CHAPTER 5

CASE BASE AND MULTI AGENT APPROACH IN DESIGNING OF TOOL

The decision making process involves vagueness and risk, and decision makers have varying degrees of risk loathing. This process also involves qualitative and quantitative analyses and some decision makers prefer one form of analysis over the other. Decision making can be affected not only by lucid judgment, but also by irrational factors such as the personality of the decision maker, peer pressure, the organizational situation, and others. Marketing research enables organizations to make well informed business decisions in different business processes and thus can be the source of competitive advantages. This is especially true when firms are able to extrapolate information from indicators in the external environment and make accurate forecasts about future trends or economic conditions. Once business intelligence is gathered effectively and used proactively then the firms can make decisions that benefit the firms [46].

Figure 5.1 Business Intelligence Cycle
Although the Marketing research plays very important role in the organization but it have many disadvantages. The main disadvantages are given as below:

- Cost
- Complexity
- Time Consuming Implementation:
  - No business case is defined.
  - Solutions that are found are rarely appropriate.

Marketing research is mainly used to identify trends and problems [47]. The major reason of failure of business intelligence is the unavailability of good business cases. Hence we should use such approach that motivates the usage of business cases in decision making process. After this, there will be availability of good business case. The case based reasoning approach is most suitable for this situation.

### 5.1 CASE BASE REASONING

The objective is that case base Reasoning help business for taking right decision at a right time especially when the situation in the market is fluid [48]. Case-Based Reasoning (CBR) is a problem-solving approach that simulates the human problem-solving behaviour. In this approach, the problem is being solved out on basis of past experiences gained from during solving the problem in the past. In case of complex system, it is very difficult to formulate the situations with domain rules. Other drawback is that the rules require more input information than is typically available, because of incomplete problem specifications or because the knowledge needed is simply not available at problem-solving time. But in case of CBR approach, if general knowledge is not sufficient because of too many exceptions, or when new solutions can be derived from old solutions more easily than from scuff, then on basis of past experiences, the problem is being solved.

The case based reasoning involves four phases in the problem solving. Each problem specification & its solution are stored in form of the cases. It maintains the collect of the cases that is known as the case base. In this system, every problem is
considered as the new case. In the retrieve phase according the new case, approximate solution case is being searched from the case base & selected. After the selection of the case, that case is adapted with the new case. It generates the solved case. Now the solved case is evaluated in the revise phase & the faults in that case are being repaired. Now modified case is the solution of the problem. This solution is stored in the case with proper index. This action is mandatory for extracting the cases very efficiently & fast access to the cases in future.

![Case Based Reasoning Cycle Diagram](image)

**Figure 5.2 Case Based Reasoning Cycle**

5.1.1 **Case based reasoning cycle**

The processes involved in CBR can be represented by a schematic cycle. CBR cycle process contains the four major steps.
➢ RETRIEVE the most similar case(s).
➢ REUSE the case(s) to attempt to solve the problem.
➢ REVISE the proposed solution if necessary.
➢ RETAIN the new solution as a part of a new case.

A new problem is matched against cases in the case base and one or more similar cases are retrieved. A solution suggested by the matching cases is then reused and tested for success. Unless the retrieved case is a close match the solution will probably have to be revised producing a new case that can be retained [49].

5.1.2 Case representation

A case is basically piece of knowledge representing an experience [50]. It contains the past record that is the content of the case and the context in which the record can be used. Typically a case consists:

➢ Problem, that describes the state of the world when the case occurred
➢ Solution, which states the derived solution to that problem
➢ Outcome, which describe the state of the world after the case occurred

The representation in the case base is well defined for the purpose of retrieval. The following table shows how cases are represented.

<table>
<thead>
<tr>
<th>Identification</th>
<th>Attribute</th>
<th>Value</th>
</tr>
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Table 5.1 Case Representation

Cases which comprise problems and their solutions can be used to derive solutions to new problems. Cases can be represented in a variety of forms using the wide range of AI representational formalisms including frames, objects, predicates, semantic nets and
rules, the frame/object representation currently being used by the majority of CBR systems [51].

5.1.2.1 Indexing

Case indexing involves assigning indices to cases to assist their retrieval. There are various approach on indexing have been proposed.

- be predictive.
- address the purposes the case will be used for.
- be abstract enough to allow for widening the future use of the case-base.
- be concrete enough to be recognized in future

Both manual and automated methods have been used to select indices. Choosing indices manually involves deciding a case’s purpose with respect to the aims of the reasoner and deciding under what circumstances the case will be useful.

5.1.2.2 Storage

Case storage is an important aspect in designing efficient CBR systems in that, it should reflect the conceptual view of what is represented in the case and take into account the indices that characterize the case. The case-base should be organized into a manageable structure that supports efficient search and retrieval methods.

5.1.2.3 Retrieval

For the purpose of case base retrieval, process should be designed to be:

- adaptable
- consistent - the basic business issues are addressed
- business oriented - concerned with the business capabilities and impact
- comprehensive - includes all factors relevant to a complete evaluation
- understandable - the contents are clearly relevant, logical and simple
- measurable - all key aspects can be quantified
transparent - key elements can be justified directly

After getting the problem description, a retrieval algorithm, using the indices in the case-memory, should retrieve the most similar cases to the current problem or situation. The retrieval algorithm relies on the indices and the organization of the memory to direct the search to potentially useful cases.

The matter of choosing the finest matching case has been addressed by research into correlation. This approach involves using heuristics to constrain and direct the search. Several algorithms have been designed and implemented to retrieve appropriate cases. Among well known methods for case retrieval are: nearest neighbour, induction, knowledge guided induction and template retrieval. These methods can be used alone or combined into hybrid retrieval strategies. But generally nearest neighbor is used in case base approach.

5.1.2.3.1 Nearest neighbor

This approach involves the assessment of similarity between stored cases and the new input case, based on matching a weighted sum of features. The biggest problem here is to determine the weights of the features. The limitation of this approach include problems in converging on the correct solution and retrieval times. In general the use of this method leads to the retrieval time increasing linearly with the number of cases. Therefore this approach is more effective when the case base is relatively small. In nearest neighbor algorithm $w$ is the importance weighting of a feature (or slot), $sim$ is the similarity function, and $f_I$ and $f_R$ are the values for feature $i$ in the input and retrieved cases respectively.

$$\sum_{i=1}^{n} w_i \times sim(f_i^I, f_i^R) / \sum_{i=1}^{n} w_i$$

5.1.2.3.2 Induction
Induction algorithms determine which features do the best job in discriminating cases, and generate a decision tree type structure to organize the cases in memory. This approach is useful when a single case feature is required as a solution, and where that case feature is dependent upon others.

5.1.2.3.3 Knowledge guided induction

This method applies knowledge to the induction process by manually identifying case features that are known or thought to affect the primary case feature. This approach is frequently used in conjunction with other techniques, because the explanatory knowledge is not always readily available for large case bases.

5.1.2.3.4 Template retrieval

Similar to SQL-like queries, template retrieval returns all cases that fit within certain parameters. This technique is often used before other techniques.

5.1.2.4 Adaptation

Once a matching case is retrieved a CBR system should adapt the solution stored in the retrieved case to the needs of the current case. Adaptation looks for prominent differences between the retrieved case and the current case and then applies formulae or rules that take those differences into account when suggesting a solution.

5.2 DECISION SUPPORT SYSTEM BASED ON CASE BASED REASONING SYSTEM

Using CBR systems for decision-aiding has a certain intuitive appeal because such man-machine collaboration in decision-making can be mutually beneficial. A CBR system can help overcome some of the limitations of case-based reasoning by humans. For example, it can augment a decision-maker’s (DM’s) memory by providing access to a large collection of cases, rapidly recalling the most relevant cases, and aiding the decision process through appropriate critiquing. In return, the DM can assume greater responsibility for the use of cases, i.e., the adaptation of prior cases to the current
While humans have been observed to be fairly good at adapting cases, these adaptation procedures have proven to be the Achilles heel for many CBR systems. Another new paradigm which is generating interest is the use of CBR systems to stimulate innovative decision-making and enhance learning about the decision situation in a DM. Such learning oriented CBR systems can be viewed as symbiotic systems in which the human DM and the CBR component play mutually complementary simulative roles in the decision-making process. By exploiting prior problem solving experiences stored within cases in the case library, CBR can provide the opportunity to emphasize the creative divergent aspects of learning such as metaphorical thinking and lateral stimulation. Prior research in such new paradigms for CBR systems has been limited and has lacked adequate conceptual bases. This section augments CBR systems being used as integrative conceptual framework for the design of DSSs. CBR systems are learning oriented and aim to enhance learning in the DM about the decision situation and the decision process. Each type of a CBR system is suited to a particular organizational decision environment and CBR systems can be seen to be evolving from conventional to decision-aiding and simulative in nature.

5.3 APPROACH OF MULTI-AGENT USING CASE BASED REASONING SYSTEM

Multi-Agent System technique is employed in CBR system for the purpose of retrieving, reusing, adapting the cases in CBR System [53]. This section explores a framework that integrates the multi-agent and case-based reasoning techniques to support the dynamic and problem-oriented knowledge sharing among supply chain members. The framework is characterized by differential knowledge sharing levels depending upon the applications as well as the knowledge creation and reuse based on the previous knowledge in the problem area. It also provides a new tool for the field of inter-organizational knowledge management.

The CBR system retrieves cases [54] relevant to the present problem situation from the case base and decides on the solution to the current problem on the basis of the
outcomes from previous cases. CBR System based on MA system consists of the following main agents:

5.3.1 Retriever agent

When a new problem is entered into a case based system, a retriever decides on the features similar to the stored cases. Retrieval is done by using features of the new cases as indexes into the case base.

5.3.2 Adapter agent

An adapter examines the differences between these cases and the current problem. It then applies rules to modify the old solution to fit the new problem.

5.3.3 Refiner agent

A refiner critiques the adapted solution against prior outcomes. One way to do this is to compare it to similar solutions of prior cases. If a known failure exists for a derived solution, the system then decides whether the similarities are sufficient to suspect that the new solution will fail.

5.3.4 Executer agent

Once a solution is critiqued, an executer applies the refined solution to the current problem.

5.3.5 Evaluator agent

If the results are as expected, no further analysis is made, and the cases and its solution are stored or use in future problem solving. If not, the solution is repaired.
5.4 MULTI-AGENT SYSTEM BASED DECISION SUPPORT SYSTEM USING DATA MINING AND CASE BASED REASONING

Intelligent agents represent an important opportunity to optimize knowledge Management. Agents, CBR and data mining can work together to achieve required target [55]. In this data mining agents perform various functions of data mining coordinate with the CBR system. It is increasingly significant to develop better methods and techniques to organize the data for better decision making processes. The following Agents are also engaged in decision support [56]:

DATA MINING AGENT: - A data mining agent is a software program built for Pre-purpose of finding information efficiently. It is a type of intelligent agent that operates
valuable information to find the relationship between different pieces of information. It is a type of agent to detect major trend changes

GOAL: - DMA finding suitable new pertaining information efficiently

FILTERING AGENT: A Filtering agent filter required information; it will check contents and attachment task both include in On End Of Data Filters (smart screen, intelligent content filtering, file filtering, Multiple AV Scan)

GOAL: - Searching message and check filtering reinforcement.

INFORMATION AGENT: An individual or company that is charged with explaining the various transaction of another party to anyone who need to know EXAMPLE: - the delivery of a security by a seller and its acceptance by the buyer

GOAL: - Delivery of commodity to give or keep information

USER INTERFACE AGENT: The user interface is the space where interaction between humans and machines occur effectively and control of the machine feedback from machine, operate making decisions.

GOAL: - Interaction between human and machines operate all levels

OFFICE AGENT: According to portal, office agent will choose information where it finds suitable. Different types of office agent occur; they work and uses are totally different. It depends on functioning values and does their own business. It is very purposeful ordinal nature of point.

GOAL: According to work through this agent altering as per work nature.

WORKFLOW AGENT: the workflow agent can be configured for polling on demand processing. When configured for polling, the workflow agent periodically polls (quires) in the database work queue for batches of task to be processed. Workflow depends on polling
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GOAL: - priority techniques use to analyze workflow

INTERFACE AGENT: - Interface agent to be a program that can also affect the objects in a direct manipulation interface, but without exploit instruction from user. The interface agent reads input that the user presents to the interface and it can make changes to the objects the user sees on the screen.

GOAL: - Defining of objects it depends on input and output

EXTRACTION AGENT: - Extraction agent extracts set of information regarding object and is used its dilute for any such information for further needs. Any information fetch it explain every criteria of objects. Collect complete information about the concept. It shows object detailed in well-mannered.

GOAL: - Launch every bit of information in detailed manner

CATEGORIZATION AGENT: - Categorization agent classified terms in-lieu of format. Such subject have separate category in various form; which category is valuable for any instance and it follow that event summarization.

GOAL: - three level of category maintain (high, middle, low) it perform under based

RETRIEVAL AGENT: - In retrieval agent retrieve information which one has been extracting. Whether this agent executes information using data sets and visualization effects etc. it will display exactly induced information as well. Such functional value used in this format for retrieving procedure

GOAL: - Execute information according to demand specification
Figure 5.4 Multi Agent based Decision Support System Using CBR and DM

5.5 BUSINESS CASES

The logic of the business case base is that, whenever resources such as money or endeavor are consumed, they should be in support of a specific business need [57]. An example could be that a new product introduction and the previous retrieved cases might
provide a good approach strategically. Also “business case base " is that better performance would pick up customer satisfaction, require less task processing time [58]. Information included in a business case base could be the background of the Market Research. A business case base related to market research captures the following:

- Forecasting
- Trends in the Market
- Sales
- Product Development
- New Product Introduction in the Market
- Competitors’ Sales and Market Strategies
- Customer Preferences
- Advertisement Strategies
- Pricing
- Distribution
- Customer Satisfaction
- After Sales Service
- Competitive Advantage

5.6 ROLE OF CASES IN BUSINESS INTELLIGENCE

The business case provides a mechanism for mitigating and guiding a business project [59]. The business case is the basis for deciding the most profitable venture of exertion. For the particular business process, the business case should correspond the following information to the business team:

- The business process’s goals
- The amount of the business process’s investment (time and money)
- The expected or desired business benefits
- The investigation’s scope
- Expectations on the desired process’s scope
The business case knowledge should come from the business, it is mandatory to have the essential analytical skills to produce a well-specified business case [60]. A well-defined business case has proper explanation of the requirements. At various stages, the business case base helps to ensure that:

- The decision taken is still valid
- The decision taken will deliver the solution to the business need