ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
FACULTY OF INFORMATICS
DEPARTMENT OF INFORMATION SCIENCE

KNOWLEDGE-BASED SYSTEM FOR SETTLING TORT CLAIMS UNDER THE ETHIOPIAN LAW

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF SCIENCE IN INFORMATION SCIENCE

BY

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Dedicated to

My Grand-mother

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
CBR	Case-based Reasoning
FSCE	Federal Supreme Court of Ethiopia
KBS	Knowledge-Based System
RBR	Rule-based Reasoning
PROLOG	PROgramming in LoGic

Abstract

Knowledge-based systems play an important role in solving problems and supporting human decision-making. The development of these systems begins with limited area of disciplines and then extends to a large number of other fields such as finding molecular structure, locating oil and mineral sites, medical diagnosis, computer system component selection etc.

This research deals with the development of a KBS as an alternative approach for handling tort claims under the Ethiopian law. An extensive review of the ruling contemporary theories about the nature of law and legal reasoning is made during the development process so as to get an insight in the modeling of the expertise needed to tackle the problem. The required tacit knowledge is collected through semi-structured interviews with domain experts. Moreover, the review of statute books, case reports and journal articles are also analyzed to gather explicit knowledge in the domain area. CommonKADS and decision tree modeling techniques are used in the modeling of expertise. Rule-Based Reasoning (RBR) approach is adopted to represent the necessary knowledge in the knowledge base of the system. The Knowledge base is developed using SWI prolog which supports backward chaining to make inferences by reading the composed rules in the knowledge base.

The testing of the prototype system is done first by using artificial test data and then a sample of thirteen previously decided test cases is taken in law of torts to make comparisons on the decision made by the system and human experts. Similar decisions passed in situation when all sufficient conditions are given for the application and non-application of the rules. However, the decision made by human experts differs in most cases. This is due to the fact that the decisions are not only determined by written rules but also some extra-legal factors which have to do with political, cultural, economic , and religious beliefs of the judges . It also influenced by the personal and psychological characteristics of a judge.

Therefore, the development of a KBS that incorporates predictive capacity to predict judicial decisions by taking precedents (or decided cases) and examining closely the personal attitudes of the presiding judges towards political, cultural, economic, religious, and social factors are demanding to make the system credible in the legal community.

CHAPTER ONE

INTRODUCTION

1.1 Background

Although there is no consensus among legal scholars about what law is and what law should be, law is, in brief, a socially constructed system of rules enforced through a set of institutions that guides and governs the relation between people (Morse, 2004). Whether it is divine or human law, the one thing which all classes of law share in common is that of guiding, influencing, or controlling the actions of citizens (Calverly, 2008).

Tort law is a legal domain that consists of two classes of duties: proscriptive and remedial (Sheinman, 2003). According to Sheinman, proscriptive tort duties are duties that proscribe various types of faulty conduct. However, remedial tort duties are duties to take remedial actions when proscriptive tort duties are breached. Remedial actions are taken depending on the nature of the defendant's conduct and the nature of the harm to the plaintiff that conduct caused. When a person causes physical injury to another person, either intentionally or due to negligence, he is required by the law to compensate all the costs incurred to the victim so that, ultimately, he will suffer the pain caused by his action (Ibid). Restoring the situation (if possible) as it was before the damage was caused and refraining from acting are the other remedial actions taken on the wrongdoer. Thus, determining the liability of a person causing injury to another, assessing the amount of damage sustained by the injured party and fixing the amount of payment to be paid to the latter, restoration and injunction are the subject matters of the law of tort.

In order to settle the many individual claimant matters including motor vehicle accidents, medical malpractice, defamation, false imprisonment etc., different alternatives to tort law have been employed by a country (Adams, 2000). These include workers' compensation; provided that when a worker is injured on the job, he or she will be entitled to certain benefits. Awarding retirement fund for an early retired victim and insurance protection against some of the more serious risks are the other alternatives to resolve tort claims (Ibid). The judicial settlement of all such kinds of tort claims involve analyzing facts, rules, principles, and other processes of legal

reasoning (Sheinman, 2003). Needless to say, all these tasks are highly in need of qualified experts in the legal profession, the serious case which is scarcely available. According to Popple(1996) and Feiler (2004) knowledge-based system plays an active role in alleviating those problems and assists legal practitioners in making decisions.

Knowledge-based systems emerged as a subset of the field of AI in the 1970s (Xing et al. 2003; Santhanam and Elam, 1998). The development of these systems were focused on storing large amount of knowledge about a particular domain in an organized fashion to enable people solve problems and make decisions in bounded, well-defined knowledge domains (Hembry,1990; White,1994; O'Hara,1994). Knowledge-based systems offer several benefits such as preserving the crucial expertise of the human expert that could otherwise be lost (Saylor and Pattrick, 1988; Hodges, 1990), the ease of sharing knowledge throughout an organization in spite of qualified personnel turnover (Hodges, 1990), and the ease of transporting expertise by simply copying the program (Saylor and Pattrick, 1988). Despite the many benefits, the development of a KBS is difficult (Waters 1990). As Waters indicated, the challenges are arising from the high cost of developing or purchasing the system, the long time it takes to develop, validate, test, etc. the KBS , the difficulty of finding skilled developers, the expensiveness of hardware and software, the difficulty of integrating differing expertise, and the sole focus on agreed knowledge rather than common sense, intuition, etc.

The progress made in computational technologies, the adoption of improved development methodologies, and the recognition of the power and importance of knowledge in supporting human problems solving have given rise to the rapid expansion of knowledge-based systems (Hembry, 1990; Xing et al., 2003). According to Coenen and Bench-Capon (1993), applications of KBS range from earlier attempts in the areas of medical diagnosis, chemical analysis, geological exploration, and computer configuration to recent advancements in the areas of real-time process control, nuclear power plant operation, and marine navigation.

Following the fruitful results of the aforementioned knowledge-based system projects, researchers divert their attention in the design and development of such systems for law in order to tackle the problems faced by legal professionals (Greinke, 1994). Some of the prominent researchers who adopt KBS in legal domain include McCarty (1980), Bench-Capon et al (1988), Gardner (1987), Susskind (1987), and Popple (1996). The possibilities of KBSs to assist general

legal practitioners in solving problems in the area of law have been investigated. Some of the main applications areas of KBS are retrieval of legal information, litigation support, and calculations and planning (Greinke, 1994; Popple, 1996; Rissland et al, 2003; Engle, 2004). Legal information retrieval systems are used for retrieving conceptually related legal terms by interpreting semantically the requested terms of the users. Typical examples of such systems include LEXIS, SCALE, and INFO1. Litigation support is the other area of KBS application. The three systems developed for litigation support are Asbestos Litigation (SAL), which advises on the settlement of asbestosis claims against insulator, Legal Decision making System (LDS) which advises on likely settlement figures for product liability, and a sophisticated system, COLOSSUS, developed by the Australian Government Insurance Office to detect possible fraudulent personal injury claims, and tag them for investigation by its officers. KBSs are also used in calculations and planning. For example, TAXADVISOR system is designed to assist lawyers to advise clients on taxation and estate planning.

Although an advancement has been made towards the development of KBSs in law (Martino, 1992), a number of studies have confirmed that more emphasis is given to the technical perspective in the development of legal KBSs by ignoring the value of close analysis of the theoretical assumptions about the nature of law and legal reasoning, (Martino, 1992; Greinke, 1994; Popple, 1996*;* Engle, 2004*).*

According to Rissland et al (2003), the legal domain is mainly characterized by six features that make it especially demanding to go beyond the technical perspective and give due regard to the theoretical principles underling the concept of law. First, law has diverse categories of knowledge consisting of cases, rules, theories, procedures, hierarchies of authority, norms and meta-rules, statutes and codes, constitutional principles, norms of interpretation, rules of criminal and civil procedure, and heuristic (rules of thumb) are considered to be rule-like knowledge. Second, there are different modalities of legal reasoning, for instance, reasoning with cases alone, rules alone, cases and rules together, etc. Third, legal analysis of the facts and circumstances and how they relate to relevant law is based on a variety of task orientations such as advocacy, adjudication, advising, planning and drafting, and administration. Fourth, concepts in law are open-textured - concepts that cannot be defined by necessary and sufficient conditions which are universally valid over their domain of application. Legal concepts, therefore, cannot be

modeled by sound, universally quantified necessary and sufficient conditions. Fifth, legal argument can be viewed as an exercise in competitive theory formation: each side forms its theory using cases and other information that support its desired conclusions while at the same time minimizing, distinguishing, undercutting or avoiding the pitfalls of the opposing theory. Six, law is a very reflective intellectual discipline. It constantly examines and re-examines its underlying methods and missions. Jurisprudence, the philosophy of law, is an active area of study that provides computational models that address how one thinks in legal matters.

Despite the availability and usage of databases and legal document retrieval systems, the legal system is heavily reliant on the richness of expert knowledge which is gained from years of extensive problem solving experience in order to assist the general legal practitioners in analyzing facts and circumstances, tackling open-textured nature of legal concepts, dealing with the different task orientations, and forming arguments and counter arguments (Susskind, 1986; O'Hara, 1994; Popple, 1996).

Jurisprudence supplies the models of law and legal reasoning that are required in the process of developing KBSs in law (Susskind 1987; Adams, 2000; Rissland et al, 2003). It also helps in avoiding problems of legal knowledge representation as it can give a clear picture about what to be represented, how the sources are interpreted and analyzed so as to avoid the distortion of the meaning of a legal term from its original meaning (Ibid). Xing et al (2003) underscore that the amount of knowledge embedded in knowledge–based system critically determines its success.

As Neale (1990) points out a properly built model in KBS development has many benefits : greater efficiency and accuracy of knowledge acquisition; create better understanding between domain experts and the system developers; providing formats for the reasoning strategies in which the domain knowledge is used to solve a particular problem. No decision at all can be offered by the system for problems not explicitly anticipated by the developer without an appropriate modeling (Ibid).

1.2 Statement of the Problem and Justification

The Ethiopian legal system categorizes and identifies its legal subjects as labor law, criminal law, business law, family law, tax law, sale law, contract law, tort law, and so on. However, the growth in number of reported cases creates difficulties on the general legal practitioners to cope with the many legal developments and make timely decisions. Table 1.1 shows the growth of cases from the year 2006 to 2009 in the federal courts (FSCE, 2009).

Year	Number of cases
2006	70991
2007	75283
2008	98913
2009(10 Months)	100058
Total	**345245**

Table 1.1: The growth of cases from the year 2006 to 2009 in federal courts

As presented in Table 1.1, the rate of growth of cases in federal courts on the average is 13% from 2006 to 2009.

As Seifu (2005) argues court congestion and delays in making decisions hamper the efforts of promotion and protection of human and democratic rights. The cases decided by the three federal courts, the adjournment made for deciding a case as well as the number of days, months, and years that cases took for getting the courts' decisions until the end of April, 2009 are summarized in table 1.2.

Table 1.2 depicts that until the end of April, 2009 a total of 100,058 cases was decided by the three federal courts. The number of adjournments made on the average by the Supreme Court is 18,639 to decide 6,213 cases. The high court made 24,394 adjournments to decide 12,197 cases and 244,944 adjournments are made by the first instant courts to decide 81,648 cases. The table also shows the number of days, months, and years that cases took for being disposed by courts. From a total of 6,213 cases decided by the federal Supreme Court, 6% of cases took more than one year, 94% of cases were decided within a year, and 79% of cases were decided in less than

six months. Out of 12,197 cases decided by the federal high courts, 3.92% of cases took more than three years, 20.75% of cases decided were taking more than a year, and 79.24% of cases were decided in less than a year. Lastly, the federal first instant courts made decisions on 81,648 cases where 85% of decided cases took less than a year and 1.75% of cases took more than three years.

Court	No. of Decided Cases	No. of adjournments for a case (Average)	Days, months and years required to decide cases						
			< 30 days	1-2 Months	2-6 Months	6 months to 1year	1-3 years	3-6 years	>6 years
Supreme Court	6213	3	1752	849	2326	911	364	9	2
High Court	12197	2	1736	1389	4002	2538	2054	384	94
First In. court	81648	3	16909	10254	26211	15993	10852	1166	263
Total	100058	8	20397	12492	32539	19442	13270	1559	359

Table 1.2: The number of decided cases and average adjournments per case (FSCE, 2009)

In addition to the increase in size and complexity of legal cases, it is common to see that the justice systems of developing countries have been suffering from critical shortage of expert knowledge, the thing which is most needed for the healthy functioning of a legal system (Getachew, 2004). According to FSCE (2009) the shortage of qualified and experienced manpower is the other problem encountered by federal courts. Currently, there are 138 judges at the federal courts. Out of them, 21 judges are employed in the Supreme Court, 41 judges are in high courts, and the remaining 73 judges are working in the first instant courts. The ratio of judges to cases in the three federal courts are, 1:296, 1:297, and 1:1119 in supreme court, high court, and first instant court respectively. This indicates that within the ten months of the year 2009, 296 cases are decided by one judge in federal Supreme Court, 297 cases are decided by a

judge in the federal high court, and 1,119 cases are decided by one judge in the federal first instant court.

An alternative means of tackling the continual expansion of the statute books as well as the growth in number of reported cases in the face of the scarcely available expert knowledge is demanding to establish a nexus between law and KBS. The connection between law and KBS would give us the system called legal KBS, which is a good repository of critical expertise and distribute that knowledge throughout a legal system. The necessity of KBS becomes apparent when unexpected departures of senior partners from law firms and members of the judiciary are encountered (Hodges, 1990; Giarratano and Riley, 2005). KBS saves the unnecessary cost and time involved in the creation of fully independent and skilled human personnel since it takes several years. Feiler (2004) also supports the idea that the quality of legal decision can be improved by the usage of KBS as it reduces the time wasted in consulting the large volumes of statute books.

There were attempts to develop KBSs for the legal domain within the context of Ethiopian by Ethiopia (2002), Tadele (2005), and Seifu (2005) in the areas of labor law, family law, and criminal law respectively. Ethiopia developed precedent retrieval system for Amharic cases. Tadele and Seifu developed their systems based on the conception that law is a system of rules by ignoring the field's theoretical assumptions about the nature of law and legal reasoning. The result of failing to do so in KBS development would be to send the message that a simple application of written rules taken from statute books determines the content and quality of judicial decisions, the assumption which does not reflect the reality (Martino, 1992; Mcleod 2008).

An examination of factors other than written rules that determine the judicial decisions and their effect on legal KBS construction should be taken into account. Such factors include the following:

- the political, cultural, and religious persuasion of the presiding judge
- a judge's psychological and personality characteristics

However, the limitation of the previous studies to examine factors other than written rules which that determine the judicial decisions and their effect on the development of legal KBS may affect

their credibility in the legal community. The abandonment of the theoretical assumptions about the nature of law and legal reasoning in the development of KBSs, as Leith (1986) argues, result in a rejection of the resulting systems on the basis that they simplify the law to an unacceptable extent that they have little or no value in legal analysis. According to Martino (1992) and Mcleod (2008) the analysis of theoretical assumptions about the nature of law, the legal principles and standards, the rules of interpretation of legal provisions and the techniques of reasoning are highly important to determine not only the process but also the outcome of legal reasoning.

Tort law is the area which draws less attention by legal KBS researchers. In an interview made with Elias Legesse, a judge at the FSCE, tort law adjudication is very complex as the judicial process is mainly characterized by long trials, detailed examination of facts (in making determination of liability, causation, and damages), and careful analysis of arguments. He also indicates that the judicial process in the law of tort greatly requires judicial competence to establish the precise chain of events that lead to an injury, determine the extent of an injury if goes beyond what the defendant might have expected, and resolve complicated economic and non-economic damages in order to decide fair and full compensation to the victim**.**

The aim of this research is therefore to discover factors other than written rules that determine the judicial decision and their effect on the development of legal knowledge-based system for settling tort claims under the Ethiopian law.

1.3 Objective of the Study

1.3.1 General Objective

The general objective of this research is to design a legal knowledge-based system that assists in the legal decision making process. This is achieved by examining the theoretical assumptions about the nature of law and legal reasoning and by exploring the prevailing legal practice of Ethiopia in settling tort claims.

1.3.2 Specific Objectives

The specific objectives of the study include the following:

- Reviewing literature about the contribution of jurisprudential theory in legal knowledge acquisition, representation, and utilization;
- Discovering factors other than written rules that determine the judicial decision and their effect on the development of legal knowledge-based system;
- Conducting interviews and analyzing documents to acquire the procedures, variables and the domain knowledge used in dealing with tort claims;
- Modeling and representing tacit and explicit domain knowledge used in settling tort claims in the real life situation;
- Building a prototype knowledge-based system that assists lawyers and judges in their decision making process;
- Conducting experiment to evaluate the validity of the system and measure its performance;
- Drawing conclusion and forwarding recommendations as a future research direction.

1.4 Methodology

A methodology provides guidelines to be followed by KBS developer in order to facilitate the development processes as well as to ensure the quality of the resulting system (Satzinger et al., 2007). Thus, in order to achieve the above stated objectives, the following procedures, techniques and tools are employed.

1.4.1 Literature Review

In this research, both conceptual and empirical literatures are reviewed. The review of conceptual literature is made with regard to the concepts and theories in the domain area of the study. The review of empirical literature focuses on exploring similar studies conducted earlier in order to learn what others have done and what is left still to be done in the study area and to get an insight into the methods, tools, and approaches employed by others which then leads to an important improvement of the research design.

1.4.2 Knowledge Acquisition Techniques

In order to capture the knowledge, including tacit and explicit knowledge, different techniques are adopted. A series of semi-structured interviews and discussions are made. Observations are also done so as to obtain knowledge when experts apply their practical experience in solving everyday problems. Furthermore, statute books, regulations, working procedures, and journal articles dealing with tort claims are consulted. The domain experts for this research include lawyers, judges, and researchers.

1.4.3 Knowledge Modeling Techniques

CommonKADS modeling technique is employed in order to have a general overview of the judicial decision-making process. Moreover, decision tree modeling technique is used to model all the details important concepts that are used for solving the problem. As Satzinger et al (2007) indicate decision tree modeling technique is best used in situation of complex decision logic that requires multiple decision variables and a large number of possible combinations of those variables need to be considered.

1.4.4 Knowledge Representation

To convert the acquired knowledge into a form suitable for KBS, rule-based knowledge representation method is employed for this research. This method is adopted as it is most commonly used in knowledge-based systems and it is easy for a human expert to read, understand, and maintain. Besides, rule-based is preferable to case-based reasoning in civil law where it is practical in the legal system of Ethiopia (Abebe, 2000; Getachew, 2004).

1.4.5 KBS Design and Implementation Tools

A prototype development approach is used in designing legal KBS for handling tort claims. Prototyping is preferred in order to test and demonstrate the applicability of KBS for tort claim handling. After one or two knowledge acquisition sessions with the expert, a working prototype system is developed. This prototype system can then be used in subsequent knowledge acquisition sessions to determine if there is any missing knowledge or modifications are required.

SWI-prolog (multi-threaded version 5.7.10) programming language is used for the codification of the expert knowledge that has a built-in backward chaining strategy for making inferences. SWI-prolog is chosen for its free availability and featured by flexibility to allow modifications to the knowledge base without any great difficulties and its rich features for developing the desired system. It is also selected due to the researcher knowledge in the area.

1.4.6 Verification and Validation

The knowledge-based system is tested for the features of consistency, redundancy and completeness. To do this, first, a unit testing (or module testing) is undertaken to find out any errors in its code. All individual modules are combined together in the second, integrated testing. Third, the system testing is performed in order to verify that the system is built right.

Artificially developed data that are similar to what users would encounter in the real life situation are used in artificial environment for the purpose of testing the proper manipulation of the knowledge base by the inference engine. The responses obtained from different inputs are verified. Basing the system's query designed for each tort claim, each domain expert is asked about the decision he/she would arrived at. Then, the system is supplied with similar inputs and its outputs are compared with those decided by human experts. In addition to this, a sample of thirteen previously decided cases by the Federal Supreme Court of Ethiopia in the area of tort law are taken and each case is supplied to the system and the results are compared with that of human experts.

1.5 Scope and Limitation of the Study

Due to the complexity and the detailed nature of the Ethiopian tort law and the shortage of time, the scope of this research is limited to the development of a prototype KBS by using rule-based reasoning approach. It doesn't cover all types of faulty conducts proscribed in the Civil Code of Ethiopia. It deals with faulty conducts; namely, physical injury, defamation, professional fault, false imprisonment, product liability, dangerous activities and moral injury.

The prototype system consists of the knowledge base, the inference engine and the user interfaces components. The system focuses on giving advice to judges and lawyers in their decision making process. The system will not make the final judgment. It only provides advice on individual liability, but not on joint liability though there are conditions where cases can be seen in combination before passing decisions and a group of defendants may be declared as liable for a given injury claim. The system also can't determine the exact amount of money to be compensated for a given tort claim. Moreover, the system essentially deduces its conclusions based on pre-programmed rules and information supplied by the user. Due to time limitation, the researcher is unable to integrate learning modules to make the system learn new rules or modify its existing rules by deriving new rules from existing ones.

1.6 Significance of the Study

The result of the study has the following benefits:

- The system can mainly assist lawyers and judges in coming up with proper legal conclusions or preparing legal arguments for tort claims.
- It provides the general legal practitioners with the possibility of overcoming difficulties resulting from intense specialization in law.
- It will be a good source of information for legal KBS developer regarding the nature of law and legal reasoning.
- It also serves as a guide to anyone interesting in the further improvement of the study area.

1.7 Organization of the Thesis

This study is organized into six chapters. The first chapter deals with introduction, which contains the background, problems and justifications of the study, objectives, methodologies employed, scope and limitation of the study and its significance. Review of literature is made in the second chapter that gives a comprehensive view on KBSs in general and legal KBSs in particular. Related works done by other researchers are also highlighted under this chapter to present the status and usage of KBS in legal system. The third chapter deals with legal systems and jurisprudence which illustrates the major types of legal systems, the notable legal theories,

the nature of legal reasoning, interpretation of statutes, and the law of tort under the Ethiopian legal system and jurisprudence and judicial decisions in Ethiopian courts. The sources of knowledge, the techniques adopted in eliciting the necessary knowledge from domain experts and other sources, and the modeling techniques employed in the conceptualization of the elicited knowledge are explained in the fourth chapter. The fifth chapter deals with implementation and performance evaluation which gives detailed explanations about the architecture of the system, the knowledge representation, testing, and evaluation of the performance of the prototype system. The last chapter illustrates conclusion and recommendations for future studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Knowledge-Based System: A Technical Overview

There are various definitions for knowledge-based systems given in the KBS literature. O'Hara (1994) defines a knowledge-based system as a computer system that attempts to store and organize a great deal of knowledge in a specific domain area to enable users solve problems and make logical inferences. Contento et al (1995) define a knowledge-based system as computer programs rich in facts, relations, and procedures and plans to support human decision-making. Xing et al (2003) describe a knowledge-based system as an interactive computer-based decision making tool that utilizes both factual and heuristic knowledge extracted from domain experts using various techniques for solving problems.

From the foregoing definitions, one can see that, KBSs differ significantly from conventional computer programs. Conventional computer programs deal primarily with quantitative data and are based on algorithms or mathematical formulas and sequential procedures that lead to a solution using data to solve problems (Glover, 1994; Seilheimer, 1988). On the other hand, knowledge-based systems target on solving problems that do not have a traditional algorithmic solution by implementing the heuristic human reasoning through specific techniques, procedures and mechanisms (Avram, 2005).

2.1.1 Components of a Knowledge-Based System

As shown in figure 2.1, a typical knowledge-based system comprises of four basic components: knowledge base, inference engine, explanation facility and user interface (Yurcik, 2002). The knowledge base, the heart of the KBS, contains the facts, rules, and other knowledge about the domain required to solve a problem (Waterman, 1985; Saleem and Azad, 1992; O'hara, 1994). Apart from storing information about the subject domain, the knowledge–base contains symbolic representation of expert's knowledge, definitions of domain terms, interconnections of component entities, and cause-effect relationships between these components (Greinke, 1994).

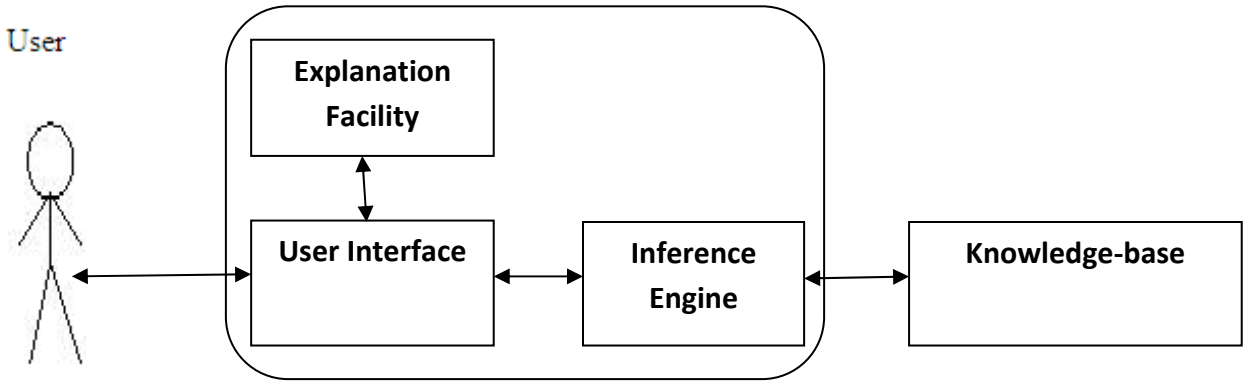

Figure 2.1: The Basic Structure of a Knowledge-Based System

Saleem and Azad (1992) conclude that the knowledge base contains both factual and heuristic knowledge. In the eyes of these authors, the factual knowledge is that knowledge of the task domain that is widely shared, typically found in textbooks or journals, and commonly agreed upon by those knowledgeable in the particular field. On the other hand, heuristic knowledge is the less rigorous, more empirical, more judgmental knowledge of performance. In contrast to factual knowledge, heuristic knowledge is rarely discussed, and is largely individualistic. It is the knowledge of good practice, good judgment, and plausible reasoning in the field. As Glover (1994) argues the knowledge represented in the knowledge base tends to be the heuristic, consisting of informal rules of thumb that more often lead to a recommendation or a best guess rather than leading to conclusions with absolute certainty.

The explanation facility explains the system's reasoning to the user. It illustrates to the user *how* and *why* a particular solution was generated and makes a user confident on the conclusion and the knowledge-based system.

The inference engine, on the other hand, is responsible for making inferences by deciding which rules (within the knowledge base) are satisfied by facts or objects, prioritizes the satisfied rules and then executes the rules with the highest priority (Saleem and Azad, 1992; Giarratano and Riley, 2005).

Pau et al (1989) and Saleem and Azad (1992) identify, three major inference engine reasoning methods: forward chaining, backward chaining, and a combination of forward chaining and backward chaining. The forward chaining, a data driven method, can work forward through a

problem from an initial set of conditions to a specific goal (Duchessi et. al., 1988; Saleem and Azad, 1992; Giarratano and Riley, 2005). As Walls (1989) explains, forward chaining reasoning method knows the ***why*** (premise or condition) and wants to find the **what** (conclusion or action), i.e. the cause is known but the effect is looked for. The backward chaining or a goal-drive method, works backward from a goal to a set of premises that support the pre-defined goal (Duchessi et. al., 1988; Saleem and Azad, 1992; Giarratano and Riley, 2005). In other words, in backward reasoning, the effect is known earlier but seeking for the cause (Walls 1989). Some KBSs incorporate both forward and backward chaining strategies to analyze complex problems (Duchessi et. al., 1988; Saleem and Azad, 1992; Walls, 1989).

The user interface component allows the user to communicate with the KBS during reasoning and after conclusion. The user interface questions, presents menu driven choices, and communicates to the user the answer or solution once it has been found (Duchessi et. al., 1988; Saleem and Azad, 1992; Giarratano and Riley, 2005).

2.1.2 Knowledge-Based System Development Methodologies

Similar to the development of any other software systems, a methodological approach is essential for KBS design and implementation (Avram, 2005). During the past periods, the building of knowledge-based systems was mainly done by transferring the knowledge of one or more experts (Studer et al 1998). However, KBS development is currently becoming a modeling activity where many of its development methodologies emphasize the use of models (Neale, 1990; O'Hara, 1994; Avram, 2005). Schreiber et al (1999) further strengthen this idea as a KBS involves methods and techniques for knowledge acquisition, modeling, representation and use of knowledge. As Studer et al (1998) argue the shift towards modeling approach in KBS construction is mainly because it enabled knowledge to be re-used in different areas of one domain. The adoption of modeling approach for building knowledge-based systems has number of benefits such as better project control, facilitating communication among participants, more accurate validation and easier maintenance of a system (Neale, 1990). Knowledge model in KBS construction provides formats for writing down both static domain knowledge (rules, classes, relations) and the reasoning strategies used to solve a particular problem (O'Hara, 1994).

As O'Hara indicates, the development of KBSs is increasingly becoming an incremental process, with an associated life cycle. This life cycle will be made up of various stages, each of which is resulted in a deliverable—either a document (e.g. requirements specification) or a piece of software (e.g. prototype)—that can be evaluated. KBS development should be seen as a process of model refinement (O'Hara, 1994), as shown in Figure 2.2.

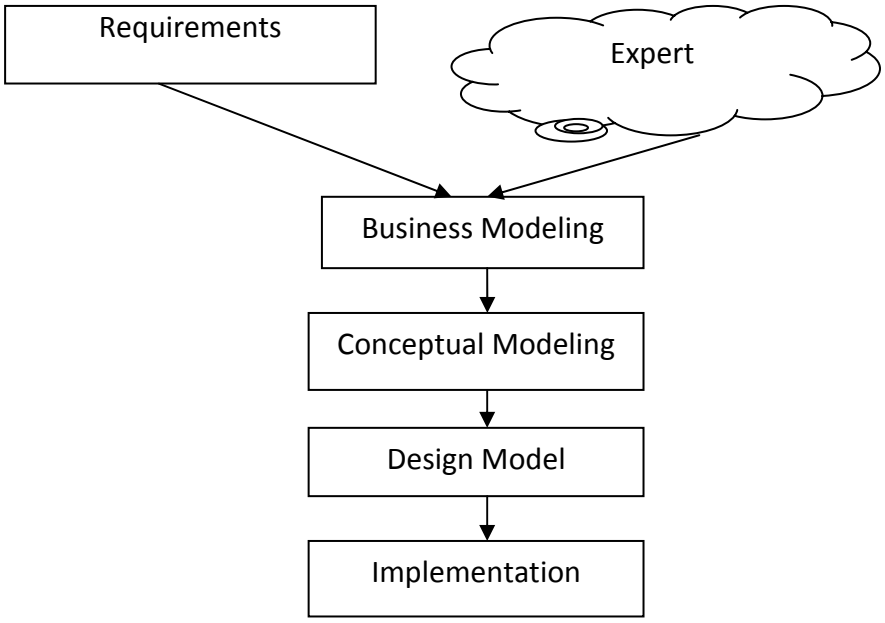

Figure 2.2: KBS Development as Model Refinement (O'Hara, 1994)

2.1.3 Stages in KBS Development

According to O'Hara (1994) and Avram (2005), the stages in KBS development are: business modeling, conceptual modeling, model design and implementation.

2.1.3.1 Business Modeling

Business Modeling models business processes and provides a description of the overall context in which the knowledge model must function (Akkermans et al, 1999 and Schreiber et al, 2000). In other words, business modeling facilitates the analysis of the actual needs of knowledge intensive applications and provides a first inventory of the knowledge that needs to be modeled. Interview techniques and analysis of various documents can be used to fill the model. Business modeling has two parts, namely: business model and system context model (Ibid). The business

model is usually descriptive, using plain text, organization diagrams as well as notations for general business processes. According to Akkermans et al (1999) and Schreiber et al (2000) the description of a business model typically includes the following:

- Problems and opportunities in a wider organizational context;
- Potential solutions to the problems and opportunities;
- System context model;
- Layout of the relevant business processes (for example by a flow diagram);
- People involved, including knowledge providers and knowledge users;
- Knowledge, a valuable resource exploited in the business processes;
- A broken down business processes into smaller tasks. The focus of KBS should be on a specific task. Tasks descriptions include people who carry out the task, business relevance, knowledge intensity, and knowledge assets; and
- A description of knowledge asset that needs to be exploited including its custodian, importance, content, representation and management.

The second part of a business modeling is a system context model that is limited to describe only the direct interaction between a system (knowledge- intensive) and its environment. This model is required for every application. There are various techniques of choice for specifying a system context model such as the UML use case diagram (Jacobson et al. 1999).

2.1.3.2 Conceptual Modeling

Conceptual modeling is the modeling of the expertise that would be needed to perform the tasks specified in the user requirements (O'Hara, 1994). It makes a clear distinction of facts, physical objects, concepts of the domain, as well as relations among them (Contento et al, 1995). Currently, there exist so many conceptual modeling techniques which are intended to model the expertise required to do the job of the target KBS. These include CommonKADS (Schreiber et al. 2000), MIKE (Angele et al 1998), and Protégé (Tu et al 1995). CommonKADS is a structured way of developing knowledge-based systems developed as an alternative to an evolutionary approach and is now accepted as the European standard for knowledge based systems. As

depicted in figure 2.3, in CommonKADS, a model of expertise is structured into 4 layers: the domain layer, the inference layer, the task layer and the strategy layer.

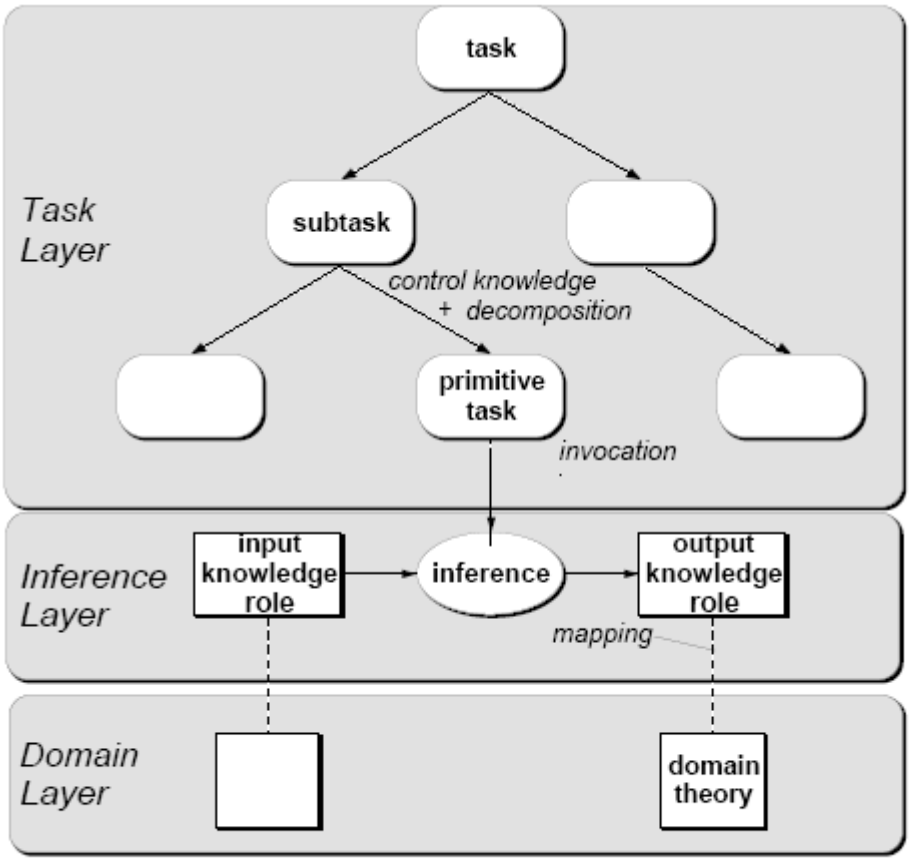

Figure 2.3 The structure of CommonKADS Conceptual Model(Fensel et al 1998)

As O'Hara (1994) and Neale (1990) indicate, the CommonKADS conceptual model effectively divides the control knowledge (the knowledge about what to do when) into three. Hence the first layer, the *domain layer*, is simply the domain knowledge, and contains the static knowledge of the domain objects and their interrelations. The second layer is the *inference layer*, and specifies the basic inferences made by the experts in problem solving; these inferences can be grouped together in an inference structure. The *task layer* is the third layer, and which contains the knowledge about how these basic inferences are grouped together to achieve goals. The fourth layer, the *strategy layer* contains the knowledge about how to configure a set of goals to solve a large-scale problem. However, there is no principled distinction between the task and strategic layers and many models will not have a strategic layer at all (Ibid).

Getting the knowledge out of the expert and moving it into the conceptual model is done through the knowledge acquisition process. The knowledge necessary for problem solving in the application domain is collected from human experts (through interview or questionnaire techniques) or from other sources like books, reports, handbooks, and internal memoranda (Popple, 1996). The task of knowledge acquisition is regarded as the main bottleneck in KBS development because getting experts articulate their intuition in terms of a systematic process of reasoning is difficult (Greinke, 1994; Nikolopoulos, 1997).

2.1.3.3 Model Design

It is a plan for the implementation of the KBS. It shows how the conceptual model can be incorporated into a computer (Grogono, 1993). At this stage, the conceptual model is then transformed into a design model, which is a model of the final KBS (O'Hara, 1994; Contento et al, 1995). The deliverable and outcome of the model design stage is an architecture which describes the physical components of the system in terms of its function and structure (Contento et al, 1995). It also depicts the knowledge representation techniques that are used to map real world objects to a form suitable to be coded in a computer (Ibid). Knowledge representation is the way of storing and organizing knowledge in a computer in a form convenient for KBS (O'Hara, 1994).

There are many different computational methods available for representing knowledge internally, such as rule-based, case-based and hybrid (a combination of rule based and case based) (Popple, 1996). Hembry (1992) and Alter (2002) define rule-based system as an AI program that has a large number of interconnected and nested IF-THEN statements, or rules that are the basis for drawing conclusions when some condition is true in the knowledge base. In a case-based system, on the other hand, cases or examples are stored in the knowledge base and the system makes conclusions by matching the closest similar case in its knowledge base when a new case is given to it (Seifu, 2005). As the name indicates a Hybrid system employs both rule-based and case-based methods. The design model is then transformed into the final implementation.

2.1.3.4 Implementation

Though the knowledge base reflects the domain expertise of one or more human experts, the expertise may be imperfect or with errors (Grogono et al, 1993). Some of the possible errors in the knowledge base may include incorrect rules, looping indefinitely when rules are fired, occurrences of redundant rules and making no inferences from the environment (Ibid). Therefore, during the implementation stage, it is highly recommended that the Knowledge base has to be verified, validated and evaluated properly (O'Keefe et al, 1987; Grogono et al, 1993; Logi and Ritchie, 1997).

According to Grogono et al (1993) and O'Hhara (1994), verification deals with internal inconsistency and completeness checks and examining for the technical correctness of the knowledge base. As O'Hara (1994) indicates verification ascertains whether the program actually fulfils its internal requirements.

After the verification of the knowledge base, validation of the KBS should be accomplished. Validation is an extensive examination of the knowledge and decision-making capabilities of the KBS (O'Learly, 1988). Grogono et al (1993) and O'Hhara (1994) discuss validation as the process of ensuring that the completed KBS performs the functions in the requirements specification and is usable for the intended tasks.

As Grogono et al (1993) indicate the validation of the knowledge base can be done by two methods: laboratory validation and field validation. In laboratory validation, the performance of the KBS is measured in an artificial environment by supplying the system with developers' test cases in place of actual users. The output of the system is then evaluated, and if it is unacceptable, the system is refined until it is satisfactory. In the case of field validation, a controlled field study is conducted with actual users and real or synthetic problem cases once the acceptability of the system is determined in the laboratory.

Evaluation of the KBS is required at last in order to determine whether the system actually performs its intended task or not (Grogono et al 1993; O'Hara, 1994). As O'Hara argues, evaluation is not only related to the outcomes of verification and validation but also involves in

examining whether the KBS's user interface is any good, or whether the KBS will take forever to make its inferences, or whether the system explains its decisions sufficiently and clearly, or whether the output is understandable (i.e. is it explanatory?) by someone who has no knowledge of computers.

The evaluation of the KBS as valuable is reflected by the acceptance of the system by its end users and the performance of the system in its application. Even if defining a standard against which to judge the acceptability of the system is difficult, two standard approaches like gold standard and agreement method can be used for tackling the problem (Grogono et al 1993). According to Grogono et al, the gold standard is set simply by defining a generally-accepted correct response for each test case. Then the determination of output of the system matches the gold standard or not is performed. An agreement method, on the other hand, is employed when there is no gold standard. The performance of the system is compared with that of other performers (human experts), and the system is deemed to be acceptable if it agrees closely with the other performers.

2.1.4 KBS Development Tools

A KBS practitioner devised software development tools to aid the construction of the system. Today, there are two ways of building a KBS (Saleem and Azad, 1992; Giarratano and Riley, 2005). The first option is developing from scratch using any of the common programming languages, such as LISP, PROLOG, and C programming languages. These languages can address highly complex problems and provide a great deal of flexibility. However, the use of programming languages can be a complex process which may involve special programmers, special operating environments, extensive hardware, extended development time, and high cost (Epp, 1988). The other KBS development option is the usage of a piece of development software known as a tool or a shell, for example, Crystals, Jess, CLIPS, BABYLON, EXSYS professional, VBExpert etc. (Nikolopoulos, 1997; Giarratano and Riley, 2005). Developing KBSs by using shells offers significant advantages and can be very inexpensive, easy to program, and reduce the development time (Teft, 1989).

2.2 Legal Knowledge-Based Systems

Under this sub-topic, the different knowledge and skills needed in solving legal problems and the application areas of KBS in the domain of law are explained.

2.2.1 Legal Knowledge and Expert Skills

The design of legal KBS requires a thorough understanding of an expert in the area exhibits expert knowledge and expert skills. In light of this, Greenleaf (1989) describes the legal knowledge and skills a lawyer must possess so as to carryout his/her work successfully. These knowledge and skills are general domain knowledge, formal knowledge, logical reasoning, interpretative skills, research skills, organizational skills, strategic skills, communication skills, and real world knowledge. Greenleaf briefs each knowledge and skill as follows:

- **General Domain Knowledge-** this is the knowledge of the general structure of the legal system that allows a lawyer to recognize when a problem falls outside of his or her normal area of competence.
- **Formal Knowledge-** is the knowledge of the content of the relevant formal sources of law in the field such as legislation or case law.
- **Logical Reasoning-** in order to arrive at a certain argument, a lawyer is expected to have the knowledge of the different reasoning techniques such as deductive and analogical reasoning.
- **Interpretative Skills-**at least three types of overlapping interpretative skills are essential to a lawyer to facilitate the reasoning task. These skills include:
    - Statutory interpretation;
    - The interpretation of cases in terms of their place and significance in the system of precedent; and
    - Instantiation, the ability to apply statute or case law to the facts of the problem at hand.
- **Research Skills-**the retrieval of relevant statute and case law and obtaining expert opinions and marshaling evidence is considered to be a lawyer's research skills.

- **Organizational Skills**-these skills are the detailed knowledge of the practical operation of the organizational systems (courts, registries, document exchanges etc) as well as the establishment of organizational structures within the lawyer's workplace.
- **Strategic Skills**-these skills are the knowledge that allows a lawyer to offer strategic advice (can't be obtained from the formal sources) to his/her clients irrespective of its relationship to the arguments that a lawyer would present to a court.
- **Communication Skills**- are very important to a lawyer due to the persuasive or rhetorical nature of legal reasoning. Moreover, these skills allow a lawyer to extract the factual raw material of a legal problem through dialogue with clients and to frame relevant questions in a comprehensive and clear manner.
- **Real World Knowledge**- this is the last but not the least type of knowledge which is highly important in assisting the solution of legal problems as law can't be understood independently of the knowledge about particular areas of human conduct.

2.2.2 Applications of KBSs in Legal Practice

There are at least five major categories of KBS applications to law (Greenleaf, 1989). These are formal advisory systems, strategic advisory systems, automatic document generators, intelligent litigation/ transaction support systems, and conceptual retrieval systems. The detailed explanations given by Greenleaf are summarized and presented here in after.

- **Formal Advisory Systems**- these systems are aimed at simulating the formal legal reasoning processes to produce advice on a question of law being supported by arguments which would get acceptance by the court. Such systems are highly expected to incorporate at least general domain knowledge, formal knowledge, reasoning skills, interpretive skills, and real world knowledge.
- **Strategic Advisory Systems-** these systems attempt to simulate the weighing of formal and informal factors that are to be taken into consideration by a lawyer in order to provide advice to a client on settling damage claim by proposing a suitable amount. In the design and development of strategic advisory systems, it is advisable to capture aspects of the informal, strategic knowledge of a lawyer, and detailed real world knowledge besides the capturing of the knowledge and skills required to develop a formal advisory system. Typical examples of such systems are SAL (System for Asbestos Litigation) which

advices on the settlement of asbestosis claim insulators and LDS (Legal Decision Making System) which advices on likely settlement figures for product liability cases.

- **Automatic Document Generators-** the primary purpose of these systems is to capture the expertise of experienced practitioners in a drafting of a particular document, in the form of a template of a type of a document.
- **Intelligent litigation/ transaction support systems-** systems that assist in all the stages of the management of a specific piece of litigation or a transaction are known to be intelligent litigation/ transaction support systems. The main tasks of these systems are automatic calculation of deadlines, generation of action reminders, and sequencing of documents. In constructing these types of systems, it is necessary to capture a lawyer's organizational skills, strategic skills, and interpretative skills.
- **Conceptual retrieval systems-** these category of systems attempt to model the relationships between legal terms in a specific area of law to help interpret semantically the requested terms of a user to retrieve other conceptually related terms. Thus, the retrieval of legal information assists legal practitioners in arriving at their conclusion in a reduced time and cost. The required knowledge and skills that are to be captured for the development of such systems are formal knowledge and interpretive skills in a detailed fashion. LEXIS, SCALE, and INFO1 are best examples of conceptual retrieval systems (Greinke, 1994).

2.3 Related Research Works

The works done that apply a knowledge-based system in the area of law uses either rule-based, case-based, or a hybrid approach. In a rule-based approach, the rule set that represents the experts' knowledge contains rules in the form of premise-action pairs. Case-based reasoning is a process where the outcome is predicted based upon a comparison between the present case and the cases in the case-base (Feiler, 2004). Obviously, case based systems are preferred by researchers in common law systems where each and every case decided by the court becomes a part of the law itself countries (Ibid). The hybrid approach combines the rule-based and the case based methods. Here under it is tried to review related works which are conducted in the legal domain.

Buchman and Headrink proposed the first rule based legal expert system in 1970 (Popple, 1996). Popple identifies Popp & Schlink's system, Michaeleson & Michiel's TAXADVISOR system, Meldman's systems, Waterman & Peterson's LDS system, Bring's SARA systems, and SoftLaw's STATUATE as early legal expert systems projects along with their major distinguishing features, such as:

- Lawyers applied complex sets of rules without having a clear understanding of the rules themselves and they have no speculation on how to carry on their work as well;
- Rules are used to represent legal knowledge and norms;
- The works lack deep model of the legal processes;
- Some of the projects are developed without any legal theoretical justification;
- Computer scientists and lawyers were wrongly believed that each has the others discipline;
- No indication of the knowledge acquisition techniques employed.

The most important of rule-based legal expert systems are the works of McCarty (1980), Bench-Capon et al (1988), Gardner (1987) and Susskind (1987). Below are given an explicit discussion for works focused on rule-based legal expert systems.!

According to Susskind (1986), McCarty's TAXMAN Project was initiated in 1972 and which later involving both TAXMAN II and I. McCarty (1980) employed a theorem-proving approach to legal reasoning with issues in corporate tax. His basic assumption was a computer-based legal consultation system must able to represent the facts at some comfortable level of abstraction, and the law that would consist of a system of concepts and rules. According to him, legal analysis is a process of applying the law to the facts. He supports a positivist approach to law- the law is a system of rules. In his findings, the task of representing facts in a computer-based legal consultation system is more problematic due to the complexity of facts of a legal case as it involves, human beliefs, actions, intentions, and motivations, etc. Although McCarty's work is seen as a significance advance in the area, it has the following limitations (Ashley 1990):

- It focuses on representing knowledge without stating a control or process model that clarifies how a legal argument is actually generated.

- Being advocates of positivist theory, the definition of legal primitives given by him is without any awareness about the nature of the legal enterprise.

Bench-Capon et al (1988) designed a rule-based system by using PRoLOG programming language to model statutes. The authors mainly concentrated on knowledge acquisition with the assertion that the statute law can be represented using the PR0LOG clause without expertise requirement as it already formulated and written down; however, eliciting knowledge from the subconscious of an expert is regarded as the main bottleneck. The assertion made by Bench-Capon et al (1988) is strongly criticized by Moles (1991) as the researchers failing to distinguish between the written legislation and the meaning of the writing. Moles contends that interpretation skills are required to avoid the possible distortion of meanings of legal terms. The other limitation of the work of Bench-Capon et al, as Moles points out they have no appreciation for an expert's advice in the process of interpretation. Thus, expert advice will have implications on the methods to be employed and the way in which the knowledge is structured.

The works of Gardner (1987), on the other hand, focused on the problem of what happens when the rules run out particularly due to the inherent open-textured nature of legal concepts and problems involving the relationship between technical and common sense meaning of words.
Gardner develops a rule-based model of case law (offer and acceptance). Although the author is cognizant of the fact that an area based on statute might seem easier for Artificial Intelligence programs to handle, she asserts that statutory interpretation raises a problem by adding a layer of complication instead of removing one. Therefore, the reverse, case law must also be taken into account in statutory areas.

Gardner's system has four different levels. The first level is the network level which represents legal states and events. The second rule level is a set of rules consisting of definitions of the major concepts in the law of offer and acceptance and operating on objects at the first level. The third level is a set of examples explaining those predicates in the rule level that are undefined, but whose resolution is clear; this includes (non-legal) common sense knowledge. In general, the first three levels are aimed at identifying the easy questions (cases having clear meanings) and resolve them. The fourth (unimplemented) level intended to deal with the hard questions (hard cases).

Her work strived to achieve a principled computational model that differentiates hard and easy cases (Rissland et al., 2003). Nevertheless, the following are identified as the limitation Gardner's system.

- Though Gardner's program evaluated case-based arguments, the way cases are represented in reality is not indicated (Ashley, 1990).
- Generalizing of her idea and its applicability is far more expensive and doubtful in other branch of law (Susskind, 1990).
- Since she adopted the (American) realist approach, it appears to make the AI paradigm of rule-based expert systems inappropriate if legal realism is taken as right. According to legal realism it is not general rules, but individual decisions that have authoritative status as law (Popple, 1996).

Susskind (1987) chose the Scottish Law of divorce for an experimental legal domain in the development of the first legal expert system. Susskind strongly recommends the importance of jurisprudence to the development of legal expert systems as it supplies the models of law and legal reasoning that are required for computerized implementation in the process of building all expert systems in law. He employed the positivist approach to law, that is; law is a system of rules.

According to Susskind, legal cases are identified as clear and hard. With clear cases it is possible to make legal conclusions on the basis of literal interpretations of the formal legal sources. Thus, the clear cases can and should be represented using rules. On the other hand, hard cases are difficult to represent with rules. Thus, Susskind recommends that other methods are required to represent cases which are not clear: methods reasoning with uncertainty and drawing probabilistically phased conclusions. Legal realists criticize the positivist approach adopted by Susskind to law since it assumes law as a system of rules.

There is also a rule-based woman legal advisory expert system (WOLA) developed domestically by Tadele (2005). WOLA is developed based on the revised family code and the labor law of Ethiopia. He adopted knowledge pro Gold Version 3 shell for the development of the system. The required knowledge for designing the system is gathered from the primary sources (the revised family code and the labor law). A hierarchical tree structure is used to model the concepts needed in women advisory service. The elicited knowledge is structured into three

components: family related, labor related, and others. The knowledge is then represented using production rules, in IF-THEN format. For the application of knowledge, a windows based graphical user interface was employed by him.

Tadele noted that the challenge in designing legal expert system is the open-textured nature of legal concepts. The problem is made resolved with the discussion of lawyers, as the researcher points out. However, Tadele didn't mention what is meant by open-textured nature of legal concepts and he didn't explore the different approaches to resolve this problem, if any are available.

He made the validation of the prototype system (WOLA) by providing cases to four experts who have been engaging in women legal advisory services. Two experts were given the developed prototype expert system and the remaining two experts are made without the system. The human experts who used the system confirmed that the system is faster and provides quick access to the required rules from the legal codes. In his evaluation, the performance of the system is promising and encouraging with regard to the application of expert system to women legal advisory services. Though, validating the performance of the system is highly required, the size and the nature of test cases are not mentioned in the work of Tadele.

He eventually, proposed issues as future research directions: the exploration of systems on their applicability in other parts of a society like children and criminals and case-based expert systems to women legal advisory provision.

There are also case-based reasoning legal expert systems developed in the area of common law. The most important examples include FINDER, HYPO and SYSTER (Popple, 1996). Basing the detailed literature review made by Popple, the summary of the main points for each of the three case-based systems are given the following section.

FINDER provides advice on the law of trover—the law concerning the rights of the finders of lost chattels (Popple, 1996). According to Popple, the leading trover cases and a set of attributes that were of legal significance in those cases are stored in a database. FINDER has a vector of attribute values that represents the relevant facts of that case. Each attribute value (yes or no) answers the corresponding attribute's question for that case. The user gives the relevant facts of the instant case to the system by responding yes or no answer to each of the attribute questions.

A weight is assigned by the system to each attribute (equal to the inverse of the variance of the values of that attribute across all the cases) to find the weighted Euclidean distance between the instant case and each of the leading cases. In order to build an argument about the likely result in the instant case, the system uses the nearest case, and the nearest case with the opposite result.

HYPO system makes use of theories in building its arguments. It is built with the aim of building a working model of making reasonable arguments in law. Even though HYPO is a sophisticated case-based system, it has some limitations. First, the complicated structure for knowledge representation makes the knowledge acquisition is difficult. Second, HYPO was developed and tested using only one domain (i.e., American trade secrets law) despite the fact that it was designed based on a general theory. Third, the applicability of the model in other domains has not been demonstrated (Popple, 1996).

SHYSTER case-based system is developed by Popple (1996) by adopting a pragmatic approach, which models the practical experience of lawyers. According to popple, the system stores knowledge of cases in fact-vectors where each fact is represented by a yes, no or unknown value in the vector. The SHYSTER asks questions when the user interacts with it so as to establish the values for each fact in the vector. Then it compares the fact-vector for the case supplied by the user with the decided cases that are in its case-base during the conclusion of the questioning. This comparison is made by the system by way of a nearest-neighbor analysis in the *n*-dimensional space that the fact vectors sit in. Upon the determination of the closest cases, a report that explains why particular cases are used to reach the conclusion and what the result of the application of those cases would be is generated.

When we come to see the works conducted locally, the use of cased-based reasoning approach is not reported. However, there is a study conducted by Ethiopia (2002) focusing on the retrieval of relevant previously decided legal case(s) similar to the case at hand. CBR-works shell/tool is adopted for the design of precedent retrieval system for Amharic legal cases. Interviews and reviews of legal cases were the knowledge acquisition techniques employed by the researcher. A sample of 39 labor cases was taken from the Federal Supreme Court of Ethiopia for the analysis and extraction of important features. The performance of the system was evaluated by taking testing parameters including the relevance of the information retrieved (how suitable the precedent is to the case at hand), the relevance of the fields (Attributes) in the case structure and

the ease of use of the system, in terms of the entry forms layout and level of detail. Then two experimental groups are formed from the actual users to test the system. In her report, in the first experimental group, all the cases indicated in the case/query relevance judgment table were retrieved (recall average is 100%) for every run. However, the precision was 13.56%. In the case of the second experimental group, the average of recall was 95.05%, with average precision 82%. The development of formal legal ontology and their use in knowledge-based systems is recommended by the researcher as a direction for future research.

As mentioned earlier, a hybrid legal KBS is the one which combines more than one method of reasoning in order to solve a legal problem. CABARET and PROLEXS are the two popular methods mixing rule-based reasoning and case-based reasoning (Popple, 1996). As Popple indicates, CABARET deals with a small area of US taxation law, home office deductions. It has a case knowledge base of 23 litigated and six hypothetical cases. Besides, CABARET has an index knowledge base of 14 dimensions that is based on precedents, scholarly legal analysis and commercial taxation materials. The rule base consists of ten home office deduction rules along with some production rules from reading cases and tax service treatises. PROLEXS is a Dutch expert legal system, focused on the domain of landlord-tenant law in a Dutch legal system. PROLEXS used four knowledge groups: legislation, legal doctrine, expert knowledge and case law. The reasoning method used on each of the four areas differs. The legislation knowledge used a rule-based reasoning. A case-based reasoning is adopted for the case law knowledge. A blackboard is used for the other areas of knowledge. The rule-based reasoning for the legislation is both forward and backward chaining. In short, in PROLEXS, cases are reasoned with case-based reasoning; statutes are reasoned with rule-based reasoning.

There is one study conducted by Seifu (2005) adopting a hybrid approach which combines rule-based and artificial neural network methods within the context of Ethiopian law. The theme of the study undertaken by Seifu was to design a prototype legal advisory expert system on criminal cases under Ethiopian law. Seifu used semi-structured interviews and review of penal codes as knowledge acquisition techniques to acquire the necessary knowledge. In addition, knowledge Pro Gold (version 3) tool was used for the design of the system; hierarchical tree modeling techniques and a backward chaining strategy were employed for the study.

One hundred previously decided criminal cases were collected and analyzed by Seifu in order to select only accused was found guilty to train the neural network. The outputs of the rule-based module of the prototype system were used as an input for the neural network to predict the number of years of imprisonment of an accused person. Seifu had done separate testing for the rule-based and the artificial neural network. To do so, four cases that are decided earlier were used to test the performance of his system. In his evaluation, the performance of the neural network module of the system was not as accurate as it is expected, but to be improved in the near future by other researcher.

To summarize, the different researchers emphasized much more on the conception that the inferential power of legal KBSs depends on the methods and techniques used in making legal inferences. Moreover, factors other than written rules that determine the judicial decision and their effect on the development of legal KBS are not investigated by local researchers. Therefore, in the present work, a close examination of the ruling theories which has effect on the construction of legal KBS has been considered. Having a clear picture of the nature of law and legal reasoning, a KBS developer able to elicit the necessary knowledge from domain experts, avoid the possible mistakes in representing the legal knowledge and get an insight on how legal knowledge is utilized.

CHAPTER THREE

LEGAL SYSTEM AND JURISPRUDENCE

3.1 Legal Systems

Legal system refers to the collection or summation of legal rules, legal principles, legal standards or legal policies operating in a given geographical area (Bodenheimer, 2004). According to Calverley (2008), the legal system is viewed as a repository of knowledge in the sense that it is a formal accumulation of practical judgments. According to McCoubrey and White (1999), the specific system, where a country is ruled by, is often determined by its history, connection with other countries, or its adherence to international standards (McCoubrey and White, 1999).

In general, the major legal systems can be: common law, civil or code law, customary law, religious law, and mixed law (Adams, 2000).

- **Common law-** this law is best known as judge–made or judge-declared law since it resides on judicial decisions (or on the notion of precedent) rather than rules (Cotterrell, 2003).
- **Civil or code law-** its primary characteristic is the codification of law and heavily reliance on legislation as the primary source of law. It governs private disputes between parties over property, business transactions, accidents and injuries, and so on. An elected, legislative body of a local government enacts this type of law.
- **Customary law**- reflects society's norms and values based on wisdom and traditions. Customs have created legitimate social contracts that are legally enforceable. Most countries that use customary law pair it with another type of legal system.
- **Religious law**- in this sort of legal system, law is not considered as a man-made, but is decreed by divine will. Some systems have codified this type of law (e.g., the Sharia in traditional Islamic law). Jurists and clerics play a central role and have a high degree of authority within the society.
- **Mixed law-** it is the mixture of two or more systems of law. It is becoming increasingly common as the world is more globalized. Traditional mix is common law plus code law; but religious law plus code law/common law is becoming more common.

Legal systems include hierarchies of the various types of laws indicated above. For example, the constitution prevails over statutes, statutes prevail over court-made rules, state statutes prevail over local ordinances as well as a hierarchical system of courts with varying degrees of authority where appellate courts can review and prevail over trial courts, (Rissland et al., 2003). In other words, a mature legal system is characterized by a definite relationship between constitution-maker, legislator, administrator, judge, and private legal subjects (Friedmann, 2003).

3. 2 Jurisprudence

Jurisprudence is defined as the science dealing with the rules and principles of human law (written and unwritten) that have been adopted for the government of an organized society (McCoubrey and White, 1999; Stevens, 2008).

The purpose of jurisprudence is to provide practitioners of law with a deeper understanding about the nature of law, legal reasoning, legal systems, and legal institutions in order to avoid the distortion of law (McCoubrey and White, 1999; Mcleod, 2008).

There are three main aspects where jurisprudence have developed; namely natural law, analytic jurisprudence, and normative jurisprudence (Ibid). The doctrine of natural law is that there are unchangeable laws of nature which govern us, and that our laws and institutions should try to align with this natural law. The most important questions of Analytic jurisprudence are "What is law?" or “What is law about?” “What are its purposes?”,"What are the criteria for legal validity?”, “What is the relationship between law and power/sociology?” and "What is the relationship between law and morality?”. Finally, normative jurisprudence asks question like what law ought to be. This idea overlaps with both moral and political philosophy and includes questions of whether one ought to obey the law, on what grounds law-breakers might properly be punished, the proper uses and limits of regulation, and as to how the judiciary should reaches its judgments.

3.3 Notable Legal Theories

There are a number of notable legal theories; the key once are discussed below.

3.3.1 Natural Law Theories

As Mcleod (2008) indicates natural law is closely associated with morality, which is set of norms governing the good life; governing how we should live as a society and/or how as an individual. Therefore, natural law theories are normative because they deal with what law ought to be (Ibid). Natural law theory strongly asserts that there are laws that are immanent in nature, to which enacted laws should correspond as closely as possible. The key natural law theorists, according to Mcleod, are Aristotle, Thomas Aquinas, Thomas Hobbes, Rousseau, Kant, Lon Fuller, and John Finnis.

3.3.2 Positivist Theories

According to the positivist theories law is best understood as a system of orders, commands, or rules enforced by powers (McCoubrey and White, 1999; Adams, 2000; Mcleod, 2008). For the positivist, law is purely human product (or artificial) not natural which has been made, enacted, or laid down in accordance with socially accepted rules by humans (political superiors to political inferiors) (Ibid). Moreover, for the positivist, a rule of law need have no connection with what is morally right or correct or true in order to qualify as law as there is no necessary connection between what law is and what is ought to be (Mcleod, 2008).

The key positivist theorists are the following:

- **Jeremy Bentham** (1748-1832) - was one of the earliest legal positivists who defines law as an assemblage of signs declarative of volition (Cotterrell, 2003). Bentham's views about law and jurisprudence were popularized by his student, John Austin.
- **John Austin** (1790-1855) - Austin perceives law as a set of commands that carry sanctions and imposes a duty to obey (Stevens, 2005). He also said the duty to obey is not related to morality but to habit (Ibid). He made a separation of law and morals in his command theory of law (Adams, 2000; Mcleod, 2008). This view is criticized and abandoned by contemporary legal positivists particularly by H.L.A. Hart (McCoubrey and White, 1999).

- **Hans Kelsen (1881-1973)** - Kelsen's pure theory of law presents law as a hierarchy of norms (Mcleod, 2008). He described the law as being a set of social facts, which are normatively binding too. Law's normativity (that we must obey it) derived from a basic rule that sits outside the law we can alter.
- **H.L. A. Hart (1907-1992)** - Hart argued law is a system of rules. Hart argued that the law should be understood as a system of social rules. Hart rejects Kelsen's views that legal rules can't always say how they are to be applied so that it is impossible to make separation of law and morality (Adams, 2000; Mcleod, 2008).

Hart made a summary of his own theory with a view that law is the union of primary and secondary rules (McCoubrey and White, 1999; Adams 2000; Stevens, 2008). Primary rules are" those social rules that concern themselves directly with the way we live and behave" (Adams 2000). "Primary rules have the quality of being either-or, yes-no, good-evil propositions" (Stevens, 2008). People obey them because the laws in this case impose a sense of duty. Secondary rules, on the other hand, are "secondary in the sense that their subject matter is not human behavior but rather the primary rules themselves"(Adams 2000). Secondary rules are principles with no clear-cut answers (Stevens, 2008). They can only serve as a guide and people obey secondary rules because they confer powers and privileges. Hart believed that the mixing of these two rules is what gives law its creative, dynamic character, and that's what people obey – the thing they perceive as growing and far superior to customs and norms (Ibid).

Joseph Raz and Ronald Dworkin attacked Hart and the positivists for their refusal to treat law as a moral issue, i.e., there is no necessary connection between law and morality. The main reason for Raz's refusal for this conception is that it is more than obvious that there are vices that a legal system cannot possibly have (for example, it cannot commit rape or murder). Joseph Raz (1976) criticized Hart's soft social thesis approach. Raz argues that law is authority, identifiable purely through social sources, without reference to moral reasoning. Any categorization of rules beyond their role as authoritative is best left to sociology, rather than jurisprudence (Ibid). Ronald Dworkin sees law as essentially an interpretive process that requires judges to find the best fitting and most just solution to a legal dispute, given their constitutional traditions (Mcleod, 2008). According to him, law is not entirely based on social facts, but includes the morally best justification for the institutional facts and practices that we intuitively regard as legal. He rejects

the idea that the meaning of the word law can usefully be approached as a semantic exercise. Dworkin's use of the word law includes polices and principles, as well as the authoritative texts (Ibid).

3.3.3 Legal Realism

Legal realists believed that books (statutes, cases, etc.) did not determine the outcomes of legal disputes (McCoubrey and White, 1999; Adams, 2000; Mcleod, 2008). Thus, according to legal realists, law is indeterminate and the best answer to the question "What is (the) law?" is "Whatever judges or other relevant officials do" (Patterson, 1999; Mcleod, 2008). According to Patterson (1999) legal realists argue that judges are largely "fact-responsive" rather than "rule-responsive" in making decisions. A fact is anything, state of things, or relation of things, capable of being perceived by the senses. In reality, what judges do is decide cases according to how the facts of the cases strike them, and not because legal rules require particular results (Ibid). This shows that judges are influenced by factors more than legal rules. Besides the legal rules, the judicial decision-making process can be influenced by political, economic, sociological, practical, and historical considerations, as well as personal and psychological prejudices and idiosyncrasies (West's Encyclopedia of American Law, 1998; Patterson, 1999; Mcleod, 2008). The brief discussions of these factors are given below.

- **Power and Economics in Society**- law represents the will of society's most powerful members. In every government the ruling party enacts law in its own interest which makes the party always the strongest. When speaking in terms of what is right and just, courts are speaking in the interest of those established in power. As a result, realists argued that law frequently links the dominant power in society with pervasive economic interests.
- **The persuasion and characteristics of individual judges-** the outcome of the trial of a lawsuit will vary according to the political, cultural, and religious persuasion of the presiding judge. Some realists insisted that the judicial decision-making process is also affected by psychological and personality characteristics of a judge.
- **Society's Welfare**- if every judge followed his or her own political convictions when deciding a case, the outcome would be instability and chaos. Thus, judges are encouraged

to consult communal mores, ethics, and religion, and their own sense of justice when attempting to resolve a lawsuit in league with the collective good.

The notable legal realists are Oliver Wendell Holmes, Roscoe Pound, Karl Lewellyn, and Jerome Frank. Other legal realists include Herman Oliphant, Felix Cohen, Underhill Moore, Hessel Yntema, Jerome Frank, and Justice Benjamin Cardozo (Stevens, 2008).

3.3.4 Pragmatism

Pragmatism has stimulated a new approach to law and it is about looking towards last things, fruits, and consequences (Friedmann, 2003). According to Spaark (2003), the main focus of pragmatic theories is that context and practice and of instrumentalist thinking are most important. According to the contextualist thinking, making legal decisions in a specific and unique context is highly important; otherwise, the decision is distorted if seen from a non-contextual perspective (Ibid). The instrumentalist view, on the other hand, is based upon an orientation towards the future implications of the decision passed by a judge (Spaark, 2003).

To resolve legal disputes in the most practical way, pragmatists argued that a judge should undertake a four-step process (West's Encyclopedia of American Law, 1998).

1. Identifying the competing interests, values, and policies at stake in the lawsuit;
2. Examining the range of alternative approaches in resolving legal issues presented by the lawsuit;
3. Weighing the likely consequences of each approach, considering the effect a particular decision may have on not only the parties to the lawsuit but also other individuals faced with similar legal problems;
4. Selecting a response that will yield the most durable result in the course of the law.

3.4 Legal Reasoning

Legal reasoning is about giving good justifying reasons for decisions. Educated and experienced experts, based upon evidence, rules, common practice, and argument, traditionally conduct it (Greinke, 1994). However, conducting logical, effective reasoning is difficult due to the complexity of legal issues and forensic evidence and so on. As a result, a deeper understanding

and application of theories on reasoning and additional tools and decision aids are very important to alleviate these problems (McCoubrey and White, 1999; Mcleod, 2008).

Legal reasoning has three functions (Susskind, 1987). These functions are justification, prediction, and persuasion. According to Susskind, judges need to provide at least persuasive reasons to justify their decisions. Predicting judicial or official behavior and persuading the courts are expected from the lawyers. These three functions, as Susskind points out, are not fundamentally incompatible with one another. Thus, a model of legal reasoning that is to be used for the development of a knowledge-based system should be common to all three accounts of function rather than basing one of these three functions.

The nature of legal reasoning involves reasoning via several modes; namely cases, rules, definitions, polices, and analogies (Rissland, 2003). As Greinke (1994) points out, the nature of legal reasoning is different from the nature of computer inference engine. According to Greinke the nature of computer inference engine is characterized by deductive procedures that rest on pattern matching routines. In other words, computer deduction is resulted from conditioning the consecutive execution of instructions on matching, or failing to match, values in the computer's storage. The adoption of this computer deduction to legal reasoning without a clear picture on legal reasoning involves unacceptable distortion of law both at a practical and theoretical level (Greinke, 1994). In general, legal reasoning differs from the computer inference due to the following major reasons (Ibid).

- open-texture nature of legal concepts;
- the normative nature of law;
- the interpretation of statutes(laws);

3.4.1 Open-texture Nature of Legal Concepts

A concept is said to be open-textured, according to Bench-Capon and Visser (1997), the conditions for its application are not tightly stated, but instead are left to be resolved by the courts in the light of the circumstances of individual cases. As Popple (1996) indicates the famous positivist theorist (H.L.A.Hart) realizes that since the law is expressed in natural language, it is subject to considerable semantic indeterminacy and he called it open texture of law. Valente (1995) distinguishes two types of open texture: incomplete definitions and

primitive concepts. In the case of incomplete definitions, some, but not all sufficient conditions are given for the application and non-application of the concept. On the other hand, primitive concepts are not defined and the application of it is left to whoever is applying the concepts.

Open-texture makes legal KBSs development problematic and it becomes a hot issue among legal theorists (Valente, 1995). In this regard, Susskind (1986) and Bench-Capon and Visser (1997) take Hart's description of open textured concepts in terms of a core of settled meaning and a penumbra of debatable cases and say that a penumbra of uncertainty must surround all legal rules as a particular example. Basing Hart's analysis, Susskind (1986) points out that all KBSs in law basing solely on deductive reasoning will function best in the clear case domain, and will be no aid in solving problems of penumbra, though his analysis is not accepted by others(Popple,1996).

In order to resolve conflicts between rules, below are suggested by Bench-Capon and Visser (1997) in the conceptualization of rule-based approach.

- General principles- evaluates rules against one another according to their properties, such as their specificity or provenance.
- Specific information- evaluates rules according to a specific relation that holds between them and expresses this relation in absolute or in quantitative terms.
- User decision- this is simply presenting the user with the conflict and invited to choose the line of argument they prefer.

3.4.2 The Normative Nature of Law

It is common to see that many sentences in law express norms, and therefore contain terms like 'may', 'must' and 'shall' (Bench-Capon, 2007). Norms tell people what they ought, or ought not, to do (Mcleod, 2008).This is known as the normative nature of law. Due to the above mentioned nature of law, it is difficult to apply the laws of traditional and classical logic (arguments from truth values) to the laws of state (Susskind, 1986; Greinke, 1994). The difficulty arises from the lack of truth-values for legal norms or imperatives (Ibid).

3.4.3 The Nature of Legal Interpretation

In a legal system, legislature makes law, judges interpret and apply law, and executive enforces the law. Statutes are defined as legislature's commands that must be followed by the courts (FSCE, 2002). Even if it is usual to give a rule with its normal meaning when enacted, the meaning of a rule becomes ambiguous, difficult to establish, problematic, or contested between some interested parties under unusual circumstances (Gilbert, 2008). The main reasons are different audiences may understand words differently because words are imperfect symbols for communication of ideas, the drafting of statutes in general terms, the usage of general language by the legislatures, and the insufficient thought given by the legislature to the meaning of the language employed (FSCE, 2002). As a result, courts are encountered the problem of giving meaning to a provision of a statute without clear direction from its language (Ibid). In such circumstances, the rule needs an official or formal interpretation in order to clarify ambiguities for the avoidance of the possible distortion of statutes true meaning or to prevent unnecessary or unintended irrationality & injustice (Sunstein, 1989).

According to FSCE (2002), judicial interpretation is the search for the meaning of the statute to decide whether it regulates the particular conduct at issue. Since interpretation is an art, not a science, legal practitioner needs some kind of theory, a guide, or a roadmap, something to follow (Stevens, 2008). Thus, the following standard approaches to statutory interpretation are recommended.

- **Textualist Approach**- this approach relies exclusively on the ordinary meaning (plain meaning or dictionary definition) of words of the statute (Sunstein, 1989; Patterson, 2003: Stevens, 2008). The reasoning behind this approach is that when legislatures pass a law, it is the text only, which then established as a standard, to be considered rather than relying on their intentions (Stevens, 2008).

Supporters of textualist approach claim that it produces value-free jurisprudence and keeps justices in touch with the people (Ibid). Critics, on the other hand, claim that the textualist approach is inadequate (as legal realists criticized) and it will lead to making serious mistakes in interpretation. This is mainly because statutory terms and words are not self-defining, and has no meaning before or without interpretation rather the meaning of words depends on both culture

and context (Sunstein, 1989). In addition to context, meaning depends on the semantic and other formal properties of sentences (FSCE, 2002). Sunstein (1989) further points out the most familiar problems with textualist approach to statutory interpretation include its unhelpfulness in situation when there are more than one dictionary definition for statutory words, or when the context produces interpretive doubt; sometimes interpretation may suggests an outcome that makes little or no sense; and ambiguity or interpretive doubt in the text may be produced in changed circumstances. The leading proponent of textualism is Justice Scalia and to a lesser extent, Justice Rehnquist (Ibid).

- Contextualist **approach**- As Sunstein indicated, this approach is a partial response to the problems of textualism to help resolve ambiguities or to fill gaps. In addition to the original meaning of a text, contextualist approach underscores the provision at issue was declared can only be understood by examining its context. The context can be one of four types (FSCE, 2002; Stevens, 2008):
    - ***Structure-*** the structural approach looks at each case as unique, and is more concerned with remedy making than rule making. As Sunstein (1989) argues, referring to the structure of the statute provides significant interpretive guidance but it has the following two problems. First, stuctural approaches depend on an assumption that statutes are internally consistent and coherent. Second, structural approaches offer only partial help.
    - ***Legislative purpose-*** In some cases, legislative purpose will provide a context within which to understand statutory terms (Stevens, 2008). However, as Sunstein (1989) indicates, purposive interpretation reproduces all of the problems of textualism in slightly different manner. However, it suffers from over inclusiveness or under inclusiveness, and when circumstances changed, and reliance on the statutory purpose becomes even trickier.
    - ***Legislative intent-*** the emphasis of this approach is on interpreting statutory terms in light of original intentions or understandings of the lawmaker (FSCE, 2002). According to advocates of legislative intent approach, after having a long deliberation, the lawmakers choose their words precisely to produce neutral principles of law (Ibid). Supporters of this approach strongly argue that it promotes consistency and stability in law (Stevens, 2008). On the other hand, according to Sunstein (1989), judicial reliance

on legislative intent suffers from three basic difficulties. First, law is represented by words, not the intent of lawmakers about what those statutes are meant for. Second, when circumstances have changed, basing legislative intent in finding the meaning of statutory terms may produce illogical result. Third, it has risks of over inclusiveness and under inclusiveness. Justice Stevens and Justice Ginsburg are the leading proponents of this approach (Stevens, 2008; Sunstein, 1989).

- ***Legislative history-*** this approach focuses on examining the broad and long history behind the provision to determine the broadest possible intent of the legislators (FSCE, 2002). Nevertheless, not every statute has a complete history (Ibid).

3.5 Tort Law under the Ethiopian Legal System

A highlight of the legal system of Ethiopia and the law of tort in Ethiopian are given in this section.

3.5.1 The Ethiopian Legal System

The legal system of Ethiopia is based on Civil law. According to Abebe (2000), the government of Ethiopia is currently practicing a two-tiered system of courts; namely, federal and state courts. At the federal level, the courts are the Federal Supreme Court, the Federal High Court, and the Federal first Instant Court. At the state level, the court structures include the State Supreme Court, the State High Court, and the State Woreda Court. Besides, local Shari'ah courts hear religion and family cases involving Muslims. The Federal High Court and Federal Supreme Court have jurisdiction over cases involving federal laws, transregional issues, and issues of national import.

According to FSEC (2007), the supreme court is the highest judicial organ which has a jurisdiction to see criminal cases in which government officials are liable, first instant cases, appeals from the high court, and final decisions which have basic flaws in the interpretation of laws, in its cassation bench.

The Federal Supreme Court of Ethiopia is currently introduced modern practices to facilitate the decision making processes (FSCE, 2007). Court Case Management System is used by the court to assist the works of registrar office in an immediate uploading of new cases field each day,

new decisions, and adjournments made by the courts. Video court session is the other technology employed by the court to process court hearings by employing video conferencing technology. Interactive voice response system is also used by the court to enable users getting access to the court's database

3.5.2 Tort law

In the Ethiopian legal system, there is no specific law on torts. Tort laws are covered in the civil code, which consists of two classes of duties: proscriptive and remedial tort duties. Proscriptive tort duties are duties that proscribe various types of faulty conduct. However, remedial tort duties are duties to take remedial actions if proscriptive duties are breached.

According to Adams (2000), *tort* is defined as wrongs recognized by law as a basis for a lawsuit. It is a wrongful act, injury, or damage, not involving a breach of contract, for which a civil lawsuit may be brought (Standler, 1999) These wrongs include intentional punch in the nose, a negligent car wreck, medical malpractice, libel or slander, fraud and so on (Adams 2000). *Tort claim* is a claim made by a victim for damage or loss of property, or claims for personal injury or death caused by the negligent or wrongful act or omission of a wrongdoer (US Postal Service, 2007). In other words, a tort claim is a claim for expenses that arises as a result of the injuries a victim has sustained in an accident, the wage loss or loss of opportunity to earn income either in the past or in the future due to his/her injuries, and an amount for pain and sufferings.

Therefore, *tort law* is a collection of rights, obligations, and remedies that is applied by courts in civil trials so as to provide relief for victims who have suffered injury from the wrongful acts of others (Sheinman, 2003). According to Sheinman the law of torts serves four basic objectives. First, it seeks to compensate the cost of such injuries from potential victims to tortfeasors. Second, it seeks to shift the cost of such injuries from potential victims to tortfeasors. Third, it seeks to discourage injurious, careless, and risky behavior in the future. At last, it seeks to vindicate legal rights and interests that have been compromised, diminished, or emasculated.

3.5.3 Jurisprudence and Judicial Decisions in Ethiopia

A review of decisions made by Ethiopian courts on some selected cases is done to see the applicability of the different theories discussed earlier in the courts' decision making processes.

Let's take three practical examples that depict a simple application of written rules taken from statute books doesn't necessarily determines the judicial decisions. The two cases are related to the law of contracts to immovable and the other one is concerning with the law of marriage.
Our law of contracts relating to formation of contracts on immovable properties states the following:

Article 1720- Effects provisions as to form: When a special form is prescribed by law and not observed there shall be no contract but a mere draft of a contract.

Article 1723:

1. A contract creating or assigning rights in ownership or bare ownership on immovable or an usufruct, servitude or mortgage of an immovable shall be in writing and registered with a court or notary.
2. Any contract by which an immovable is divided and any compromise relating to an immovable shall be in writing and registered with registered with a court or notary.

Case 1:

Issue: Is registration a validity requirement for a sale of immovable property? If so what would be the effect of a sale contract on immovable which is not registered in the notary according to Art.1723 of the civil code?

A sale contract was concluded in 1985 E.C. between Ato Getachew Nega and Agaz Gebrehiwot and his wife W/o Aberash Dubargie. The contract was not registered in the notary or the court. The daughter of Ato Agaz Gebrehiwot instituted a case against w/o Aberash in a federal first instant court claiming that she deserved half of the property representing her deceased father. Ato Getachew intervened in the litigation arguing that he bought the house in 1985 E.C. from the husband and the wife. The daughter (w/o Gorfe Gebrehiwot) of deceased opposed the validity of the sale contract on many grounds. The *Federal first instant court* gave its decision by asserting that the sale contract between Ato Getachew Nega on the one hand and Agaz Gebrehiwot and w/o Aberash Dubargie on the other has legal effect and thus rejected the opposition presented by

w/o Gorfe Gebrehiwot. W/o Gorfe Gebrehiwot appealed to the federal high court but the high court approves the decision given by *Federal first instant court.* Finally, the case was presented for cassation division of the *Federal Supreme Court* and made its decision on Miazia 30, 1999 E.C with a cassation number 21448. *The court* reversed the decisions of the lower courts and nullified the contract on the ground that it was not registered in the notary or court as article 1723(1) of the civil code requires and thus it is simply a draft, devoid of any legal effect according to article 1720.

Case 2:

Issue: Is registration a validity requirement for a sale of immovable property? If so what would be the effect of a sale contract on immovable which is not registered in the notary according to Art.1723 of the civil code?

In a case applied on Megabit 29, 2000 to the federal Supreme Court, the applicant (Alganesh Abebe) bought a house at the cost of 5000 birr from the defendants (Gebru Eshetu and Workit Eshetu) on Meskerem 13, 1997. However, according to the applicant, after receiving the 5000 birr, the defendants refused to deliver the house and transfer the ownership right to her based on the contract they made. The buyer pleaded the court to give decision ordering the sellers to hand over the house and to effect transfer of title of the same.

Before the case is presented to the Federal Supreme Court, the highest decision making organ, it was seen by two lower courts: the Amhara State Supreme Court and the South Wollo Zone High Court. *The South Wollo Zone High Court* decided the case in favor of the plaintiff. The reasoning of the court is that since the two parties concluded a sale contract which imposes obligation to deliver the house and since the sellers do not have justifiable reasons to cancel the contract; the sellers have to abide by the contract, they have to deliver the house for the buyer. Then the defendants (the sellers) took the case to the Supreme Court of the Amhara Regional State. The court reversed the decision of the lower court on the ground that the contract made by the two parties is not registered with a court or notary as indicated under article 1723(section 1 and section 2), and thus , it has no effect as per article 1720 of the civil code. The case was brought to the Cassation division of the Federal Supreme Court by the buyer arguing that the regional Supreme Court commits a fundamental error of law. *The Federal Supreme Court* gave its decision with a cassation number 36887 dated on Hidar 18, 2001 E.C by reversing the lower

court's decision. The court reasoned that the fact that the contract made between the two parties was not registered in the notary or court does not make it void because the sellers has previously admitted the existence of the contract.

As one can observe clearly, the above two cases involve the same question of law. The issue is whether or not the registration requirement stated under Article 1723 of the civil code of Ethiopia a mandatory validity requirement for sale contract on immovable so that failure to meet the requirement make the contract void (of no effect). That being the nature of the two cases, it does not require legal knowledge to predict that the courts would dispose them in the same way. Nevertheless, the same court (the Cassation of the Federal Supreme Court) gave two opposite decisions on the same issues. In the first cases, the court ruled that registration is a validity requirement for sale contract on immovable and rejected the question of performance of the contract of sale of house by the buyer saying that the contract is not registered according to Article 1723 of the civil code. The second case shows us the radical change of position by the same court. Here the court argued that the requirement stated under Article 1723 is not a validity requirement. The vivid reality that we can infer from the above two decisions given by the highest justice organ of the country is that rules alone cannot determine the way legal problems can be solved.

Another practical example that shows law is not merely a system of rules is related to marriage. According to the Revised Family code of Ethiopia, the causes of dissolution of marriage are indicated under article 75 as:

a) Death of one of the spouses, or declaration of absence, by the court, of one of the spouses;
b) Dissolution order by court due to violation of one of the essential conditions of marriage; or
c) Divorce.

Case 3:

Issue: are the rules in article 75 cause of dissolution of marriage? If so what would be its effect on marriage which is not dissolved based on the grounds stated under article 75?

The two spouses (Yilma W/Hana and Sara Lngane) have been living together from 1966 to 1977. Due to their disagreement, Sara married another man in 1977 and Yilma married another woman (Shewaye Tessema) in 1987 without terminating their earlier marriage. In 1989, Yilma is passed away; as a result, Sara applied to the court demanding a declaratory judgment that she is the legal wife of the deceased.

The federal first instance court, by consulting what Article 75 of the Revised Family Code, decided that Sara Lngane is the wife of Yilma since the marriage made earlier was not dissolved based on one of the three grounds stated under the law article 75. *The federal high court* approves the decision of the lower court. However, The cassation Division of *the federal Supreme Court* canceled the decisions made by the lower courts by arguing that though the marriage between W/O Sara and Ato Yilma was not dissolved by one of the grounds stated under the Family Code, the fact that they have been living separately for several years shows by itself that they dissolved the marriage. Accordingly, the court concluded on its decision made on Miazia 11, 1999 E.C. with a cassation number 20938 Sara Lngane is not the wife. Here the court's decision is clearly against the law, the rules stated under Article 75 of the Family code. What dictate the court decision are the socio–economic realities rather than the law.

The decisions made above by the courts for the three cases assert that written rules are inadequate in making judicial decisions. Thus, examining factors other than written rules which determine the outcome of the judicial process are very critical.

Finally, in addition to examining the factors that determine the outcome of the judicial decision-making process under this chapter, the researcher has given due attention to the important concepts to be raised in the legal knowledge acquisition and modeling, the way legal knowledge is represented and implemented. The knowledge acquisition and modeling, representation and implementation issues are discussed in the next subsequent chapters.

CHAPTER FOUR

KNOWLEDGE ACQUISITION AND CONCEPTUAL MODELING

4.1 Knowledge Acquisition

O'Hara (1994) defines knowledge acquisition as the act of getting information out of the expert and making it available in the machine. In order to obtain the knowledge required by the KBS, the knowledge acquisition phase is undertaken by following two steps: knowledge elicitation and knowledge structuring.

In the first step, the knowledge necessary for the construction of the KBS is elicited from domain experts including lawyers and judges through a series of semi-structured interviews, discussions, and observations while experts are solving a given problem. These knowledge-gathering techniques help to collect the heuristic knowledge, which is the knowledge of good practice, good judgment, and plausible reasoning in the field of tort law. A total of six experts such as judges, lawyers and researchers are interviewed. The experts were selected based on their educational qualifications, experience, and their immediate job positions in the domain area. Table 4.1 presents the profile of domain experts. Moreover, statutes books (Civil Code of Ethiopia and Criminal Code), case reports, and journal articles in the area of tort law were consulted so as to gain the explicit knowledge, which is the knowledge that is documented and widely shared.

Experts Category	Number	Sex	Qualification	Experience
Judges	2	Male	MSc	10
Lawyers	2	Male	1BSc,1 MSc	8
Researchers	2	Male	1BSc, 1MSc	5

Table 4.1: The Profile of Domain Experts

Knowledge structuring and the building of model are performed in the second step based on the concepts discovered in the knowledge elicitation step. The knowledge used for building the KBS

in this research is organized into four modules. These are knowledge regarding fault-based liability, non-fault-based or strict liability, causation and liability, and redress.

4.2 Modeling of Concepts in Settling Tort Claims

As previously indicated, the concepts used in making a judgment for a given tortious act were gathered by interviewing domain experts and referring relevant documents. Before the detailed discussions of the concepts, a brief overview of how judges arrive at decision in the trial of tort claims is given in figure 4.1 using the CommonKADS modeling technique.

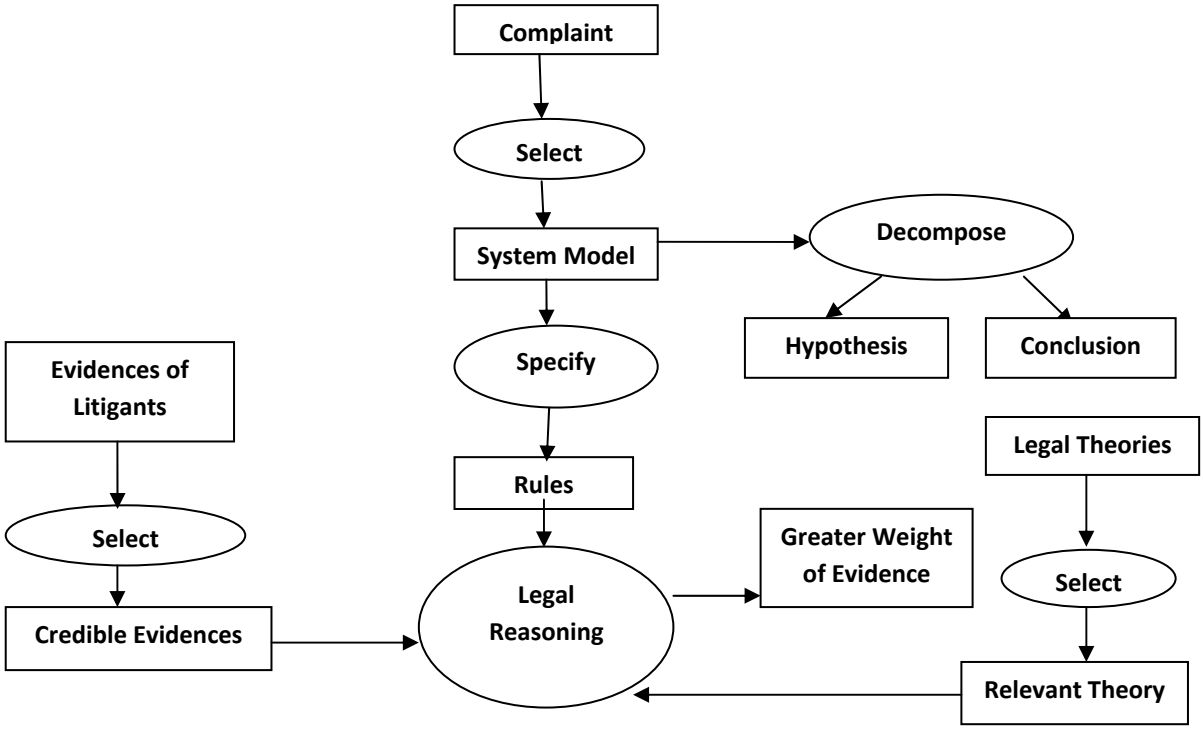

Figure 4.1: The CommonKADS Model of Tort Claim Handling

Based on the model shown above, a comprehensive explanation of the concepts essential for handling tort claims and the associated conceptual models are presented in the next sections.

4.2.1 The Bases for Liability

Liability is an obligation of an individual under the applicable law to provide compensation for damage/injury resulting from an action for which that individual is deemed to be responsible.

The law of torts has recognized three distinct bases of tort liability. These include intent, negligence, and strict liability.

1. **Intentional torts-** an intentional tort is any deliberate interference with a legally recognized interest. Liability for intentional torts such as assault, trespass, false imprisonment, invasion of privacy, conversion, misrepresentation, and fraud.
2. **Negligence-** is behavior that falls below the standard established by law for the protection of others against unreasonable risk of harm. The standard established could be more specifically referred to as that of an ordinary, reasonable, and prudent person—in the law he is a fictitious person who acts ideally under the circumstances and is never negligent.

Each of the following factors is required for a legal action in negligence to exist:

- A legal duty was owed,
- That legal duty was breached as the result of conduct falling below the standard of that of a reasonable person under like circumstances,
- Actual damage or harm was sustained,
- A legally defined causal connection between the conduct and the resulting injury or the damages.

In general, liabilities caused by both intentional and negligence torts are termed as fault-based liability. Article 2028 of the civil code of Ethiopia stated fault-based liability as: Whosoever causes damage to another by an offence shall make it good. Fault-based liability arises when the conditions in figure 4.2 are satisfied.

The person has a duty of care; AND
The person breaches that duty either by an intentional act, or through negligence; AND
Actual damage recognized by the applicable law has occurred; AND
There is a causal link (causation) between the act or omission and the resulting damage.

Figure 4.2: Rule for Fault Based Liability

Where:

- ***Duty of care*** refers to a legal obligation placed on a person in a position of control of relevant activities to use their best or reasonable efforts to prevent damage.
- ***Causation or causal link*** refers to a legal requirement to demonstrate that an act or omission is linked to the damage in the manner required by the applicable law.

3. Strict Liability (liability without fault) - is the attribution of liability without the requirement of fault. In other words, it is a liability imposed by the law on defendants who are neither negligent nor guilty of intentional wrongdoing. This type of liability is selective, and applies only in certain cases. It is imposed on the creation of an abnormal risk or for a damage caused by animals, buildings, machines, motor vehicles or manufactured goods.

There is a **time limit** to the liability (whether it is fault-based or is strict liability). In this regard, article 2143 of the civil code of Ethiopia states the following:

1) The action shall be brought by the victim within **two years** from the time at which he suffered the damage for which he is claiming compensation".
2) Where the damage arises from the commission of a criminal offence in respect of which the Penal Code prescribes a longer period of limitation, the latter period shall apply to the action for damages.

Article 224 of the Criminal Code Ethiopia, indicates the ordinary periods of limitation of Penalties and Measures as follows:

1) The period of limitation of the penalties or measures shall be:
   a) thirty years for a death sentence or a sentence for rigorous imprisonment for life;
   b) twenty years for a sentence for rigorous imprisonment for more than ten years;
   c) ten years for a sentence entailing loss of liberty for more than one year;
   d) five years for all other penalties or measures.
2) In the event of concurrent penalties, the lighter penalties shall be barred at the same time as the most severe penalty.

4.2.2 Damages for Tortious Act

Damage is the harm for which liability is imposed. Damages for tortious acts include loss of life, personal injury, loss or damage to property, loss of income directly deriving from an economic interest in the environment, and loss of dignity. Damages can also be categorized as:

- **Personal injury**- specifically, personal injuries include permanent disability, pain and suffering. A personal injury could result in death.
- **Economic harm**- is a harm that costs the plaintiff money without causing him physical injury caused by the wrongdoer such as impairment of earning capacity, lost wages or profits, and medical costs.
- **Dignitary harm**- is a harm that neither costs money nor causes physical injury. It includes disfigurement, humiliation, embarrassment, and emotional distress.

The extent of damages according to the civil code of article 2091, the damages due by the person legally declared to be liable shall be equal to the damage caused to the victim by the act-giving rise to the liability.

4.2.3 Causation and Liability

Causation is an element to all the three bases of liability discussed above. Before the liability is imposed, the plaintiff is required to prove two kinds of causes of an injury. These causes include factual cause or proximate cause.

- **Cause in fact (factual cause) -** a tort must be the cause in fact of a particular injury, which implies that a specific act must actually have resulted in injury to another. In its simplest form, cause in fact is established by evidence that shows that a defendant's act or omission was a necessary antecedent to the plaintiff's injury. Courts analyze this issue by determining whether the plaintiff's injury would have occurred "but for" the defendant's conduct. If an injury would have occurred independent of the defendant's conduct, cause in fact has not been established, and no tort has been committed. When multiple factors have led to a particular injury, the plaintiff must demonstrate that the tortfeasor's action played a substantial role in causing the injury.

- **Proximate cause-** It limits the scope of liability to those injuries that bear some reasonable relationship to the risk created by the defendant. This proximate cause is evaluated in terms of foreseeability. If the defendant should have foreseen the tortious injury, he or she will be held liable for the resulting loss. If a given risk could not have been reasonably anticipated, proximate cause has not been established, and liability will not be imposed.

4.2.4 Immunity

Certain individuals and entities are granted immunity from both damage awards and assessments of liability in tort. In this regard, sovereign immunity (or government immunity) is granted to legal institutions such as the legislature (members of parliaments), the judiciary (judges), and the executives (Ministers) to insulate them from liability for torts committed within the scope of official duties. Besides, an employee of a government unit is not liable for torts that he/she commits within the scope of his or her official duties.

4.2.5 Tort Law Adjudication

Tort law adjudication brings together exactly two legal subjects: the defendant and the plaintiff. The person who sustains injury or suffers economic damage as the result of tortious conduct is known as the plaintiff, and the person who is responsible for inflicting the injury and incurs liability for the damage is known as the defendant or tortfeasor.

There are three major elements needed in tort adjudication to reach at fair and just conclusions. These elements include:

1. **The law (rules)-** the rule is treated as a standard for the behavior of oneself and others.
2. **The facts-** a fact is anything, state of things, or relation of things, capable of being perceived by the senses.
3. **Credibility of evidence-** evidence means and includes:
    a. All statements which the court permits or requires to be made before it by witnesses, in relation to matters of fact under inquiry; such statements are called oral evidence;

b. All documents including electronic records produced for the inspection of the court; such documents are called documentary evidence.

Therefore, credibility of evidence means evidence which in the light of reason and common sense is worth of belief.

One of the distinguishing features of tort law from criminal law is the plaintiff (or victim) make an appeal to the court of law for the tort committed on him/her by a defendant's wrongdoing. In this regard, article 2141 of the Civil Code states that "the victim at the injury shall establish the amount thereof and prove the circumstances which render the defendant liable to make it good". While making an appeal, the victim is required to state all the necessary information in the claim statement including his age, income status, the benefit lost due to the damage, and an estimate of the total cost(s) he has to be recovered for the loss incurred due to the wrongdoer.

The plaintiff is also expected to prove his claim with written evidences and/or witnesses that the defendant's act or omission caused him/her damage in order to succeed in an action. It may also be necessary for the plaintiff to show that the defendant was at fault.

4.2.5.1 Physical Injury

According to article 2032 of the Civil Code of Ethiopia, the defendant is liable for his/her intentional wrongdoing which caused a physical injury to the plaintiff'. Therefore, in case of such injury claim, a plaintiff has to prove the following conditions.

1) There is an act or omission by a defendant,
2) The act or omission causes a physical injury to the plaintiff/victim,
3) The injury is recognized by law,
4) The injury is resulted due to the defendant's intentional wrongdoing or negligence act,
5) There is a casual link between the defendant's act or omission with the resulting injury

However, the defences for physical injury claim are indicated in the civil code. These are listed as follows:

- **Article 2066**

    1) A person shall be liable for any damage he deliberately causes to another in order to save himself or another from an imminent damage to person or property.
    2) No liability shall be incurred where the damage is due to the victim's fault.

- **Article 2067— Bodily harm**

    1) A person shall be liable where by his act he inflicts bodily harm on another.
    2) No liability shall be incurred where the act causing the harm was ordered by law or was done in legitimate self-defence, or where the harm is due solely to the victim's fault.

- **Article 2068-** the defendant is not liable in the exercise of a sporting activity when a person injures another taking part in the same activity, or present as a spectator,' provided that there is no deceit or gross infringement of the rules of the sport.

In situation when a physical injury is resulted in death, the defendant is charged with being liable for injury resulting in another's death by reason of negligent actions or a failure to act which could foreseeably result in death. The plaintiff (the executor or administrator of the estate of the decedent, family member, or spouse) must prove that the decedent would not have died but for the negligence of the defendant.

Thus, the concepts for handling physical injury claims modeled using a decision tree is shown in figure 4.3.

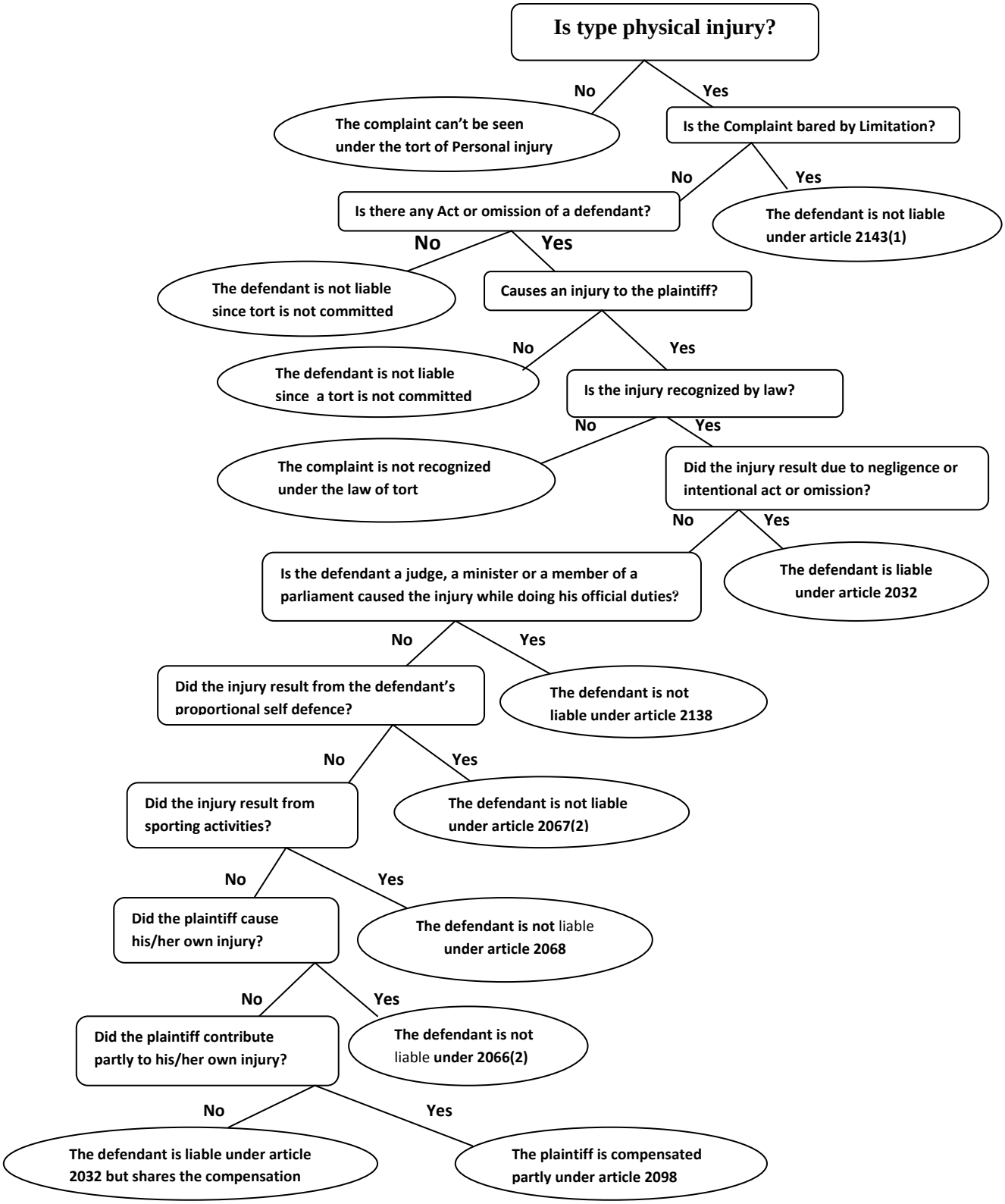

Figure 4.3: Conceptual model of handling physical injury claim

4.2.5.2 Defamation

A statement is said to be defamatory statement when it has a tendency to lower the claimant in the estimation of right thinking members of a society generally and in particular to cause him to be regarded with feelings of hatred, worthless, fear and disesteem. Defamation can be committed either in written or oral statements.

According to article 2044 of the civil code, a person commits an offence where by his words, his writings or by any other means he acts in such a way as to make another living person detestable, contemptible or ridiculous and to jeopardize his credit, his reputation or his future.

There are **five elements** that the plaintiff must prove by a preponderance of the evidence or greater weight of evidence in order to prevail in the case of defamation. These include:

- The statements must be a defamatory statement of fact.
- The plaintiff must prove that the defamatory statement concerned the plaintiff.
- The plaintiff must prove that the defamatory statement is false.
- The plaintiff must prove that the defamatory statement was communicated to a person or persons other than the plaintiff.
- The plaintiff must prove that defendant actually knew the statement was false when he/she communicated it, or the defendant communicated the statement with reckless disregard of its truth or falsity, or defendant acted negligently in failing to ascertain the falsity of the statement before communicating it.

The defences for defamation claim are stated in different articles of the civil code of Ethiopia.

- **Article 2046**

  1) A person shall not be deemed to have committed an offence where he confined himself to expressing his opinion on matters of public interest, notwithstanding that such opinion inflicts injury on another by bringing him under public obloquy.
  2) In this case, defamation shall not be deemed to have been committed unless the defendant has made against the plaintiff charges which to his certain knowledge are false.

- **Article 2047**

    1) No defamation shall be deemed to have been committed where the defendant adduces proof of the accuracy of his charges,
    2) In this cue, he shall not be liable unless he has acted solely with intent to injure.

Based on the above elicited concepts, the conceptual model of solving claims on defamation is portrayed in figure 4.4.

4.2.5.3 Professional Fault

A professional fault is indicated in the two sections of article 2031 of the civil code as follows:
1) A person practicing a profession or a specific activity shall, in the practice of such profession or activity, observe the rules governing that practice.
2) He shall be liable where, due regard being had to scientific facts or the accepted rules of the practice of his profession; he is guilty of imprudence or of negligence constituting definite ignorance of his duties.

In order to persuade the court, the plaintiff is expected to prove the following issues:

1) There is an act or omission by a defendant,
2) The act or omission causes a physical injury to the plaintiff/victim,
3) The injury is recognized by law,
4) The injury is resulted due to the defendant's intentional wrongdoing or negligence act,
5) There is a casual link between the defendant’s act or omission with the resulting injury.

The concepts required for settling professional fault are modeled and shown in figure 4.5.

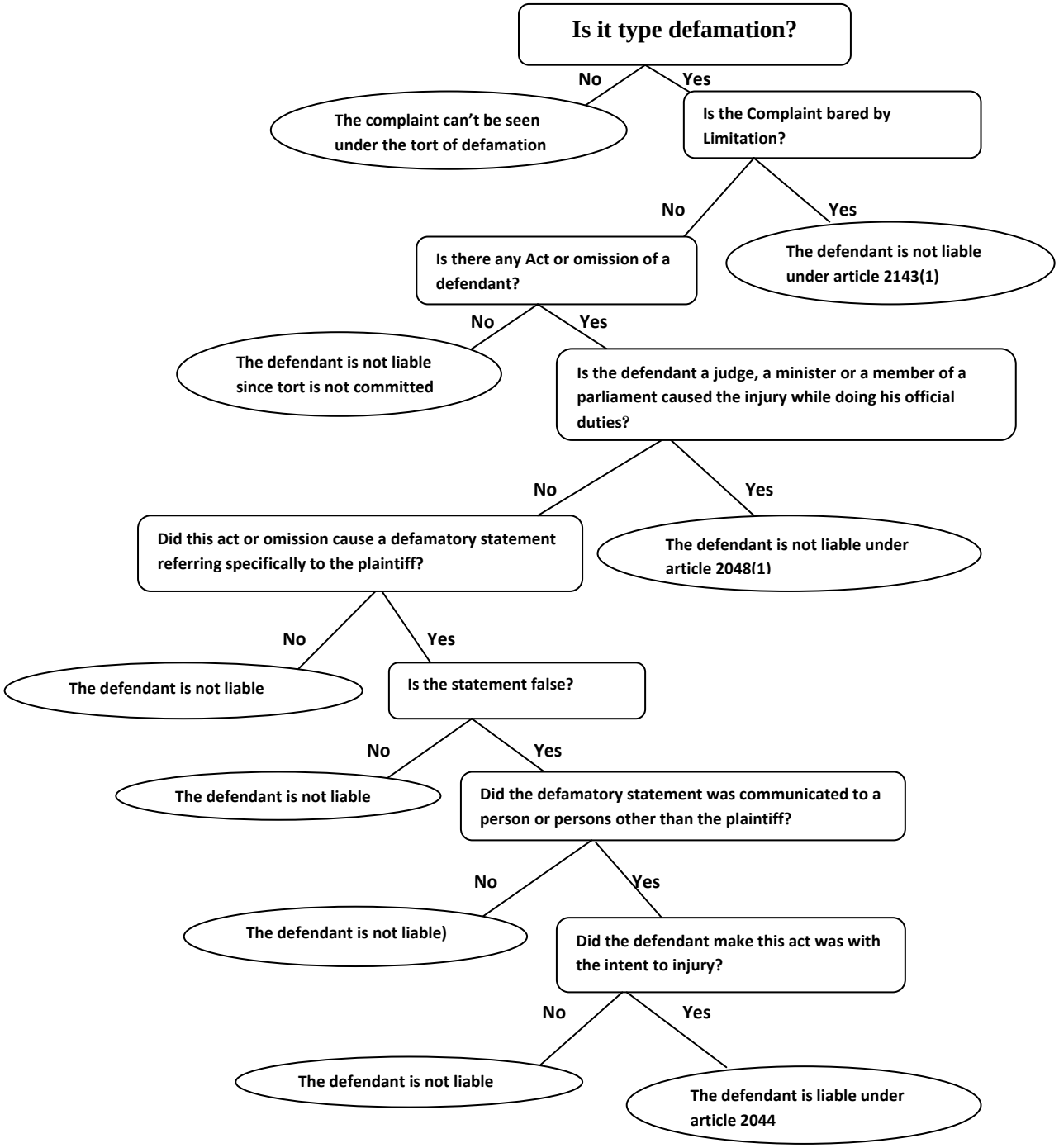

Figure 4.4: Conceptual model of handling claims on defamation

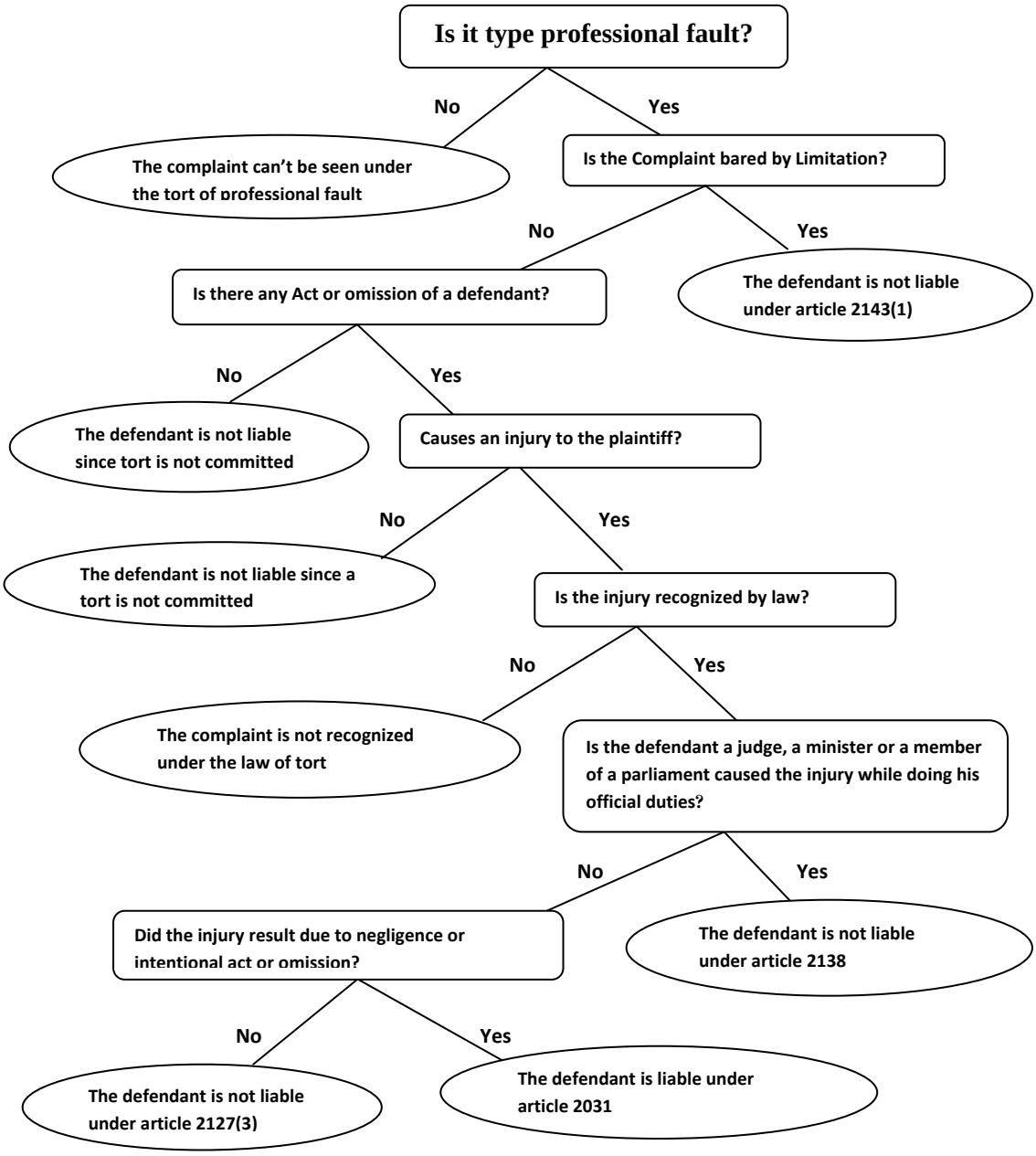

Figure 4.5: Conceptual model of handling professional fault

4.2.5.4 False Imprisonment (False Arrest)

False imprisonment is the unlawful detention of an individual. In this context the word "detention" means the restraint of a person's personal liberty or freedom of movement and the word "unlawful" means without legal authority or justification. If the defendant was exercising

hi/her rights according to law then imprisonment was justifiable. In this regard, article 2040 indicates about the interference with the liberty of another: These are:

1) A person commits an offence where, without due legal authority, he interferes with the liberty of another person, even for a short time, and prevents him from moving about as he is entitled to do.

2) In such a case, an offence shall be deemed to have been committed notwithstanding that no injury is done to the plaintiff's person.

3) It shall be sufficient for the plaintiff to have been compelled to behave in a certain manner by the threat of a danger of which he could not be unaware.

However, the defences for false imprisonment claim are indicated in articles 2041, 2042 and 2043 of the civil code:

Article 2041

No offence shall be deemed to have been committed where the constraint has been imposed in a reasonable manner on a person in the legal custody of the defendant and for the purpose of enforcing the authority conferred upon the latter by law.

Article 2042

1) No offence shall be deemed to have been committed where the person who has interfered with the liberty of another had good reason to believe that the latter had committed a criminal offence.

2) The person interfering with the liberty of another shall be liable in the case provided for in sub article (1) where he fails to hand over forthwith the person under his constraint to the police.

Article 2043

A person who has provided bail for another, guaranteeing to the authorities that the latter will reside in a certain place, may lawfully interfere with the liberty of the person on bail where he has good reason to believe that he is preparing to abscond.

As a result, the tort of false imprisonment has been defined to include the following elements:

a) There must be a detention
   - A detention is an unlawful restraint of a person's liberty or freedom of movement.
   - The Detention needn't be forcible type. Threats of force by conduct or words coupled with the apparent ability to carry out such threats are sufficient.
   - The detention must be total, *i.e.*, it must be within boundaries.
   - The detention must be for an appreciable time, however short.

b) The detention must be unlawful

c) The act of the defendant in confining the plaintiff must have been done with the intention of causing a confinement

d) The detention must have been against the plaintiff's will.

The concepts required for settling false imprisonment claim are modeled and shown in figure 4.6.

4.2.5.5 Product Liability

Designers, manufactures, and sellers of products are responsible if the item is dangerous or defective. Besides, the manufacturers are accountable if failing to inform or to warn consumers adequately about the possible dangers of their product. Sellers of goods or products are responsible if causing damage on the consumers by introducing defective products into the stream of commerce. Therefore, product liability can mean a defective product that has caused a person an injury or an illness. Product liability encompasses a number of legal claims that allow an injured party to recover financial compensation from the manufacturer or seller of a product.

In light of this, the liability arising from manufactured goods is indicated in article 2085 of the civil code of Ethiopia as:

1) A person who manufactures goods and sells them to the public for profit shall be liable for any damage to another person resulting from the normal use of the goods.
2) No liability shall be incurred where the defect which has caused the damage could have been discovered by a customary examination of the goods.

According to article 2086(2) the defence for product liability claim is that the plaintiff shall be relieved of his/her liability, entirely or in part, only where the damage is due solely or partly to the fault of the victim.

In a case covered by product liability, the plaintiff must show that:

a. The defendant has a duty of care,
b. The plaintiff was injured, and
c. The injury was caused by what the defendant did.

Moreover, the plaintiff claims that the product was not reasonably safe for its intended purpose because of:

a. Manufacturing defect; or

b. A failure to adequately warn or instruct; or

c. A design defect.

The court employs at least two criteria to determine where a design is defective.

1. If the product fails below reasonable consumer expectation.

2. The product sold creates such a risk of serious injury that the cost to make it would outweigh the benefits to the society.

The conceptual model pertaining to product liability is depicted in figure 4.7.

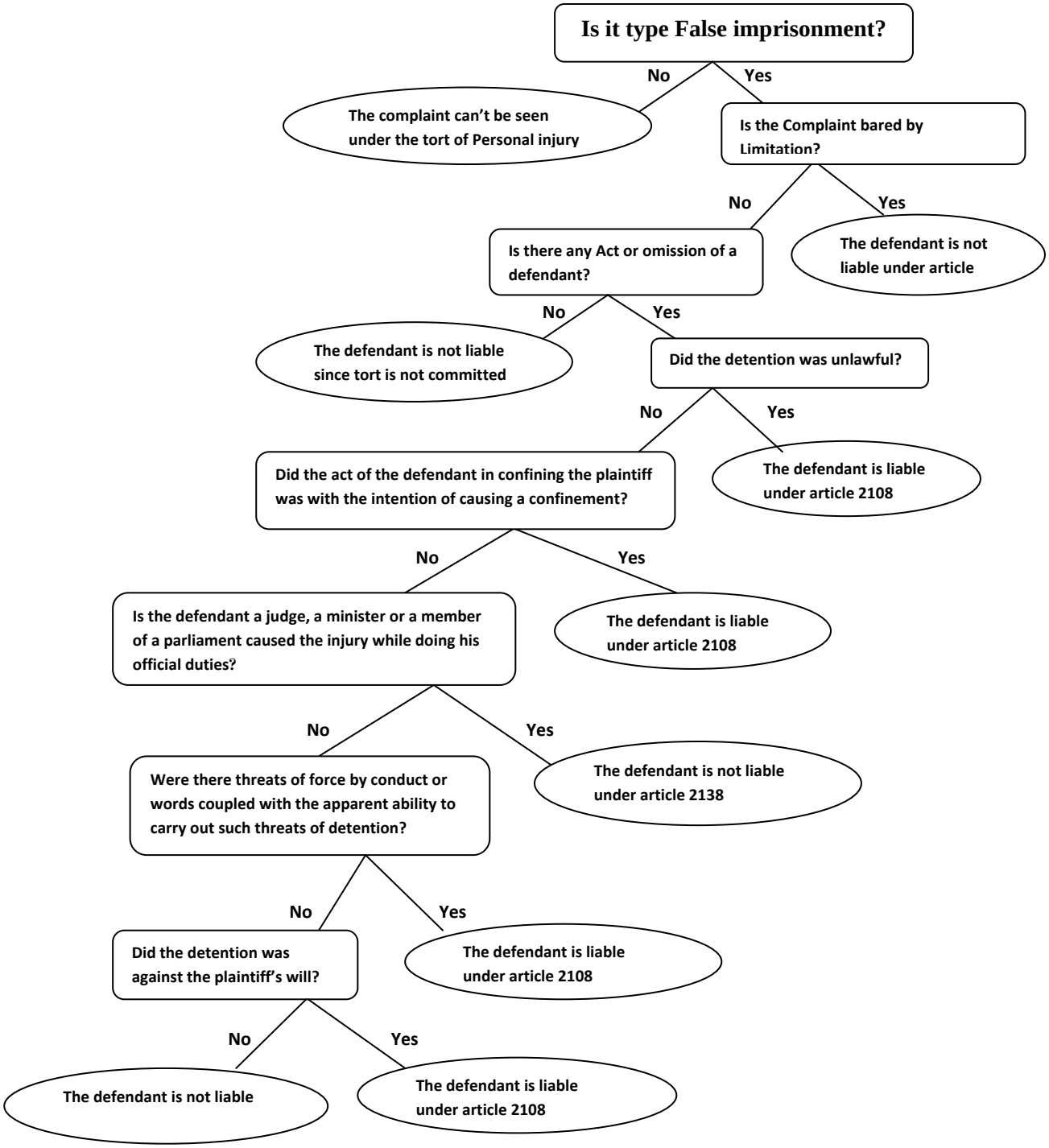

Figure 4.6: Conceptual model of handling false imprisonment claim

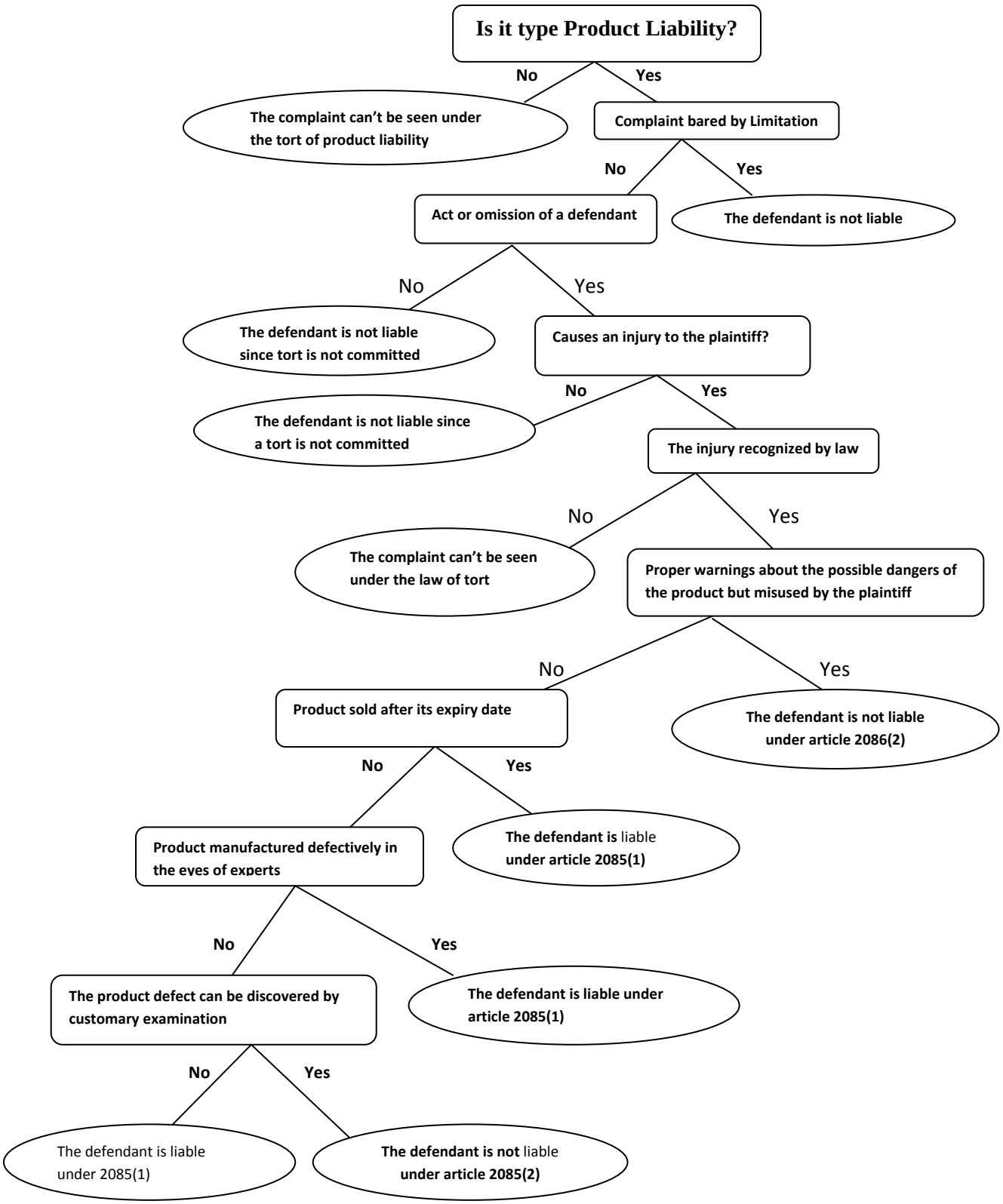

Figure 4.7: Conceptual model of handling product liability claim

4.2.5.6 Dangerous Activities

Article 2069 of the civil code clarifies the liability regarding dangerous activities as:”A person who exposes another to abnormal risk, by using or storing explosive or poisonous substances, or by erecting high-tension electric transmission lines, or by modifying the lie of the land, or by engaging in an exceptionally dangerous industrial activity, shall be liable where the danger he has created materializes, thereby causing damage to another.”

In a case covered by dangerous activities, the plaintiff must show that:

a. The defendant has a duty of care,
b. The plaintiff was injured, and
c. The injury was caused by what the defendant did.

On the other hand, the defence for dangerous activities claims is as stated in article 2066(2), no liability shall be incurred where the damage is due to the victim's fault. There is also a condition that a plaintiff may be compensated partly as indicated in article 2098(2). It says that where the damage is due partly to the fault of the victim, the latter shall be entitled to partial compensation only.

Figure 4.8 shows the conceptual model in coming to a decision regarding liability of dangerous activities.

4.2.5.7 Moral Injury

As mentioned before, moral injury neither costs money nor causes physical injury, but may cause emotional harm or demean the plaintiff as a human being. The liability of moral injury is mentioned in the three sections of article 2030 of the civil code as:

1) A person commits an offence where he acts or refrains from acting in a manner or in conditions which offend morality or public or order.

2) Regard shall be had to the behavior of a reasonable man.

3) Unless otherwise provided by law, the offence shall be assessed without regard to the age or mental state of the person concerned.

In order to assert the defendant commits moral injury, the plaintiff is has to prove the following conditions:

1) There is an act or omission by a defendant,
2) The act or omission causes a moral injury to the plaintiff/victim,
3) The injury is resulted due to the defendant's intentional wrongdoing or negligence act.

The necessary concepts in handling moral injury claim are modeled in figure 4.9.

4.2.5.8 Physical Assault

The term assault refers to a crime; the unlawful touching of another. With regard to physical assault, article 2038 of the civil code states the following:

1) A person commits an offence where he intentionally makes contact with the person of another against the latter's will.
2) An offence shall be committed regardless of whether the bodily harm done to the other person is caused by personal contact or by the use of an object, animate or inanimate.
3) Unless otherwise provided, the mere threat of physical assault on another shall not constitute an offence.

According to article 2039 of the civil code, the defence for physical assault claim is indicated as follows.

a) the defendant could not reasonably have foreseen that the plaintiff would object to his act; or
b) the act was done, in a reasonable manner, in legitimate self-defence, or in the legitimate defence of another, or to safeguard property of which the defendant is the lawful owner or possessor; or
c) the act consists in reasonable corporal punishment inflicted by the defendant on his child, ward, pupil or servant; or
d) the plaintiff was a dangerous lunatic whom it was necessary to restrain from doing harm, and the act was done in a reasonable manner; or

e) there are any other circumstances such as to justify the defendant's action in the eyes of a reasonable person.

Figure 4.10 indicates the conceptual model for resolving the claims for physical assault.

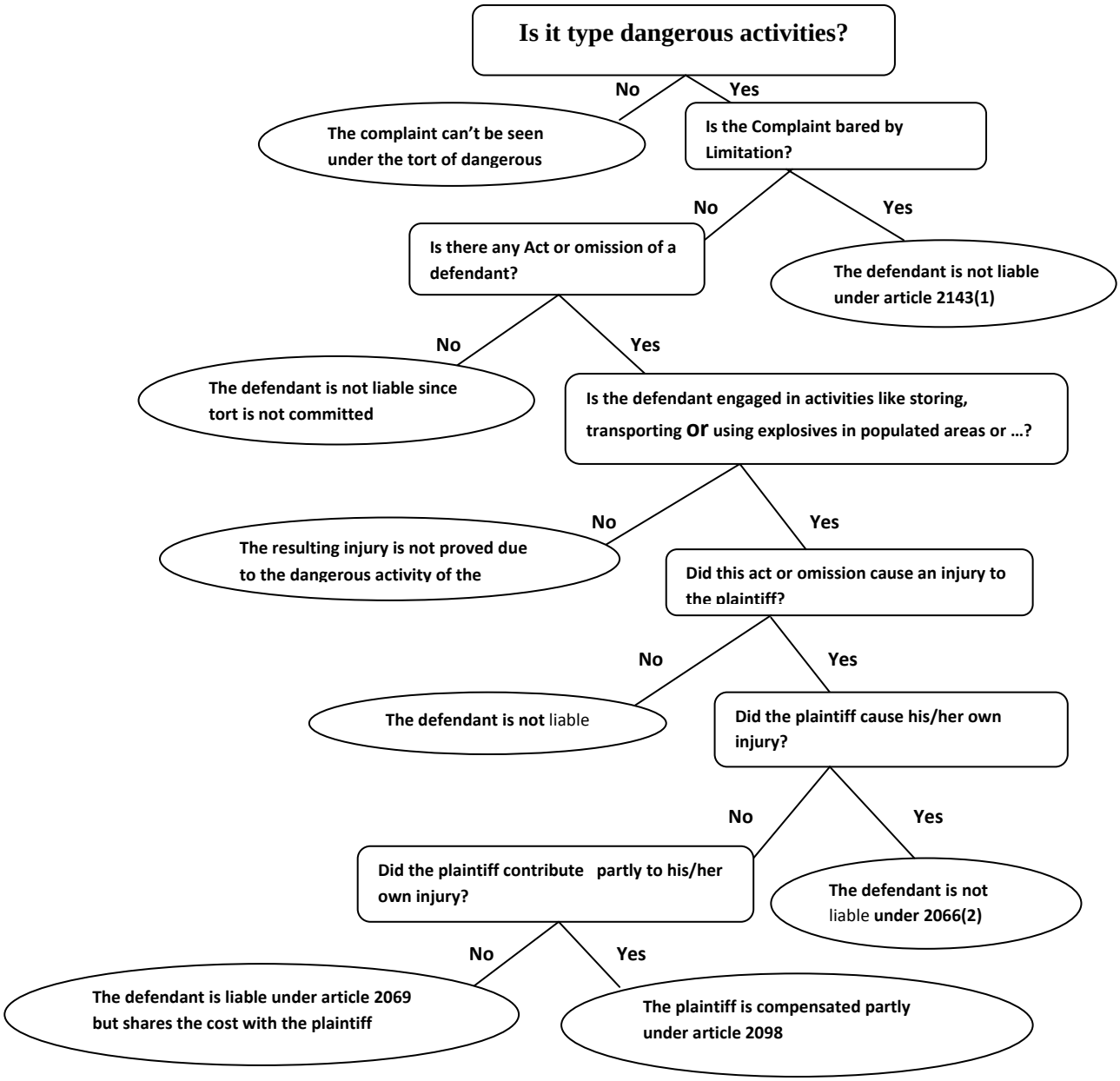

Figure 4.8: Conceptual model of handling claim on dangerous activities

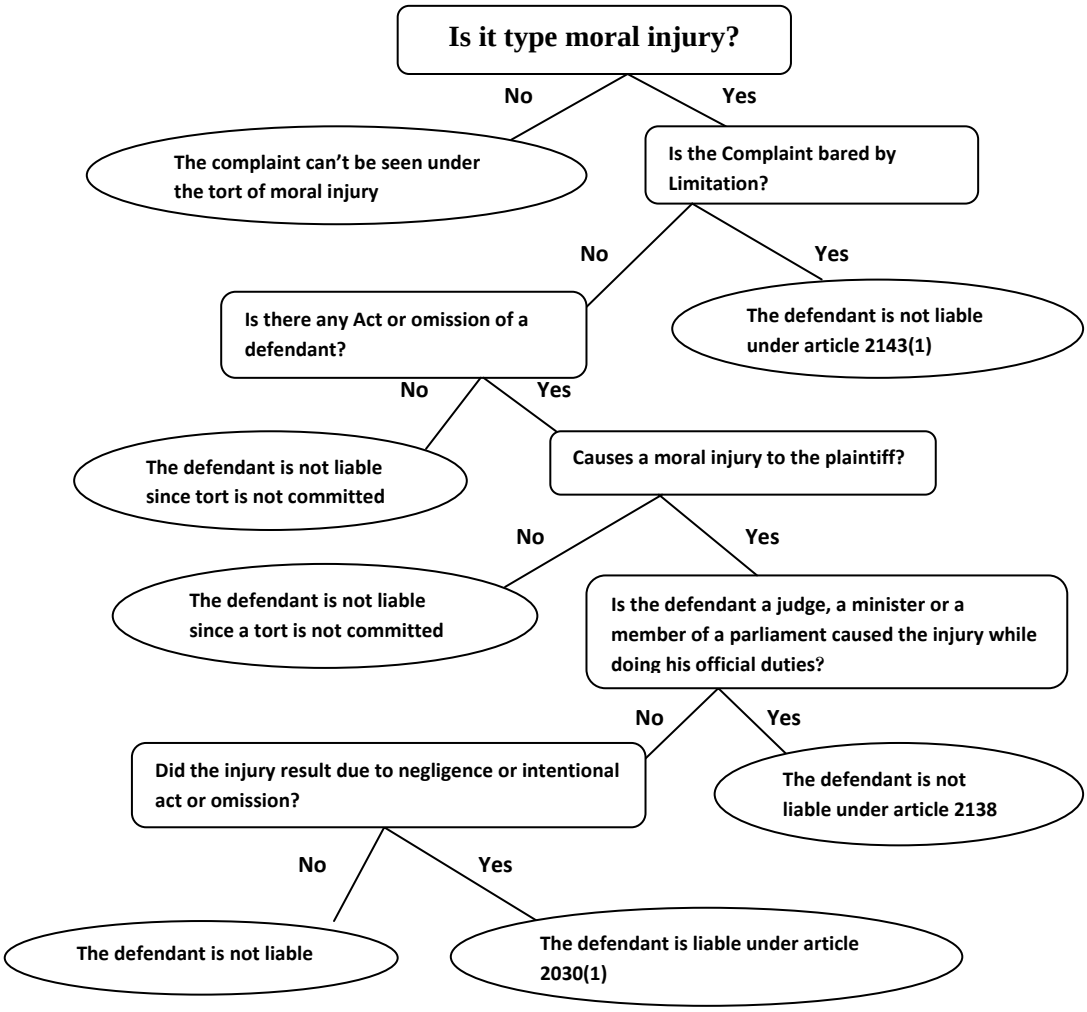

Figure 4.9: Conceptual model of handling claim on Moral Injury

After asserting liability for a given tortious act, the court then makes decision on awarding the plaintiff the right amount of money for the injury suffered from the accident which is caused by the wrongdoer. The amount to be compensated to the injured party is based on the specific rules stated in the civil code of Ethiopia. The next section presents the concepts on remedial duties.

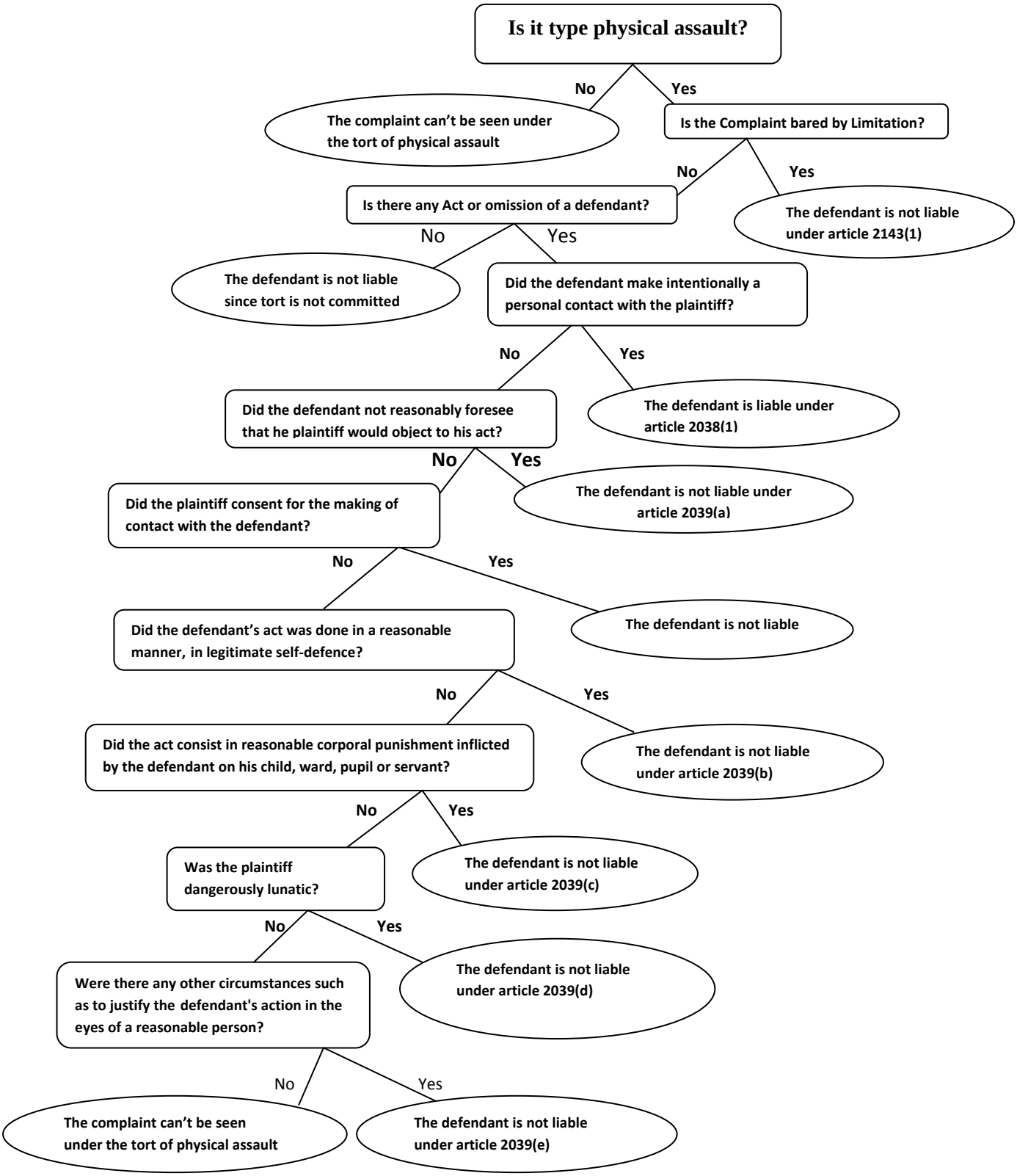

Figure 4.10: Conceptual model of handling claim on physical assault

4.2.6 Liabilities and Redress

When duty, breach, and causal link have been established in a tort action, the plaintiff may recover damages for the economic losses sustained. Redress is a remedy or relief that the person who is liable for harm must provide to the person who has suffered the harm. The remedy can consist in undoing the harm (restoration) if this is possible, or in monetary compensation or in injunction.

1. **Restoration-** means re-establishing the situation as it was before the harm was caused. It is one of the possible types of redress to be provided by a liable person to the person who suffered the harm. However, depending on the type of harm, restoration will not always be possible.
2. **Compensation -**is the provision of the monetary value of the harm. In some legal systems, compensation is due if restoration is not possible. The court generally determines the value of the goods or rights that have been infringed, on the basis of their market value, and thus the amount of compensation to be paid. In Ethiopian tort law, there are no minimum or maximum financial limits to the liability. Courts may typically rely on expert testimony to translate the losses into monetary figures in situations of complexity.

With regard to compensation, article 2097 of the civil code states that:

1) Compensation for the damage may not be claimed contrary to good faith.
2) The victim may not claim compensation for the damage he has suffered in so far as, by acting in a reasonable manner; he could have avoided or limited the damage.

3. Injunction- is a legal mandate to act or refrain from acting. In addition to damages for past tortious conduct; plaintiffs may seek injunctive relief to prevent future harm. Manufacturing plants that billow smoke that pollutes the air, companies that discharge chemicals that poison the water, and factories that store chemicals that migrate through the soil create risks of injury that are likely to recur over time. If the harmfulness of such operations outweighs their usefulness, plaintiffs may successfully obtain a court order enjoining or restraining them.

The measure of damages is determined by the nature of the tort committed and the type of injury suffered. With regard to the amount of money awarded to the plaintiff suffering physical injury,

defamation, professional fault, false Imprisonment, moral injury, and physical assault, the Ethiopian tort law includes the following specific rules.

1. Physical Injury

Article 2113 - Physical Injuries or Death

Fair compensation may be awarded by way of redress to the victim of bodily injuries or, in the event of his death in consequence thereof, to his family.

Article 2095- Fatal Accidents

1) In the case of a fatal accident, the spouse of the victim, his ascendants and his descendants may claim compensation on their behalf for the material damage they have suffered as a result of his death.
2) In this case the compensation for the damage shall be in the form of a maintenance allowance.
3) The maintenance allowance shall be due notwithstanding that the plaintiffs have relatives whom they can ask to support them.

Article 2098- Fault of the Victim

1) Where the damage is due partly to the fault of the victim, the latter shall be entitled to partial compensation only.
2) In fixing the extent to which the damage shall be made good, all the circumstances of the case shall be taken into consideration, in particular the extent to which the fault committed have contributed to causing the damage and the respective gravity of these faults.

Physical injury tort must normally recover all the plaintiff's damages—pain, suffering, disability, impairment and loss of enjoyment of life, past medical expenses, future medical expenses , past lost wages , future lost wages—during a single lawsuit. In order to make an award for future pain and suffering, disability and impairment, loss of enjoyment of life, medical expenses, and loss of future earnings should be considered. It is better to consider the plaintiff's life expectancy at the time of the accident.

The measure of damages for loss of profits to a plaintiff who is an owner of a business is the value of the plaintiff's services in carrying on that business which were lost as a proximate result of his/her injuries. In determining the value of the plaintiff's services, the nature of the business, the capital, assets and personnel employed, the average weekly (or monthly) profits earned before and after the accident and any expense to which the plaintiff was put to hire others to perform services which he/she had previously performed himself/ herself should be taken into consideration.

2. Defamation

Under **Article 2109** of the civil code, fair compensation may be awarded by way of redress to the plaintiff or to a charity named by him, in the case of insult or defamation where:

a) The injurious or defamatory charges are that the plaintiff has committed a crime or an offence punishable under the criminal law; or

b) They allege that the plaintiff is incompetent or dishonest in the exercise of his profession; or

c) They allege that the plaintiff, if a business man, is insolvent; or

d) They allege that the plaintiff is suffering from a contagious disease; or

e) They allege that the plaintiff is of low morals.

Article 2135

The managing editor of the newspaper, the printer of the pamphlet or the publisher of the book shall be liable under the law for defamation committed by the author of a printed text.

3. Professional Fault

The mode of compensation due to a professional fault is indicated in three sections of article 2127 of the civil code. These are worth mentioning here under:

1) A fault shall be deemed to be a professional fault where the person who committed it believed in good faith that he acted within the scope of his duties and in the interest of the state.
2) A fault shall be deemed to be a personal fault in other cases.
3) Unless the contrary is proved, the servant or employee shall be deemed to have acted in good faith.

4. False Imprisonment

The compensation pertaining to False Imprisonment is stated under Article 2108 as: where the plaintiff has been unlawfully deprived of his liberty by the defendant, the court may, by way of redress, order the defendant to pay fair compensation to the plaintiff or to a charity named by the plaintiff.

5. Moral Injury

Article 2105 and Article 2106 indicate the compensation for moral injury as follows.

Article 2105

1) The author of a misdeed shall make good the moral harm resulting from his misdeed wherever adequate procedure exists for such redress.
2) Unless otherwise expressly provided by law, moral harm may not be made good by way of damages.

Article 2106— Intentional Offence

Where moral harm has been inflicted upon the plaintiff deliberately, the court may, by way of redress, order the defendant to pay fair compensation to the plaintiff or to a charity named by the plaintiff. However, as stated in **article 2116(3),** the compensation for a moral injury in no case exceed Birr 1000(one thousand Birr).

6. Physical Assault

The mode of compensation resulted from physical assault stated under article 2107 of the civil code as: where the defendant has forced an unpleasant or repulsive contact on the person, the court may, by way of redress, order the defendant to pay fair compensation to the plaintiff or to a charity named by the plaintiff.

Redress pertaining to product liability and engaging on dangerous activities is based on the rules stated for physical injury liability, if fault is resulted in personal injury. The concepts with respect to redress are depicted in figure 4.11.

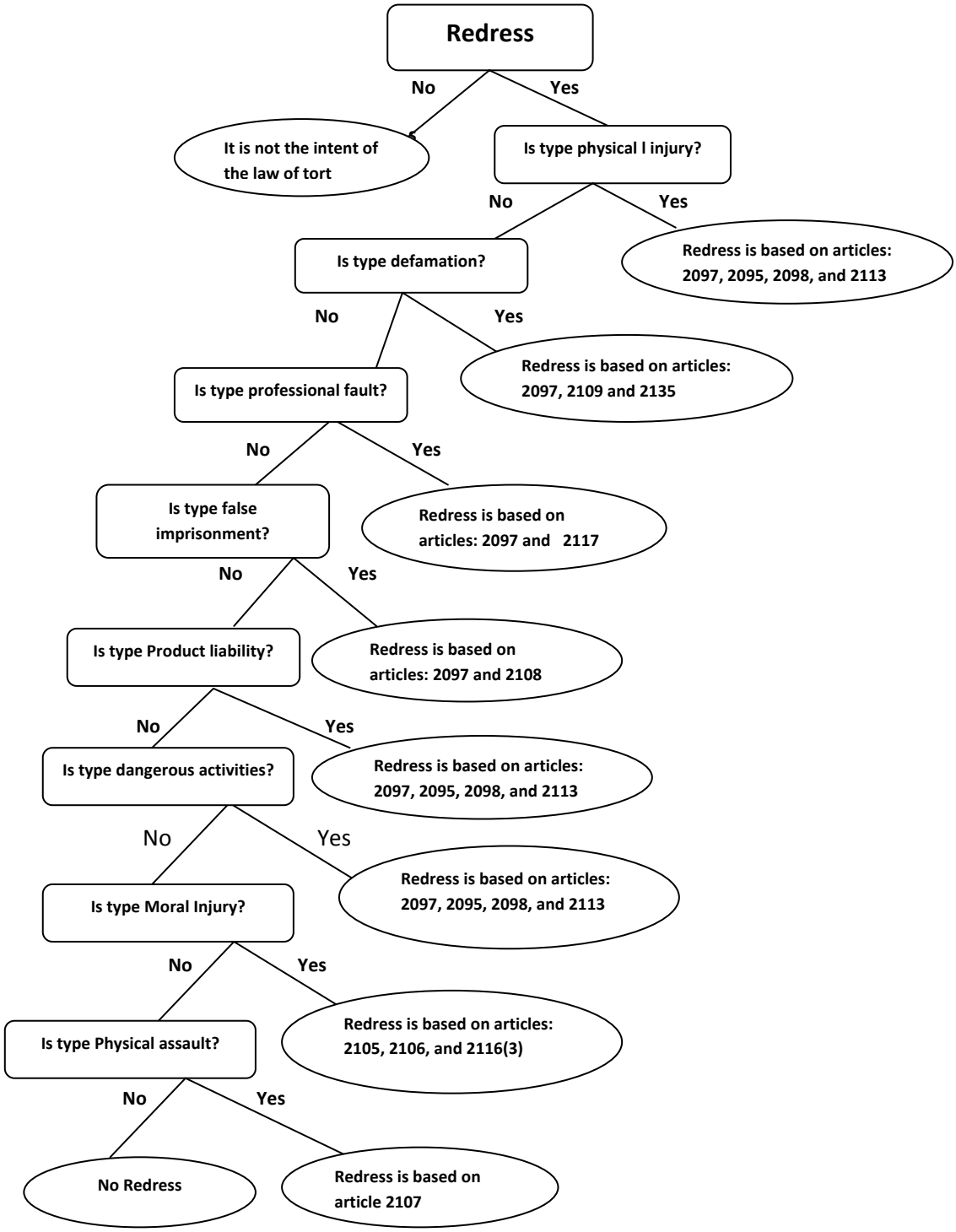

Figure 4.11: Conceptual Model of Redress

The entire discussions made in this chapter revolve around capturing the essential knowledge for handling tort claims from domain experts, statute books, and journal articles followed by the

modeling of the elicited concepts which serve as a blueprint for the representation of the knowledge inside the machine.

The next chapter presents the representation of the acquired knowledge, the testing of the knowledge base for accuracy and completeness, and the performance evaluation aspects at length.

CHAPTER FIVE

IMPLEMENTATION AND PERFORMANCE EVALUATION

Once the necessary knowledge is acquired and modeled as presented in chapter four, the knowledge based system is designed and implemented in order to evaluate its suitability for cases related to tort claims. To this end, the researcher first attempt to design the knowledge-based system architecture as presented here under.

5.1 Architecture of the System

The KBS development follows two phases, as shown in Figure 5.1. On the one hand, the knowledge engineer collects both tacit and explicit knowledge. The tacit knowledge is the important knowledge for designing the KBS that serves in tort claim, is acquired from domain experts. In addition, the codified knowledge is gathered from manuals and law documents. Then, the knowledge is modeled and represented using rule-based knowledge representation technique, which is stored in the knowledge base.

On the other hand, users (both external and domain experts) are requesting the system for advisory services. Through the user interface, users provide their queries and then the inference engine, which is implemented using backward chaining, is initiated to search for rules in the knowledge base that are matching with the user's query. Accordingly, the solution is communicated back to the user through the user inference.

The architectural design of the KBS serves as a blueprint for the implementation of the system. The purpose of implementation is to show how the knowledge is codified internally and then to test the system is built right. The implementation of the system is done into two phases: writing codes using the PRoLOG programming language and performance evaluation.

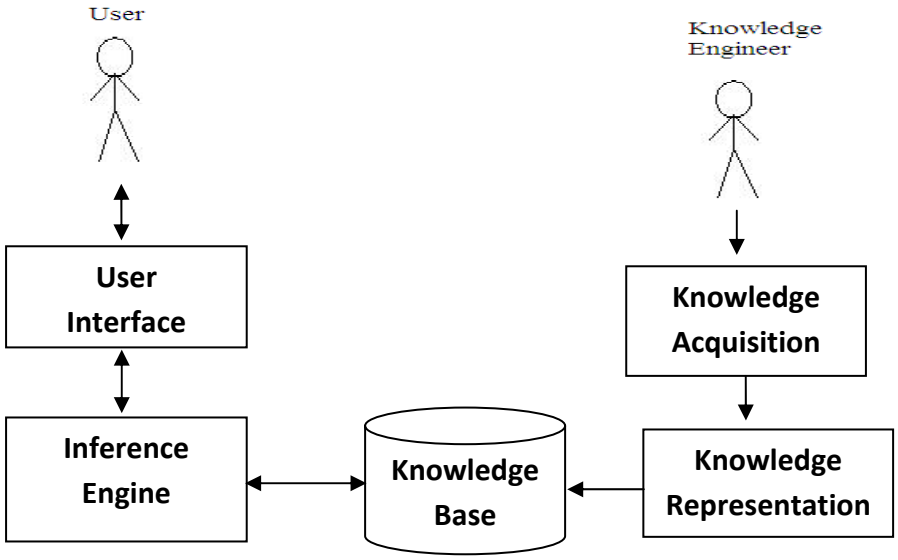

Figure 5.1: The Overall Architecture of the KBS

5.2 Knowledge Representation

Prior to the discussion of the internal representation of the knowledge for use by the KBS, it is better to give a general idea on how the knowledge is going to be encoded using the rule-based approach. The following shows some of the representative IF-THEN rules included in the tort adjudication knowledge-based system.

In the tort law of Ethiopia, a defendant is said to be in a fault-based liability if the conditions in RULE1 are satisfied.

RULE1:

THEN:

The defendant is liable for a given tortious act as a result of this he/she is obliged to make compensation to the plaintiff for the injury/damage suffered.

IF:

1) There is an act or omission by a defendant, AND
2) The act or omission causes an injury to the plaintiff/victim, AND
3) The injury is recognized by law, AND
4) The injury is resulted due to the defendant's intentional wrongdoing or negligence act, AND

5) There is a casual link between the defendant's act or omission with the resulting injury.

There are also conditions under which the defendant will not be liable for a given tort claim as listed in RULE 2.

RULE2:

THEN:

The defendant is not liable and no remedies are made.

IF:

1) The plaintiff causes his/her own injury, OR
2) Defendant cause harm/injury to the plaintiff without committing a legal wrong for a self defence which is done proportionally, OR,
3) The defendant is a member of a parliament, a judge, or a minister ',where an injury/harm is committed within the scope of official duties, OR
4) The tort claim which is not recognized as crime is made to the court after two years.

As shown in RULE3 below, the plaintiff made to be recovered partly when he/she contributes partly to his/her own injury.

RULE3:

THEN:

The plaintiff is compensated partly for the resulting damage

IF:

The plaintiff partly contributes to his/her own injury

In the case of non-fault based liability (or strict liability), the plaintiff must prove the three conditions stated under RULE4.

RULE4:

THEN:

The defendant is liable under strict liability as a result the plaintiff must be compensated for the resulting damage.

IF:

1) The defendant did something, AND

2) The plaintiff was injured, AND
3) The injury was caused by what the defendant did

5.2.1 Knowledge Coding

The prototype KBS comprises of eight modules: physical injury, defamation, professional fault, false imprisonment, product liability, dangerous activities, moral injury, and physical assault. The codification is undertaken module by module where the first module is codified first, the second module next and so on. A methodical discussion on the implementation of each module is made in the next subsequent sections.

The knowledge regarding physical injury claim consists the following:

- Declaring liability of a defendant for committing a physical injury and making redress;
- Asserting the contribution of a plaintiff to the resulted injury, partly, or entirely;
- Knowledge that frees the defendant from being liable for the claim.

The knowledge in the physical injury claim module is written by following four steps. First, important facts about the knowledge category made above are garnered and grouped together as:

- The conditions that assert a defendant is liable for a given tort;
- The conditions that determine whether the plaintiff has contribution to his own injury or not;
- The conditions that free the defendant from a given tort claim.

In the second step, different questions are designed to be answered as ‘yes’ or ‘no’. Then, the coding of the knowledge regarding physical injury claim is done by using eleven rules as shown in Figure 5.2.

```
decision(1, [no,_,no,yes,yes,yes,_,_,_,_,no]):-
nl,

write('Decision May be:\n\n'),nl,
write('The defendant is liable according to art. 2032 and art. 2067 of the Civil Code of
Ethiopia for his/her intentional wrongdoing which'),nl,
write('caused a physical injury to the plaintiff'),nl,
write('Thus, the injured plaintiff is entitled to recover:'),nl,
write('a: loss of earning capacity or wage loss(considering the past and the future), '),nl,
write('if the plaintiff is paralyzed as a result of tortious act.'),nl,
write('b: reasonable medical expenses '),nl,
write('c: a payment for pain and suffering, including mental pain and suffering.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
decision(1, [no,_,no,yes,yes,no,_,no,_,yes,no]):-
nl,
write('Decision May be:\n\n'),nl,
write('The plaintiff has to be compensated partly according to art.2098 of the Civil Code of
Ethiopia since he/she has contributed partly to the injury/harm.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
decision(1, [no,_,no,yes,yes,no,yes,_,_,_,no]):-
nl,
write('Decision May be:\n\n'),nl,
write('According to art. 2067(2) of the Civil Code of Ethiopia, the defendant has no liability
for this tortious act as it is committed proportionally for self defence. '),nl,
write('As a result, no remedies will be awarded to the plaintiff.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
decision(1, [no,_,no,yes,yes,no,_,yes,no,_,no]):-
nl,
write('Decision May be:\n\n'),nl,
write('According to art. 2068 of the Civil Code of Ethiopia, the defendant is not liable in the
exercise of a sporting activity, '),nl,
write('a person injures another taking part in the same activity, or present as a spectator,'),nl,
write('provided that there is no deceit or gross infringement of the rules of the sport.'),nl,
write('As a result, no remedies will be awarded to the plaintiff.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
decision(1, [no,_,no,yes,yes,no,_,no,yes,_,_]):-
```

Figure 5.2: Codes for the Knowledge Regarding Physical Injury

From the above figure, the rule *decision(1, [no,_,no,yes,yes,yes,_,_,_,_,no])* indicates that the defendant is liable for committing a tort of physical injury if the responses of question one, three, and eleven are each ‘no’, and question four, five, and six are each ‘yes’. The underscore (_)

indicates that don't consider the response of a given question as it has no effect in the decision. The remaining rules for physical injury are represented in similar fashion.

In the third step, the codes for capturing the relevant inputs from the users are written with respect to physical injury claim (see figure 5.3).

```
askSpecificQuestion1([Q1, Q2, Q3, Q4, Q5, Q6,Q7,Q8,Q9,Q10,Q11]):-
write('\n\nAnswer the following questions by writing yes or no answers in a lower cases
followed by a full stop'),nl,nl,
write('1: Is the tort claim made to the court after two years, '),nl,
write('   starting from the date at which the plaintiff/victim suffered the damage?\n'),nl,
tab(3),write('ANSWER:'),read(Q1),nl,
write('2: Is there an act or omission by a defendant?  '),nl,
tab(3),write('ANSWER:'),read(Q2),nl,
write('3: Is the defendant a member of a parliament, a judge, or a minister?'),nl,
write(',  where such injury/harm is committed within the scope of official duties. '),nl,
tab(3),write('ANSWER:'),read(Q3),nl,
write('4: Did this act or omission cause a physical injury to the plaintiff/victim  '),nl,
tab(3),write('ANSWER:'),read(Q4),nl,
write('5: Is the injury recognized by law?  '),nl,
tab(3),write('ANSWER:'),read(Q5),nl,
write('6: Did the injury occur due to the defendant's intentional wrongdoing or due to
negligence?  '),nl,
tab(3),write('ANSWER:'),read(Q6),nl,
write('7: Did the defendant cause harm/injury to the plaintiff without committing a legal
wrong for a '),nl,
write('   self defence which is done proportionally?'),nl,
tab(3),write('ANSWER:'),read(Q7),nl,
write('8: Did the injury result from sporting activities where the defendant's activity was '),nl,
write('   without gross infringement of the rules of the sport?  '),nl,
tab(3),write('ANSWER:'),read(Q8),nl,
write('9: Did the plaintiff/victim cause his/her own injury?  '),nl,
tab(3),write('ANSWER:'),read(Q9),nl,
write('10: Did the plaintiff contribute partly to his/her resulting injury/harm?'),nl,
tab(3),write('ANSWER:'),read(Q10),nl,
write('11: Did this act or omission cause a  death to the plaintiff/victim?'),nl,
tab(3),write('ANSWER:'),read(Q11),nl.
```

Figure 5.3: The Codes for Capturing Input for Physical Injury Claim

At the fourth step, the codes for allowing users to interact with the subsystem are written. In here, the code for starting the advisory system, selecting options, links to specific questions and to the expected decisions are given in figure 5.4.

```
display_menu(Response),
getResponse(Response, Answer),nl,nl,
decision(Response, Answer).
display_menu(Response):-
write('Select one of the torts or civil wrongs that you want to make an assertion?'),nl,
write('Please type in (or enter) the number instead of typing in text for each  tort category
given below:'),nl,nl,
write('1: physical injury'),nl,
read(Response).
% Obtaining the user's response for Asking specific questions
getResponse(Response,Answer):-
1 = Response,
askSpecificQuestion1(Answer).
```

Figure 5.4: Codes of the User Interface for Physical Injury Claim

In order to begin the system, users just have to type the word 'start.' in the console windows of PRoLog language software. Once the user has key in the word *start*, the subsystem will bring him/her to the introduction session of the system before beginning the consultation as shown in figure 5.5.

```
1 ?- start.

This tort adjudication knowledge-based system identifies whether a defendant commits a
given tort (civil wrong) or not.
It also comments on the compensation to be recovered by an injured plaintiff/victim
**********************************************************************
***Select one of the torts or civil wrongs that you want to make an assertion?
Please type in (or enter) the number instead of typing in text for each tort category given
below:    1: physical injury
|: 1
```

Figure 5.5: Introductory Message of the Physical Injury Subsystem

After the introductory message is displayed for the user, the system waits for user's query. When the user enters 1 for physical injury, the system then starts the question-answer session depicted in figure 5.6 to forward proper recommendation.

Answer the following questions by writing yes or no answers in a lower cases followed by a full stop

1: Is the tort claim made to the court after two years, starting from the date at which the plaintiff/victim suffered the damage?
ANSWER:no.
2: Is there an act or omission by a defendant?
ANSWER:yes.
3: Is the defendant a member of a parliament, a judge, or a minister,? where such injury/harm is commited within the scope of official duties?.
ANSWER:no.
4: Did this act or omission cause a physical injury to the plaintiff/victim
ANSWER:yes.
5: Is the injury recognized by law as attracting liability?
ANSWER:yes.
6: Did the injury occur due to the defendant's intentional wrongdoing or due to negligence?
ANSWER:yes.
7: Did the defendant cause harm/injury to the plaintiff without committing a legal wrong for a self defence which is done proportionally?
ANSWER:no.
8: Did the injury result from sporting activities where the defendant's activity was without gross infringement of the rules of the sport?
ANSWER:no.
9: Did the plaintiff/victim cause his/her own injury?
ANSWER:no.
10: Did the plaintiff contribute partly to his/her resulting injury/harm?
ANSWER:no.
11: Did this act or omission cause a death to the plaintiff/victim?
ANSWER:no.

Figure 5.6: Questions and Answers Session on Physical Injury

After a series of questions and answers, the system finally proposes an appropriate decision as indicated in figure 5.7.

The defendant is liable according to article 2032 and article 2067 of the Civil Code of Ethiopia for his/her intentional wrongdoing which caused a physical injury to the plaintiff. Thus, the injured plaintiff is entitled to recover:

a: loss of earning capacity or wage loss(considering the past and the future), if the plaintiff is paralyzed as a result of tortious act.
b: reasonable medical expenses
c: a payment for pain and suffering, including mental pain and suffering.

TO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop

Figure 5.7: Advice given by the system on Physical Injury

The second implementation is performed for defamation sub-module by following similar steps of implementing physical injury. The necessary knowledge for defamation are coded as depicted in figure 5.8.

```
decision(2, [no,_,yes,_,_,_,no]):-
nl,
write('Decision May Be:\n\n'),nl,
write('According to Article 2048(1) of the Civil Code of Ethiopia, the defendant has no liability for this tortious act '),nl,
write('since he/she has an immunity granted not to be liable for utterances made in a parliamentary debates or the course of legal proceedings.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
decision(2, [no,_,yes,yes,yes,yes,yes]):-
nl,
write('Decision May Be:\n\n'),nl,
write('According to Article 2048(2) of the Civil Code of Ethiopia, the defendant has liability for this tortious act'),nl,
write('where he/she has an intent to injure specifically the plaintiff although the defendant has a legal immunity in a '),nl,
write('parliamentary debate. Thus, according to article 2109 of the Civil Code of Ethiopia fair compensation may be awarded'),nl,
write('by way of redress to the plaintiff or to a charity named by him.'),nl,
write('\nTO CONTINUE PRESS ENTER KEY THEN TYPE start followed by full stop.'),nl,nl.
```

Figure 5.8: The codes for knowledge of Defamation

The various input questions for making conclusions related to defamation are written in figure 5.9.

```
askSpecificQuestion2([Q1, Q2, Q3, Q4, Q5, Q6,Q7]):-

write('\n\nAnswer the following questions by writing yes or no answers in a lower cases
followed by a full stop'),nl,nl,
write('1: Is the tort claim made to the court after two years, '),nl,
write('   starting from the date at which the plaintiff/victim suffered the damage?  '),nl,tab(3),
write('ANSWER: '),read(Q1),nl,
write('2: Is there any act or omission by a defendant?  '),nl,tab(3), write('ANSWER:
'),read(Q2),nl,
write('3: Is a defendant a member of a parliament'),nl,
write(',  where such utterances made in a parliamentary debates or '),nl,
write('   the course of legal proceedings? '),nl,tab(3), write('ANSWER: '),read(Q3),nl,
write('4: Did this act or omission cause a defamatory statement '),nl,
write('   referring specifically to the plaintiff/victim  '),nl,tab(3), write('ANSWER:
'),read(Q4),nl, write('5: Is the statement false?  '),nl, tab(3),write('ANSWER: '),read(Q5),nl,
write('6: Did the defamatory statement was communicated to a person '),nl,
write('   or persons other than the plaintiff?  '),nl,tab(3), write('ANSWER: '),read(Q6),nl,
write('7: Did the defendant make this defamatory statement with the intent to injury '),nl,
write('   the plaintiff when he/she communicated it?  '),nl,tab(3), write('ANSWER:
'),read(Q7),nl.
```

Figure 5.9: The Codes for Capturing Input for defamation

The user interface for the defamation subsystem is coded as depicted in figure 5.10.

As soon as the user enters the word start, the system takes the user to the question answer session as shown for physical injury module in order to make recommendation. The remaining modules professional fault, false imprisonment, product liability, dangerous activities, moral injury, and physical assault are implemented in similar ways. See table 5.1 about the numbers of questions and rules represented for each tort claim.

```
display_menu(Response),
getResponse(Response, Answer),nl,nl,
decision(Response, Answer).
% display menu for selection of options
display_menu(Response):-
write('Select one of the torts or civil wrongs that you want to make an assertion?'),nl,
write('Please type in (or enter) the number instead of typing in text for each  tort category
given below:'),nl,nl,
write('2: defamation'),nl,
read(Response).
% Obtaining the user's response for Asking specific questions
getResponse(Response,Answer):-
2 = Response,
askSpecificQuestion2(Answer).
```

Figure 5.10: Questions and Answers Session on Defamation

Tort Claim	Number of Questions	Number of Rules Generated
Physical injury	11	11
Defamation	7	7
Professional fault	6	7
False imprisonment	7	6
Product liability	9	11
Dangerous Activities	5	6
Moral injury	5	5
Physical assault	9	6
Total	**59**	**59**

Table 5.1: Summary of the Number of Questions and the Rules Generated for Each Tort claim

After completing the coding of the separate modules, the integration of the entire modules is required so as to control and facilitate communication among the components. The coordinating module first initiates the component responsible for displaying an introductory message about the purpose of the KBS. It then transfers control to the subprogram that provides menu options to allow users getting advisory services on a specific tort claim. Based on the user's choice, the coordinating module passes control to the asking specific questions subprogram. At the end, making inferences are performed by the inference engine. Figure 5.11 shows the codes for the coordinating module.

Following the representation of the rules and the facts using the rule-based reasoning approach, a discussion about the represented knowledge are made with the domain experts who were involving in the knowledge acquisition phase in order to check the completeness of the knowledge base. As a result, the represented knowledge is found to be inadequate for the decisions made in the areas of period of limitation, product liability, and professional fault.

The knowledge regarding to the period of limitation was taken from the civil code of Ethiopia which is included under article 2143(1). It says "The action shall be brought by the victim within two years from the time at which he suffered the damage for which he is claiming compensation." Before making the decision, the system asks the question is the tort claim made to the court after two years, starting from the date at which the plaintiff/victim suffered the damage? If the user replies "yes" to the system, it makes a decision as the plaintiff cannot claim for compensation because his/her claim is barred by limitation according to Article 2143(1) of the Civil Code of Ethiopia. However, according to the discussion with the experts, there are conditions where the period of limitation is unbinding in one of to the following cases:

a) Where the damage arises from the commission of a criminal offence in respect, of which the Penal Code prescribes a longer period of limitation, the latter period, shall apply to the action for damages.

b) When the defendant admits the claim.

c) When the plaintiff brought an action asking such compensation previously.

d) There is also a ground on which the court cannot accept plea for limitation, due to the referential fear the plaintiff has towards the defendant.

```
start :-

display_message,
display_menu(Response),
getResponse(Response, Answer),nl,nl,
decision(Response, Answer).
% Displays the Purposes of the knowledge base
display_message:-
write('\n\nThis tort adjudication knowledge-based system advice whether a defendant '),nl,
write('commits a given tort(civil wrong) or not. It also advice the legal bases for deciding the
compensation '),nl,
write('to be recovered by an injured plaintiff/victim '),nl,
write('**********************************************************************'),nl
,nl.% display menu for selection of options
display_menu(Response):-
write('Select one of the torts or civil wrongs that you want to make an assertion?'),nl,
write('Please type in  the number(1,2,3,...,8) corresponding to each  tort category given
below:  '),nl,
write('To QUIT or to EXIT without any selection, type in the word halt in a small letter
followed by a full stop.'),nl,
write('================================================'),nl,
nl, write('1: physical injury          2: defamation'),nl,
write('3: professional fault       4: false imprisonment'),nl,
write('5: product liability        6: dangerous activities'),nl,
write('7: moral injury             8: Physical assault'),nl,
read(Response).
% Obtaining the user's response for Asking specific questions
getResponse(Response,Answer):-
1 = Response,
askSpecificQuestion1(Answer).
getResponse(Response,Answer):-
2 = Response,
askSpecificQuestion2(Answer).
getResponse(Response,Answer):-
3= Response,
askSpecificQuestion3(Answer).
getResponse(Response,Answer):-
4= Response,
askSpecificQuestion4(Answer).
```

Figure 5.11: The Codes for the Coordinating Module

Based on the comments made by the experts, the knowledge regarding the period of limitation is re-examined and incorporated in the knowledge base.

The other area commented by the experts was product liability. At the time of checking for completeness of the knowledge for product liability, the experts raised a question on the response of the system in a situation when a plaintiff made a claim on product liability where the product defect is detected by customary examination. In this case, the system was responding nothing to them as other relevant article on product liability was missed in the represented knowledge. A revision of the required article in the civil code was made with respect to the issue raised by the experts. According to article 2085(2), 'the defendant is not liable to the plaintiff or victim under the strict product liability as the defect which has caused the damage could have been discovered by a customary examination of the goods." This knowledge is made to be included in the knowledge base to make the knowledge represented is complete.

5.2.2 System Testing

Before evaluating the performance of the system by taking previously decided sample cases, non-live test data were used in non-live environment for the purpose of system testing. Both the data and situations are artificially developed which are similar to what users would encounter in the real life situation. The checking of the proper manipulation of the knowledge base by the inference engine and the checking of the responses obtained from the different inputs were done by the researcher as well as by the intended users who were not participating in the knowledge acquisition phase (one lawyer and one judge). Basing the system's query designed for each tort claim, each expert was asked about the decision he would made, for example see figure 5.6. Then, the system was supplied with similar inputs and its outputs were compared with those obtained from human experts. When errors are identified, corrections were made at any stage where necessary before moving to the integration of the entire system. Then, integrated testing was done in a similar way to ensure that the prototype works properly.

5.3 Performance Evaluation

Performance evaluation is performed to ensure whether the prototype system works properly or not, and to ascertain what the system knows, what it incorrectly knows, and what it doesn't know. To do this, six experts from legal domain (two judges, two lawyers and two legal

researchers) who were not participating in the knowledge acquisition stage are made to use the system and evaluate it. At the end of their evaluation, they were asked to assign values (Poor, Fair, Good, Very good, and Excellent) based on the evaluation criteria set as ease of the user interface, appropriateness of queries/questions for making decision, adequacy and clarity of decision made, and the KBS doesn't take forever (loops) to make its inferences. Table 5.2 shows the result of the experts' evaluation.

Evaluation Criteria	**Response**		
	Judges	**Lawyers**	**Legal Researchers**
Ease of the user interface	Good	Good	Excellent
	Very good	Very good	Very good
Appropriateness of queries/questions for making decision	Excellent	Very good	Very good
	Good	Very good	Good
Adequacy and Clarity of decision made	Good	Very good	Very good
	Good	Very Good	Good
The KBS doesn't take forever(loops) to make its inferences	Excellent	Excellent	Excellent
	Excellent	Excellent	Excellent

Table 5.2: The Performance Evaluation of the System by Domain Experts

As shown in the above table, the ease of the user interface is evaluated as good which is 33%, very good (50%) and excellent (17%). The evaluation of user interface as good is due to the adoption of command based nature of user to system interaction. The ease of the user interface is improved further if menu-based user interface is employed for the system. Appropriateness of queries/questions raised by the system for making decision is responded as good (17%), very good (66%), and excellent (17%). The evaluation of adequacy and clarity of decision made by the prototype system is good (50%) and very good (50%). At last, the KBS doesn't take forever (loops) to make its inferences is evaluated as excellent (100%). In general, the evaluation of the prototype system by domain experts shows a promising result.

Since the evaluation technique described above provided more of a rough assessment of the performance of the KBS, a sample of thirteen cases is taken from thirty-five previously decided cases by the Federal Supreme Court of Ethiopia in the domain of tort law. The samples are selected based on purposive sampling techniques. This technique is adopted mainly because the selection of cases that are related to the scope of this research is required from the different tort cases. The decisions made by the court for each tort claim are compared with the system's output. A sample of how the comparisons made between the decision made by human experts and the prototype KBS are given in the following sections.

Case 1: A complaint Bared by Limitation

The wife of the plaintiff applied to the court that her husband was killed on June 5/1984 E.C due to the careless driving of the defendant in an application made on Meskerem 4/1992 E.C. Therefore, she inquired the court that the defendant has to pay money amounted to 220,000 birr to compensate the loss of benefits for her and including her two children which is caused by the fault of the defendant.

In making a decision, the court considers the following facts, evidences, and rules.

Facts

- The plaintiff was killed on June 5/1984 E.C.
- The wife of the victim claimed to the court on Meskerem 4/1992 E.C.

Evidences

- The defendant was punished for his criminal act.

- The insurance company made payments to the victim on behalf of the defendant but she complained that this was not satisfactory.

Rules Applied: Article 2143(1)

Decision By the court

According to article 2143(1), the plaintiff has no right to appeal the court for such claim as she brought the case to the court after seven years.

The prototype KBS

The system asks first the question: Is the tort claim made to the court after two years, starting from the date at which the plaintiff/victim suffered the damage? It also directs the user to consider the points to be considered in the period of limitation. Then it makes the following decision.

Decision by the prototype KBS*:*

The plaintiff cannot claim for compensation because his/her claim is barred by limitation according to Article 2143(1) of the Civil Code of Ethiopia.

Discussion: There is no difference in the decision made by human experts and the decision made by the prototype KBS regarding the period for a claim to be made to the court.

Case 2 Defamation

The plaintiff asked the court that the defendant was witnessing baselessly on him to a first instant court for making deforestation. As a result, the defendant has to pay him a total of 350 birr where 150 birr for moral injury and 200 birr for the expenses incurred for an appellate to the Supreme Court.

In making a decision, the court considers the following facts, evidences, and rules.

Fact

The defendant witnessed that he saw the plaintiff while selling woods but not observing while he was cutting trees.

Evidences

- The fact is supported by evidence.
- The plaintiff can’t prove this allegation with evidences.

Decision By the court

The defendant is not liable as he witnessed what he has seen. Therefore, he is not committing defamation and the plaintiff is not getting a reward for the alleged moral injury and expenses incurred.

Decision by the prototype KBS

The system asks a series of questions and arrives at the decision given below: The defendant does not make any defamatory statement as the plaintiff cannot prove such defamatory statement is false and communicated to other persons.

Discussion

Similar decision forwarded by the court and the system that the defendant is not liable for the defamatory claim made by the plaintiff.

Case 3: Permanent Injury claim accompanied by Moral Injury

A 37 years old house wife applied to the court that the defendant (policeman) causes severe injury on her right hand and the body near to her breast by a bullet shot by him for ensuring security when the violence was erupted while destroying illegally constructed homes by the pertinent bodies. Thus, she requested the court that a total of 50,680 birr to be rewarded for the injury suffered due to the fault of the defendant. The amount asked was calculated based on her life expectancy. At the time of the accident she was 37 years old and she will remain in life for additional 23 years so that she will be forced to pay approximately 6 birr a day for a maid due to her inability to undertake her home activities which amounted to 49,680 birr in the coming 23 years and 1000 birr for her moral injury.

The court considers the following facts, evidences, and rules to come to a decision.

Fact

- The plaintiff is a house wife so that there are no losses of benefits due to the injury.
- The injury is resulted due to the defendant's wrongdoing.

Evidences

10% permanent body injury is caused by the accident which is attested by medical experts.

Rules Applied: Articles 2066, 2067, and 2092

Decision By the court

The Plaintiff has to be rewarded a total of 9000 birr of which 8000 birr is for the future injury and 1000 birr is for moral injury.

The prototype KBS

After asking different questions, the system decided the case as:

The defendant is liable according to article 2032 of the Civil Code of Ethiopia for his intentional wrongdoing which caused a physical injury to the plaintiff. Thus, the injured plaintiff is entitled to recover:

a) Loss of earning capacity or wage loss (considering the past and the future), if the plaintiff is paralyzed as a result of tortious act.
b) Reasonable medical expenses.
c) A payment for pain and suffering, including mental pain and suffering.

Concerning the **moral injury** the system decided as: The defendant is liable for committing a tort of moral injury to the plaintiff as he did it intentionally. Thus, according to Article 2116(3) of the Civil Code of Ethiopia the victim has to be compensated for the injury sustained up to 1000 Birr.

Discussion: There are slight differences in the decisions made by the court and the prototype system. As shown clearly, the human experts make decision on the amount to be rewarded to the plaintiff. However, the system recommends that the cases to be regarded in calculating the total monetary value to be rewarded to the plaintiff. The other difference is that the prototype system cites article 2032 which makes the defendant commits the tort intentionally but it has to be under article 2066 as referred by the court, the defendant shall be liable for any damage he deliberately causes to the plaintiff in order to save himself or another from an imminent damage to person or property.

Case 4: Permanent Injury Claim

An eighth grade plaintiff applied to the court that his right eye was lost due to the torture committed by the defendant. Thus, the defendant has to reward him a total of 52,830.56 birr for

medical costs, the cost incurred for transport, food and bedroom and the future benefits lost from employment opportunities.

The following facts, evidences, and rules were considered by the court considers in making a decision.

Fact

- The plaintiff lost his right eye due to the fault of the defendant.
- The injury type is permanent partial disablement.

Evidences

It is proved that he plaintiff lost his right eye due to the fault of the defendant.

Rules Applied: The defendant is strictly liable for causing bodily harm under article 2067 and 2102.

Decision By the court

The defendant is liable for inflicting bodily harm on another according to article 2067. Therefore, according to article 2102, by taking into account the ordinary course of events and the measures taken by the plaintiff, the defendant has to reward a total of 21378.92 birr to the plaintiff.

The prototype KBS: Following a series of questions, the system decides that the defendant is liable according to article 2032 of the civil code of Ethiopia for his intentional wrongdoing which caused a physical injury to the plaintiff and under article 2067 for causing bodily harm. Thus, the injured plaintiff is entitled to recover:

a) Loss of earning capacity or wage loss (considering the past and the future), if the plaintiff is paralyzed as a result of tortious act.
b) Reasonable medical expenses
c) A payment for pain and suffering, including mental pain and suffering.

Discussion: In here, the decision made by the court and the system differs also in allocating fair amount of money to the victim. The system is not capable of making decision on the right amount of money to be given for the plaintiff. Similar comparisons were made for the remaining cases. A summary of testing the performance of the system is given in the table below.

Problem	Expert's Decision	KBS's Decision	Why the same/ difference in decision?
A complaint bared by limitation	According to article 2143(1), the plaintiff has no right to appeal the court for such claim as she brought the case to the court after seven years.	The plaintiff cannot claim for compensation because his/her claim is barred by limitation according to Article 2143(1) of the Civil Code of Ethiopia.	The decision is simply based on explicit rules stated in the law of torts.
Defamation	The defendant is not liable as he witnessed what he has seen. Therefore, he is not committing defamation and the plaintiff is not getting a reward for the alleged moral injury and expenses incurred	The defendant does not make any defamatory statement as the plaintiff cannot prove such defamatory statement is false and communicated to other persons.	Since the case/claim is not proven by the plaintiff as indicated in the law, similar decision is arrived.
Permanent Injury claim accompanied by moral injury	The Plaintiff has to be rewarded a total of 9000 birr of which 8000 birr is for the future injury and 1000 birr is for moral injury.	The defendant is liable according to article 2032. The injured plaintiff is entitled to recover the loss of earning capacity.	The human judges fix the exact amount of the injury basing their good faith. They consider the ordinary course of events and the measures taken by the injured party.
		Thus, according to Article 2116(3) the victim has to be compensated for moral injury sustained up to Birr 1000.	The system recommends rewarding up to 1000 Et. Birr for a morally injured claimant. However, human experts decide this maximum amount based on their personal and psychological persuasions of an act or omission of the wrongdoer was due to negligence or intentional.

Problem	Expert's Decision	KBS's Decision	Why the same/ difference in decision?
			They also consider the severity of the injury.
Permanent partial disablement	The defendant is liable for inflicting bodily harm on another according to Article 2067. Therefore, according to article 2102, the defendant has to reward a total of 21378.92 birr to the plaintiff.	The defendant is liable according to article 2032 for his intentional wrongdoing which caused a physical injury to the plaintiff. Thus, the injured plaintiff is entitled to recover the loss of earning capacity.	The system is not capable of making decision on the right amount of money to be compensated to the plaintiff. Moreover, the article cited by the system and human experts differs. Human experts may interpret the case : in a specific and unique context, based upon an orientation towards the future implications, by consulting communal mores, ethics, religion and their own sense of justice, how the facts of the case strike them.
Liability for Injury caused by a car	The owner of the car has no liability for an injury of the plaintiff which is resulted from the car accident. Thus, it is the liability of the driver for committing fault while the	The defendant is liable according to Article 2032 of the civil code.	There is similarity in asserting liability for the injury. But the

Problem	Expert's Decision	KBS's Decision	Why the same/ difference in decision?
	car was in his possession.		system doesn't make decision on transferring liability from the wrongdoer to the owner of the car.
Wrongful death	The defendant is liable based on article 2067. The wife and the two children of the deceased shall be compensated for the cost incurred and the benefits lost due to his death under article 2113. However, the moral injury is not calculated on individual bases. It is based on Article 2116.	The defendant is strictly liable according to article 2067 as the bodily harm resulted in the death of the plaintiff. Thus, according to article 2113 fair compensation should be awarded by way of redress to his family.	Declaring strict liability of the defendant for causing death of the plaintiff is same. This is because the explicit rules pertaining to wrongful death are taken simply from the law of torts.
		According to Article 2116(3) the victim has to be compensated 1000 Et. Birr for moral injury.	The system recommends rewarding up to 1000 Et. Birr for a morally injured claimant. However, human experts decide this maximum amount based on their personal and psychological persuasions of an act or omission of the wrongdoer was due to negligence or intentional. They also consider the severity of the injury.

Problem	Expert's Decision	KBS's Decision	Why the same/ difference in decision?
Medical Malpractice	The plaintiff can't prove professional fault is committed. The fault has to be attested by the board of doctors. Thus, the act of the defendant is considered committed with respect to article 2127(3). As a result, the defendant has no liability.	The defendant is not liable under article 2127(3). It is resulted while the defendant acting accordingly to the scientific facts or the accepted rules of the practice of his/her profession with a good faith of betterment of his official duties.	The decision easily based on explicit rules as stated in the law of torts.
Claim without supporting evidences	The defendant is not liable as the medical evidence of the plaintiff for the injury claim is not from the hospital which is stated in his claim statement for getting a continued medical treatment.	The act or omission of the defendant did not cause a physical injury to the plaintiff or victim so that the claim has no legal ground to be seen under the tort of law.	If an act or omission of the defendant didn't cause an injury on the plaintiff, the system declares no liability for the claim.
Defamation	The defendant is liable for committing a defamatory statement on the plaintiff according to article 2044. Therefore, the defendant has to pay 300 Birr for moral injury.	The defendant is liable for his for this tortious act according to article 2044 of the Civil Code of Ethiopia.	The same article is cited in declaring liability.
		According to Article 2116(3) the victim has to be compensated 1000 Et. Birr for moral injury.	The system simply indicates the maximum limit to be rewarded.

Table 5.3: Summary of the Performance of the System

In short, there are similarities and differences in decisions made by the human experts and the system as shown in table 5.3. Similarity of decisions occurred in situation when all sufficient conditions are given for the application and non-application of the rules. However, the decision passed by the human experts and the system varies in most cases for a number of reasons. First, the system tries to assert liability for the claim based on legal considerations without recommending the exact amount of money to be delivered for the victim. But when the decision made by the human experts are examined, they further consider factors like the victim's income status, benefits lost due to the injury, age at the time of injury , average life expectancy, and nature of the injury (partial or permanent) either to approve or modify the total cost proposed by the claimant. If the assessment of the damage is difficult to fix its exact amount, the human experts determine the amount equitably by taking the ordinary course of events and the measures taken by the injured party.

Second, human experts may interpret the case : in a specific and unique context, based upon an orientation towards the future implications, by consulting communal mores, ethics, religion and their own sense of justice, and how the facts of the case strike them.

Finally, the result of the study shows that the adoption of KBS in tort adjudication as an alternative enables lawyers and judges to have access to a good deal of knowledge and assists them to make appropriate decision by reducing the time required in consulting the large volumes of statute books and in analyzing the complex tort claims. In addition to the legal rules, the outcome of the judicial decision-making process is determined by the political, cultural, economic, and religious persuasion of the presiding judge. It also influenced by the personal and psychological characteristics of a judge. Thus, the legal KBS development effort should concentrate on the factors other than written rules since they have impact on its success. Having a clear picture of the nature of law and legal reasoning, the KBS developer able to elicit the necessary knowledge from domain experts, avoid the possible mistakes in interpreting and representing the legal knowledge and get an insight on how the legal knowledge is utilized.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In the world of scarce resources, law plays a vital role in resolving conflicts by protecting one goal set over another. Tort law is a legal domain which focuses on transferring the injury suffered by the victim to the wrongdoer. This is mainly done by making the wrongdoer liable for all the costs of the accidents. As a result, the costs incurred and the benefits lost due to the accident are calculated and rewarded to the victim. In making such a decision, tort law adjudication greatly requires judicial competence to establish the precise chain of events that lead to an injury, determine the extent of an injury/damage if goes beyond what the defendant might have expected, and resolve complicated economic and non-economic damages to decide fair and full compensation to the victim. In addition to compensation, restoration and injunction are the concern of tort law.

The aim of this research is therefore to discover factors other than written rules that determine the judicial decision and their effect on the development of legal knowledge-based system for settling tort claims under the Ethiopian law.

In order to obtain the necessary knowledge for solving a given tort claim, semi-structured interviews and review of statute books, case reports, and journal articles are employed as knowledge gathering techniques. CommonKADS and decision tree modeling techniques are used to model the different concepts acquired in the knowledge acquisition phase. Rule-based reasoning approach is employed for representing the knowledge required for handling tort claims. The knowledge base is developed using SWI prolog, which is the most compatible and reliable language to deal with rule-based system.

An attempt to understand first how lawyers and judges fashion and utilize legal rules is done before modeling the legal reasoning. It is jurisprudence, which is the science of law, providing a clear picture on the nature of law and legal reasoning. Hence, the close examination of jurisprudence shows that legal rules are essential but inadequate in making legal decisions.

Judicial decision-making process might be determined by the political, cultural, and religious persuasion of the presiding judge. It may also be affected by the personal and psychological characteristics of the judge. As a result, an emphasis has to be given to these factors in the construction of KBSs in the legal domain.

To deal with the open-textured nature of legal concepts legal practitioners devised different methods of statutory interpretation such as textualist, structural, legislative purpose, legislative intent, and legislative history approaches. Jurisprudence also enables KBS developer to elicit the necessary knowledge from domain experts. It also helps to avoid the possible mistakes in representing the legal knowledge and get an insight how legal knowledge is utilized.

The performance of the prototype system is evaluated by taking thirteen previously decided sample cases by FSCE from a total of thirty-five cases. There are similarities and differences in decisions made by the human experts and the system. Similar decisions made in situation when all sufficient conditions are given for the application and non-application of the rules. However, the decision made by human experts differs in most cases. This is basically accountable for the fact that the decisions are not only determined by written rules but also some extra-legal factors which have to do with political, cultural, economic , and religious beliefs of the judges and sometimes personal and psychological characteristics of the judge.

During performance evaluation, there is a problem encountered by the researcher in getting decided cases in the areas of professional fault, physical assault, and product liability. As a result, taking more samples to test for further improvement was difficult. However, the performance of the system is encouraging and can be improved further if large data sets are taken and the factors other than written rules that determine the legal decision are taken into consideration.

Finally, the prototype system enables lawyers and judges to have access to a good deal of knowledge and assists them in making appropriate decision by reducing the time required in consulting the large volumes of statute books and in analyzing the complex tort claims.

6.2 Recommendations

Although this study shows promising results, further work needs to be conducted in order to enhance the prototype system to a full-fledged system. Thus, the following recommendations are forwarded as future research directions.

- The development of a system that will assist judges in determining the precise chain of events that lead to an injury, determining the extent of an injury/damage if goes beyond what the defendant might have expected, and assisting judges in awarding fair compensation for a victim by considering his age, the benefits lost due to injury, life expectancy, all the expenses spent.

- The present system is handling one case at a time. But there are times where cases can be seen in combination and liability may be declared on a group of defendants for a given injury claim. It is therefore necessary to undertake further research on how to analyze different cases before passing decision.

- The judicial decision-making process is determined by the political, cultural, and religious persuasion of the presiding judge. Moreover, it is influenced by the personal and psychological characteristics of the judge. Hence there is a need to explore how to develop a KBS that simulates both legal rules and these factors to enhance predictive capacity of the system.

- The present system is an attempt to design a knowledge base system that incorporates explicit knowledge in civil code. However, there is frequent variability of cases which challenges even the human expert. So to make the KBS up-to-date further research is required to enable the system learns new rules or modify its existing rules by deriving new rules from existing ones to cope with changes in legal developments.

- As the science of law, jurisprudence is an active area of research which deals with the nature of law and legal reasoning. It is therefore necessary to further investigate its usage for KBS development.

- There are legal information systems operational at FSCE. The KBS needs to communicate with such systems to get the necessary data and information. Hence, further

research is recommended to explore on how to integrate tort adjudication KBS with the legal information systems so as to provide an efficient and effective legal services to the general public.

- The practical use of the tort adjudication KBS is realized if the knowledge in the area is exhaustively extracted and other proscriptive tort duties and the associated remedial duties including property damages and liability of individuals for damages caused by their animals, buildings, machines and motor vehicles on another person are incorporated. These can be achieved by undertaking comprehensive study by participating large panel of domain experts, and a thorough extraction of applicable rules from statute books and legal precedents.

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APPENDICES
Appendix I

Appendix I: Interview Questions.

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1) What are the facts of a tort case?
2) What are the issues for the court to decide?
3) Which party evidence as to the facts did the trial judge prefer and why?
4) What are the main issues on causation for the judge to decide?
5) What test had the trial judge applied to determine the standard of care?
6) What cases support the view that there might be negligence even if a body of opinion exists to support the defendant?
7) How do you tackle the problem of open-textured nature of legal concepts? More specifically, how do you make an interpretation of hard cases, when encounterd?
8) Are there problem(s) in handeling tort claims under the Ethiopian law?
9) Are there any importances of jurisprudential theory for legal professionals?
10) What is your view if general legal practitioners consulted by KBS in situations when problems go beyond their level of experience?

Appendix II: Sample Test Cases

DECLARATION

This thesis is my original work and has not been submitted as a partial requirement for a degree in any university and all sources of material used for the thesis have been duly acknowledged.

……..

Solomon Abebe Nurye

January 2010

The thesis has been submitted for examination with my approval as university advisors.

……..

Dr. Millon Meshesha

January 2010