## Expert System in Agriculture

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An Expert System is a software application that attempts to reproduce the performance of one or two more human experts. The concept of expert system development came from the subject domain of Artificial Intelligence (AI). The expert system is used to behave like a human expert to solve the problem with the help of pre-set conditions in the software application. The computer programme uses knowledge and inference procedures to solve problems.

## Definitions

Daniel Hunt (1986) – Expert system is an intelligent computer program that uses knowledge and inferences procedures to solve problems.

According to Prasad and Babu (2008) Expert system can be defined as a tool for information generation from knowledge. It is a computer programme designed to stimulate the problem-solving behaviour of an expert in a narrow domain or discipline.

An expert system is typically composed of at least three primary components. These are the inference engine, the knowledge base, and the User interface.

❖ Knowledge base - This component consists of data, facts and rules for a certain topic, industry or skill, usually equivalent to that of a human expert.
❖ Interference engine - This component uses the facts and rules in the knowledge base to find and learn new knowledge or patterns. It is responsible for gathering the information from the user, by asking various questions and applying it wherever necessary. It seeks information and relationships from the knowledge base and to provide answers, predictions and suggestions the way a human expert would.
❖ User interface -A user interface is the method by which the expert system interacts with a user.
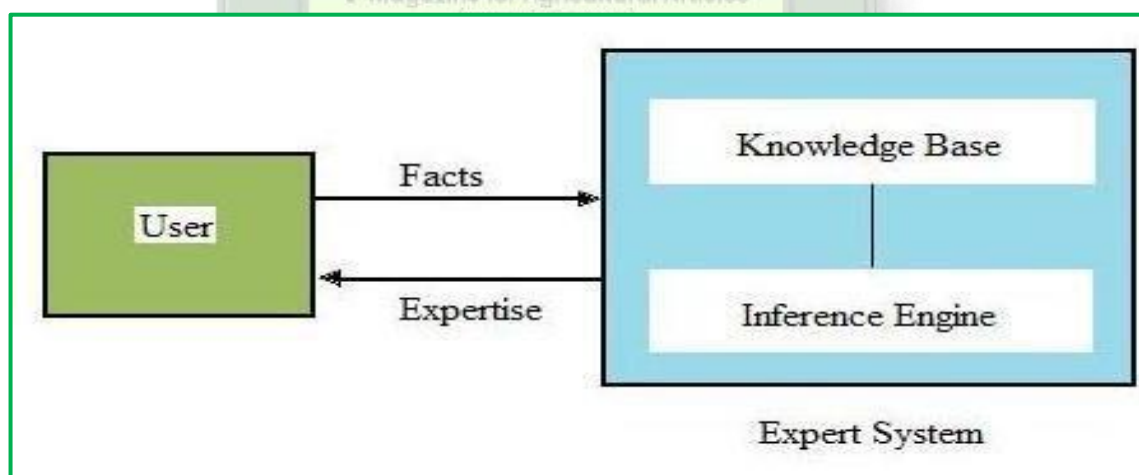
Expert systems use information technology to gain and use human expertise. Obviously, this can be very beneficial to organizations. Expert Systems can:

1. Provide answers for decisions, processes and tasks that are repetitive
2. Hold huge amounts of information
3. Minimize employee training costs
4. Centralize the decision making process
5. Make things more efficient by reducing the time needed to solve problems
6. Combine various human expert intelligences
7. Reduce the number of human errors
8. Provide strategic and comparative advantages that may create problems for competitors

## Objectives

The main objectives of developing expert system in agriculture are:

1. To enhance the performance of agricultural extension personnel and farmers.
2. To make farming more efficient and profitable.
3. To reduce the time required in solving the problems and performing the routine tasks of extension workers.
4. To maintain the expert system by continuously upgrading the database.

**Difference between Conventional Extension and Expert System Extension** (Bahal *et al.* 2004)

| S. No. | Conventional Extension | Expert System of Extension |
|---|---|---|
| 1 | Universal approachability of same information is a problem | Universal approachability of same information is possible |
| 2 | Information is given whatever is available without considering needs and resources | Information is chosen based on their needs and resources |
| 3 | No Cost benefit analysis | Cost benefit analysis |
| 4 | Information flow depends on availability of agent | Information through Cyber Cafe at any place at any time |
| 5 | Require users to draw their own conclusion from facts | Conclusion is drawn based on the decision given by the expert |

Some examples of expert system in India

1. **Rice-Crop:** The MANAGE has developed an expert system to diagnose pests and diseases for rice crop and suggest preventive/curative measures. The rice crop doctor illustrates the use of expert-systems broadly in the area of agriculture and more specifically in the area of rice production through development of a prototype, taking into consideration a few major pests and diseases and some deficiency problems limiting rice yield.
2. **Expert System on Wheat Crop Management -** EXOWHEM Expert system on wheat crop management is an expert system which includes all aspects of wheat production on India. The main goal of the system is to provide the users with all kinds of suggestions and advices regarding the wheat crop production. The system is designed as web based application by IASRI New Delhi that covers agricultural operations, fertilizer application, variety selection, as well as the economic benefits. It is purely a rule based expert system.
3. **AMRAPALIKA** is an Expert System for the diagnosis of pests, diseases, and disorders in Indian Mango. The system makes diagnosis on the basis of response/responses of the user made against queries related to particular disease symptoms. A rule-based expert system is developed using Expert System Shell for Text Animation (ESTA). The

knowledge base of the system contains knowledge about symptoms and remedies of 14 diseases of Indian mango tree appearing during fruiting season and non-fruiting season.

4. **e-Sagu** is a tool for IT–based personalized Agro-Advisory system. ("Sagu" means cultivation in Telgu language). It aims to improve farm productivity by delivering high quality personalized (farm–specific) agro-expert advice in a timely manner to each farm at the farmer's door–steps without farmer asking a question. In e-Sagu, the development of IT such as (Database, Internet, and Digital Photography) is extended to improve the performance of agricultural extension services. The e-Sagu system was implemented during 2004 by delivering advisory to 1051 cotton farms for the farmer of three villages in Warangal district in Andhra Pradesh.

## Advantages

The advantages of expert system are:

1. Expert Systems are useful in many aspects and ready to use by end user as advisory system.
2. Provides consistent answers for repetitive decisions, processes and tasks.
3. Holds and maintains significant levels of information.
4. Encourages human expert to clarify and finalize the logic of their decision-making.
5. Never "forgets" to ask a question, as a human might.
6. They can respond at great speed due to the inherent advantages of computers over humans.
7. Unlike humans, they do not get tense, fatigue or panic and work steadily during emergency situations.

## Disadvantages

However, there are also disadvantages to expert systems, such as:

1. Lacks common sense needed in some decision making.
2. Cannot make creative responses as human expert would in unusual circumstances.
3. Not capable of explaining the logic and reasoning behind a decision
4. Cannot adopt to changing environments, unless knowledge base is changed