and the previous studies of the SSM in the field of information systems were shown and the explanation of the research structure.

2. Chapter Two:

In the second chapter all of the suggested methodologies, tools and techniques in the research were explained and the seven stages of the SSM as Peter Checkland developed.

3. Chapter Three:

The relationship between the SSM methodology and the information system were explained as the methods role with the data and information during developing the system, and in the third chapter the Fuzzy logics role in translating the incoming in the insurance policy and transferring them into equations.

4. Chapter four:

Chapter four is the practice area for all the theories and suggested methods in the research applied to the Libyan car insurance system; this complicated system and subjected to the complex social, cultural, Economical, and political factors that the SSM can deal with.

5. Chapter five:

This chapter discusses the flaws and advantages of the use of SSM in the felid of ISD, and this chapter contains the conclusion, Appendices, and References of the research.

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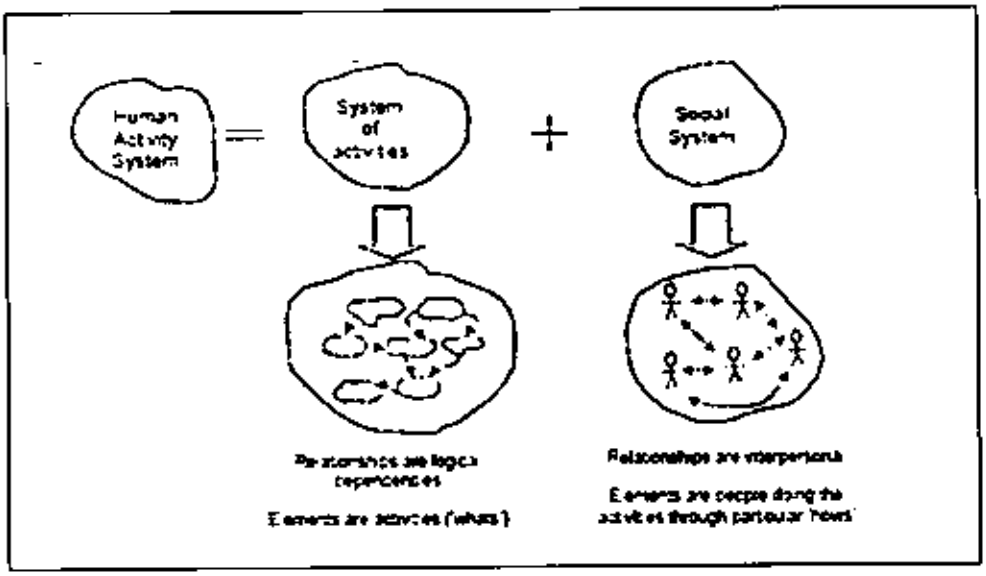
5.4 Appendices

5.4.1 Human Activity Systems

In examining the real-world situations, the fact that humans interpret the world in different ways will never yield only one relevant holon. The 'human activity system' is a specific kind of holon made up of two sub-systems. One subsystem is made up of a collection of activities linked together according to their dependent relationships in order to make a purposeful whole. The other sub-system is one of monitoring and control so that the whole is adaptable to changes in the environment. (Checkland & Holwell [21]; Checkland & Scholes [6])



The Subsystems of human activity system

The human activity system can be divided into a system of activities and a social system whose boundary is concurrent with the boundary of the human activity system itself. The system of activities is made up of elements of activities whose relationships are logical dependencies.
These elements can be used to define 'what' to change. The elements of the social system are the people doing the activities. These elements are the ones that defines 'how' that change may be implemented in real life and if that change is desirable and feasible. Therefore it is important to remember that although the human activity system usually is modeled as the system of activities, the related social system must also be defined.

Human activity systems are very complex. The human components may display different attributes when studied separately, than they would if their role in the whole system was examined. The human activity system recognizes the significance of people in organization as a whole. It is

therefore vital to include the human aspect in order to make sense of the real world.

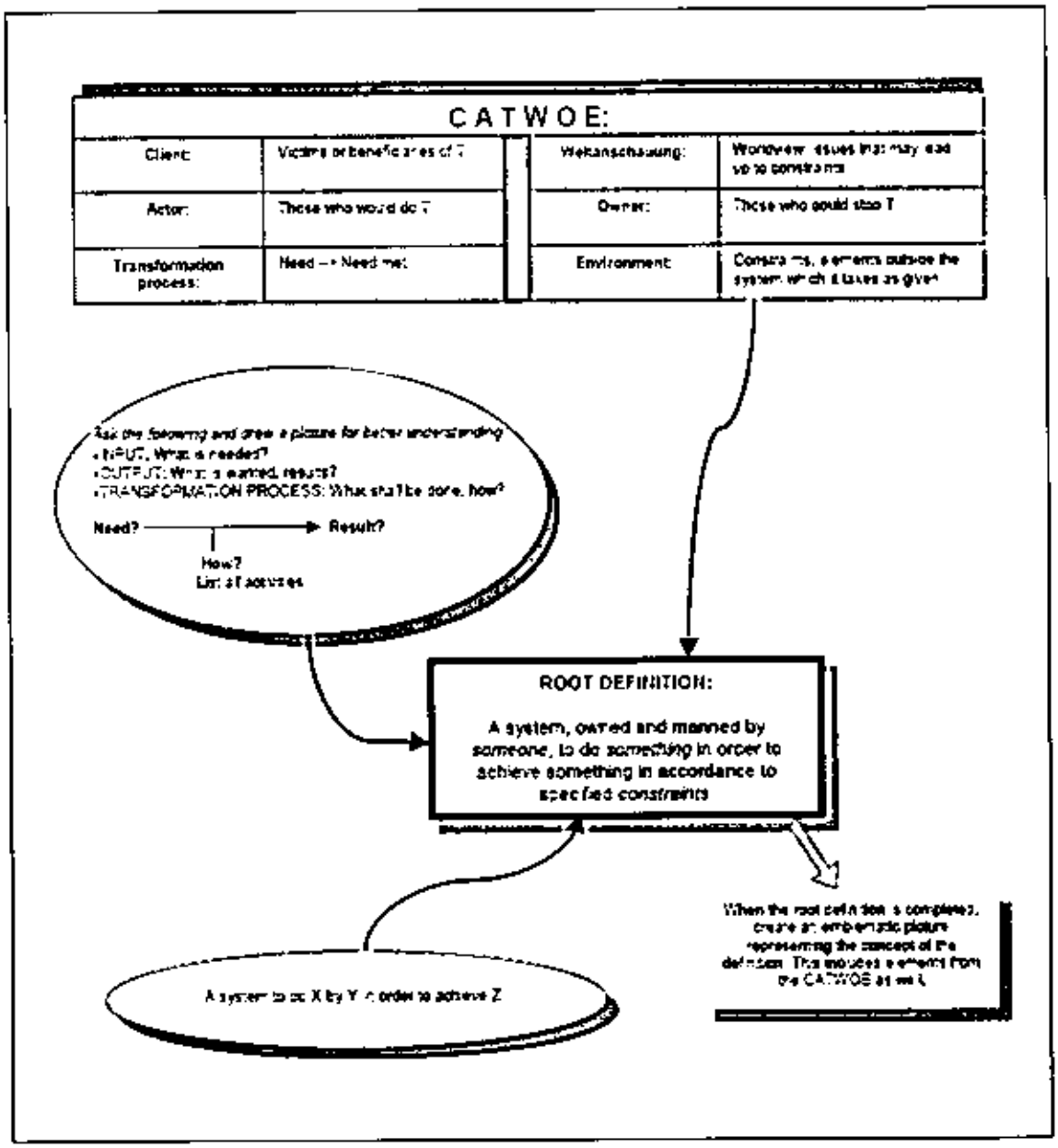
This would entail including people in the model. The unpredictable nature of the human activity systems, different conflicting objectives, perceptions and viewpoints of the people makes it quite difficult to model. (Avison & Fitzgerald) [27] It is therefore necessary to construct several models of human activity systems and to discuss their relevance to real life. Before modeling can commence, choices have to be made as to which human activity models are likely to be the most relevant in investigating the situation. Once this choice is made, it is essential to determine the perspective or viewpoint from which each purposeful activity model will be built. (Checkland & Scholes)[6]

It is important to remember that human activity systems do not exist in the real world, they are holons, models to be compared with the world. These human activity systems provide a logical intellectual framework that can be used in order to understand and intercede in the rich and surprising unpredictability of everyday situations. The complexity of the models can never surpass the complexity of real purposeful action. By using the models as a base for relevant questions, they can be seen as mechanisms to explore realworld situations. The process of questioning should be made so explicit that it can be recreated by anyone interested enough to trail the process and see how it led to the reached conclusions. (Checkland & Holwell)[21]

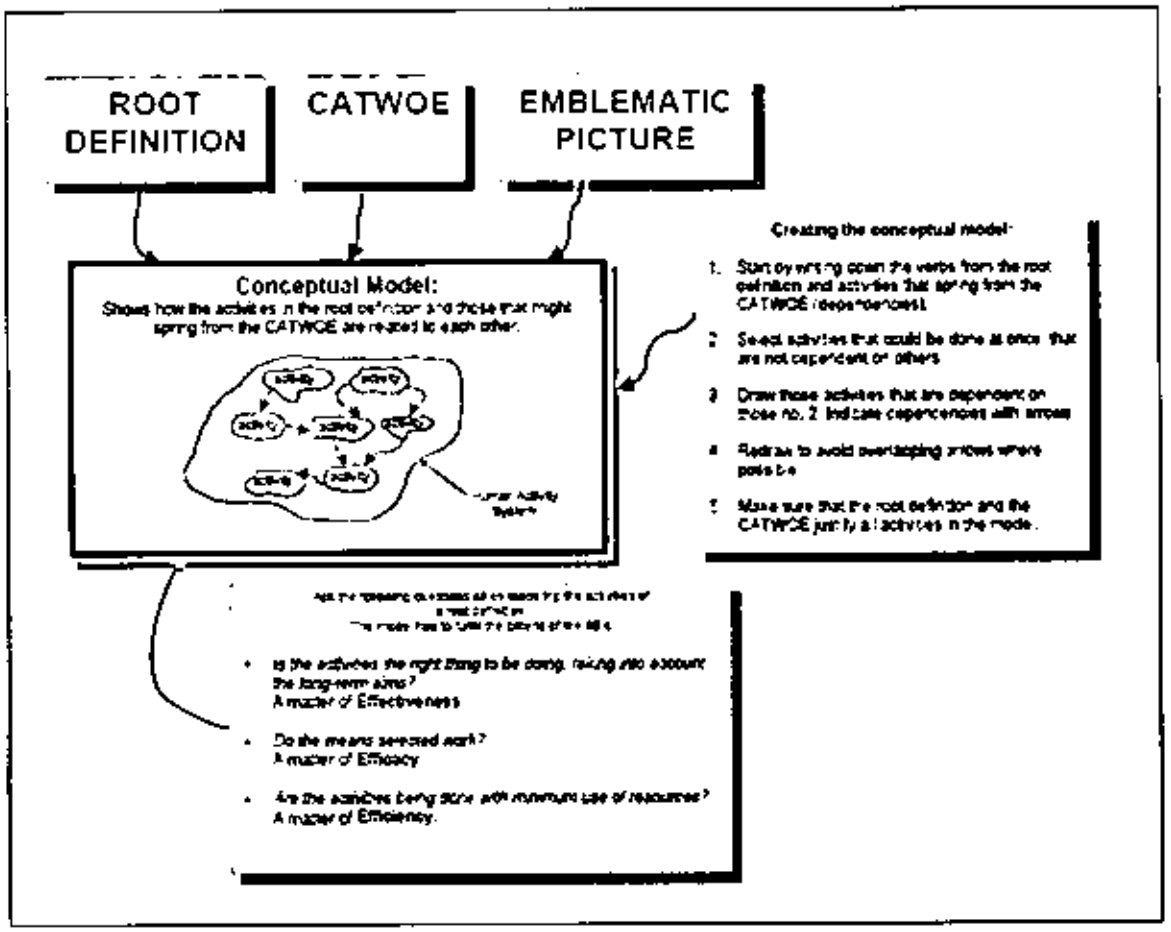
Holons

One of the principles of soft systems thinking is that the whole is greater than the sum of its parts. This covers the idea that the whole may display emergent properties. The properties of the parts have no meaning in terms of the parts of the whole. (Avison & Fitzgerald [27]; Checkland & Scholes [6]) The idea of the whole is an epistemological device, a theoretical concept that is used to describe and make sense of the real world. It would be better to use the word 'holon' to distinguish the theoretical concept from the systems of the perceived world, leaving the word 'system' to everyday language (Checkland & Scholes) [6]; (Koestler, 1967) [28]. A holon is a special kind of model that organizes thinking by means of systemic ideas. (Lane & Oliva, 1998) [29]

5.4.2 The process of creating the Root Definition



5.4.3 The process of creating the Conceptual Model



مقدمة

في هذا البحث سنقوم باستخدام منهجية soft system methodology في فهم وتحليل أنظمة المعلومات الإدارية, اخترنا منهجية SSM لما تتمتع به من تقنيات وإمكانيات عالية في مجال تطوير أنظمة المعلومات وخصوصا الأنظمة التي تتدخل فيها العوامل الاجتماعية والسياسية والثقافية, و التي تؤثر على عملية فهم و تحليل هذه الأنظمة, حيث أن كل المنهجيات والتقنيات المستخدمة اليوم في تطوير أنظمة المعلومات تقوم بتحليل النظام إلى مجموعة من الفعاليات التي تتدفق بينها البيانات والتي تقوم بالعمل معاً لأداء وظائف النظام , هذه يعني أن المنهجيات المستخدمة حاليا في تحليل أنظمة المعلومات لا تهتم ببيئة النظام الاجتماعية والثقافية والسياسية , و حيث تؤثر بيئة النظام بشكل مباشر و فعال على أداء النظام .

هدف البحث أن نقوم باستغلال التقنيات التي تتميز بها SSM في فهم وتحليل الجانب الاجتماعي والسياسي للنظام وكذلك سنقوم بدراسة دور هذه المنهجية في فهم وتعريف الأنظمة الغير معرفة Fuzzy Systems .حيث أن تدخل بعض العوامل الاجتماعية والسياسية قد يقوم بتحويل بعض من أجزاء النظام إلى أنظمة فرعية غير معرفة Fuzzy Systems و التي يصعب على منهجيات تطوير النظم مثل (Structured Approach and Object-Oriented Approach) على فهم هذه الأنظمة الاجتماعية المعقدة والمصاحبة لنظام المعلومات قيد الدراسة.

حيث سنقترح إطار عمل يستطيع مطور النظام استخدامه لفهم وتحليل الجانب الاجتماعي من النظام في نفس الوقت الذي يقوم فيه بتحليل وتطوير ونمذجة نظام المعلومات المتبع , حيث سنستخدم منهجية SSM كمنهجية رئيسية في تحليل وفهم نظام المعلومات , واستغلال الأدوات والتقنيات التي تتمتع بها SSM (e.g. Social and Cultural Analysis, Political Analysis, Root Definition, and Rich Picture) والتي تستخدم في تحليل وفهم الجانب الاجتماعي من النظام المتبع داخل المؤسسة, هذا الجانب الاجتماعي والذي من الصعب فهمه وتحليله باستخدام المنهجيات المستخدمة حاليا في تطوير أنظمة المعلومات لأنها لا تحتوي على أي أدوات أو تقنيات لفهم وتحليل العلاقات الاجتماعية داخل المؤسسة قيد الدراسة أو أي من الفعاليات الإنسانية والتي غالبا ما تكون لها التأثير الكبير في نظام المعلومات المتبع بتلك المؤسسة. وفي الفصل الثاني سوف نقوم بشرح مفصل للمنهجية SSM المستخدمة في البحث و علاقتها مع التقنيات التي ستستخدمها في البحث, وأيضا سنقوم بشرح كيفية عمل كل من تلك التقنيات وهي SSM with DFD & UML في إطار عمل موحد, ومن ثم سنقوم بتطبيق كل من تلك المنهجيات والتقنيات المقترحة على نظام التأمين في ليبيا , ودراسة مزايا وعيوب استخدام SSM في حقل تطوير انظمة المعلومات.

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قســـم الحـــاسوب

عنـــوان البحـــث

استخدام منهجية النظم اللينة في تحليل و تصميم المعلومات الإدارية وعلاقتها بمنهجيتي النظم الكائنية و نظم انسياب البيانات

مقـــدمة مـــن الطالـــب

معمـــر حســـن ســـالـــم أبوشعـــالة

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كلـــــية العلـــــوم
قســـــــــم الحاســـوب

بحث للإيفاء بمتطلبات إجازة الماجستير بعنوان:

استخدام منهجية النظم اللينة في تحليل و تصميم أنظمة المعلومات الإدارية المبنية علي الحاسوب

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