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ADOPTION OF INFORMATION TECHNOLOGY FOR FARM MANAGEMENT, A CASE STUDY

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Abstract

Ma'ayan is a software package developed by the Israeli extension service. The package was developed under the assumption that extension has a comparative advantage in bridging the gap between farmers' need for innovative farm management practice, managerial information and software to support it. Farmers producing a wide range of products adopted Ma'ayan. In many cases the adoption process had to overcome various barriers such as: insufficient knowledge using a PC, conservatism, cost benefit considerations, etc..

This review details the results of successful implementation of Ma'ayan as a case study of adoption of a software package for farm-management.

Keywords : Information-Quality, Managerial-Processes, Farm-management

Background

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It is common knowledge that many farmers hand-record, if at all, their relevant data: agricultural production information, cost accounting parameters and such. This results in an inability to efficiently recall, analyze and meaningfully use information when needed and is likely to create tangible business inefficiency. The potential benefit of computerizing data input and information management is well known and apparent. Nevertheless the adoption rate of information technology by farmers is very low and it is even lower then the overall information technology adoption rate in other sectors [5].

Literature based on industry case studies indicates that successful adoption of information systems depends on support of senior management, outside consultants, avoidance of unattainable expectations, and more [10]. When an information system does not succeed in becoming successfully operational there is often a tendency to view the reasons for failure as weak managerial support [18]. This even though the technological systems can be critically important, state of the art, competent, stable and user friendly.

Previous studies have recognized the importance of the adoption processes. However they fail to define the principles and theory required in order to manage them successfully. Most studies focus on evaluating critical adoption success factors while broadly discussing the failure to adopt information technology [2]. Still lacking is a theory which when applied will provide a higher degree of confidence that implementation will be successful.

Most studies relating in general to adoption of information system focus either on the human factor, the engineering factors of hardware and/or software. The discussion tends to evolve around solving the problems of the socio-organizational factors as referring in general to managerial and cultural issues [11, 12].
This review is a focused attempt to contribute to a better understanding of adoption success factors. It concentrates on an evaluation of the success in adopting a farm management software package called Ma'ayan. It runs on a PC and enables the farmer to record production activities, monitor, quantify and cost them, make on farm decisions and follow product marketing. Ma'ayan was an attempt to introduce a user friendly and cheap tool to attain the benefits derived from computerizing records. A significant Ma'ayan advantage is derived from its simplicity and the ability to log events as they occur. The user has easy access to details of each activity as they are registered and related to historical data. Reports are easily formulated enabling ongoing support for necessary decisions. Comparison to the cost / benefit ratios of alternatives for farm management in Israel favors Ma'ayan.

Information Technology Adoption Constraints

Agricultural production is a relatively long biological process with a major element of uncertainty. In many cases production is a complex sequence of activities often termed dynamic complexity [14]. It is characterized by varying consequences and results over time. Results depend on different components in the production sequence and intervention in the production process which can yield unexpected results. In general, most of the discussion in the literature that deals with adoption of information systems refers to information technology [16, 17], while disregarding the complexity of the organizational processes involved. Complexity can be defined in the following way: A complex adaptive system is composed of interacting agents following rules, exchanging influence with their local and global environment and altering the very environment they are responding to by virtue of the simple action [15].

Complexity related to agricultural production stems from the number of stochastic variables during the production process such as climate, prices and others. A smaller number of stochastic variables increases the potential benefit from information management. It can be assumed that in a world of perfect information the planned results would be certain. In the opposite case where the outcome of decisions could not be influenced at all planning and control would make no sense. This was found in the different information technology adoption rates in various production branches. In Germany for example, in animal husbandry with a limited amount of stochastic variables the number of software installations is higher in comparison to field crops with many external production variables [7].

A benefit of information technology is embedded in the organization's products by turning capital and information inputs to higher-value outputs [2]. The general approach is that information technology can be defined as a managerial resource similar to other resources [1]. However, focusing exclusively on information technology or an information system is a supply perspective that assumes that if information is made more easily available and accessible people will use and share it. This is a doubtful assumption. As a result the existence of information technology does not assure successful adoption or adoption at all.

Different, yet important constraints that are relevant to agricultural production are derived from the characteristics of farm management. The owner has to control production while dealing with all management aspects, mainly on his own. Operating and managing the farm leaves the farm operator little time to adopt computerized information management, let alone acquire proficiency in it. The adoption process itself will depend to a large degree on the farmers' absolute conviction of the benefits from implementing information technology. To all these should be added traditional conservatism, lack of infrastructure, difficulties to access technical support, and more.

All these issues were considered when Ma'ayan was developed.

Ma'ayan Development Stages

The first attempt in Israel to develop a unique on-farm software package was made by a publicly funded effort in the early 80's. It was initiated by the Farm Management Department of the Extension Service. The program was developed by a professional programmer. Due to limited program maintenance funds and other shortcomings, the development was terminated. Over time it was decided to use available extension personnel to redevelop and disseminate a better program.

The new software package was named Ma'ayan. By 1991 the first version was ready for on farm use. Acceptance was favorable, enabling incremental program updating as needed, training of farmers and useful on-farm visits to promote further development. These focused activities became an integral feature of the department's services. Interaction with farmers enabled an ongoing updating process and system upgrading. Version two was distributed in mid 1992, Version three in the beginning of 1994 and version four at the beginning of 1996. In 2000 the system was upgraded to Windows and the 2003 version is currently being distributed with online updating.

Over the years the system sold more than 600 copies. Until recently it was estimated that 40% of them are actually used. A recent random telephone survey indicated that the ratio of Ma'ayan users as compared to buyers is now close to 60%. This ratio compares favorably with other similar commercial on-farm managerial information systems packages, which have a smaller number of clients somewhere in the high tens.

Reasons for Ma'ayan Acceptance

The reasons for the successful adoption process seem to be as follows:

An increased need for information

Agricultural production is in the process of constant structural adaptation dictated by deteriorating terms of trade and characterized by larger, commercialized production units [9]. The larger the production unit and crop diversity the larger the need for more sophisticated data management and support for decision making.

Prevalence and simplicity

The prevalence of computers is consistently increasing which in turn reduces reluctance to adopt them. Eventually reduced inhibition and lower costs lead farmers to seek and adopt software to suit their needs. The less sophisticated farmers tend in time to join the process by seeking suitable simple, non-challenging solutions.

Ma'ayan uses a simple user-friendly management model. This has the advantage of avoiding complicated models, which need a higher level of management and theoretical competence. The cost accounting model used in Maayan is simple, easy to understand with reports accessible when needed and meeting farmer expectations.

Returns on investment

Farmers that found Ma'ayan to be beneficial and compatible with their needs pointed out the following advantages: easy collection of data, favorable comparisons of cost and income, follow-up of data input, establishment of cumulative data sets, their use and information accessing all translating into management efficiency.

Measuring the benefit from the use of information systems is difficult [13]. One reason is the unavailability of quantifiable variables, although attempts to measure information have been made [16]. This makes measuring the expected benefit of information systems very difficult. One of the intuitively obvious variables is the return on investment but the level of investment is not necessarily correlated to profitability. Contrary to expectations it was found that quantifiable changes were modest at best [2].

Since performance goals are usually presented as justification for investment in information technology the measure should be an improvement in the production process and not necessarily a direct return on investment. In this case if Ma'ayan indeed improved the production processes, these improvements should eventually be evident. Examples would include better decisions in a specific production process, shorter supply lead-time, etc.

No effort was made to quantify the benefit from Ma'ayan although the negligible cost of the package contributes to the farmer's favorable cost benefit ratio.

Synchronizing Ma'ayan with production processes

The fact that extension personnel developed Ma'ayan enabled them to bridge the gap between different attitudes to technology and management methodology. While undertaking Ma'ayan dissemination responsibilities, they were involved in farm management, agricultural production, training and business considerations. This situation gave the extension personnel several advantages:

a. Familiarity with farmer needs which enabled formulation of better and more efficient production programs.

b. An overview based on integration between defined needs and ability to service them, enabling extension to focus support on critical bottlenecks.

c. An ability to respond to software modification needs, when needed.

d. Extension's independent budgeting allows the development of Ma'ayan when and where needed, within the budget constraints, without commercial and / or other dictates.

A reason for possible lack of synchronization between an information system and a managerial process are different concepts and terminology. Information systems concepts are to a large extent standardized, whereas specific production parameters are unique. This explains the difficulty to devise a standard set of variables that will enable definition and measuring of the managerial process for all production activities [6, 8].

Ma'ayan avoids this problem by using terminology accepted by farmers.

Maintaining existing competencies

An adopter's level of education and training correlates positively with the ability to manage information, production processes and attain benefit from adopting a new technology [4]. It stands to reason as well that an adopter's level of education correlates positively with the level of benefit accrued to adoption of the managerial information systems. Ma'ayan enables even the most conservative farm managers to utilize the system for supporting decisions without a threat of unfamiliar changes in management procedures. Older and traditionally trained managers can easily adopt Ma'ayan without a need to study new background data sets and / or management methodology. As such prior knowledge for using Ma'ayan is not a prerequisite for adoption.

Efficient implementation of Ma'ayan does not require economic theory proficiency beyond farm management essentials. Adopter's age and / or education were neither evident nor prominent in Ma'ayan's successful adoption.

Despite the approach that agriculture is a comprehensive business as any other, most farmers limit their management efforts to production aspects. In comparison to other businesses, farmers are usually isolated professionally in their decisions. This is a self-perpetuating situation that encourages resistance to changes in production methods and changes in business management methodology. It is in line with the contention that individuals tend to justify their actions according to their beliefs, past experience and reluctance to relinquish their time proven traditions and experience [19]. This may result in disassociation from a new technology and diversion of time and efforts to alternatives [20]. Ma'ayan enables the user to maintain his habits thereby minimizing the resistance.

Reduced Transaction costs

Adoption of new information systems can involve prohibitive transaction costs such as: proficiency acquirements and operation capabilities. Ma'ayan was designed to assist in managing decisions without sidetracking the farm owner there by reducing transaction costs. The simplicity of the system reduces adoption time dramatically, mainly because the farmer can continue in his traditional data input and record-keeping format. An immediate added benefit is the ability to extract various reports from past and new records. In many cases this attribute alone makes Ma'ayan adoption beneficial.

Since managerial information systems proficiency develops over time, the farmer can adopt advanced Ma'ayan modules accordingly. Farmers are advised to start with a basic Ma'ayan module of their choice such as recording of labor. Once initial inhibitions are overcome adding additional modules is spontaneous.

An additional factor is extension's explicit recommendation to resist the prevalent temptation to put in maximum data. Such overloading will lead the farmer to reconsider his recording activities and / or think that he is devoting more time to reporting activities rather than doing them. Experience indicates that the 80:20 rule applies, with 20% of the time being sufficient to collect 80% of the necessary information for decision support and record keeping. With that in mind extensions' recommendation to the farmer is not to spend the remaining 80% of his data collecting time to obtain the missing 20% of the information. The experience with Ma'ayan is that the 80% computerized information will sufficiently support the farmers' main information needs.

Flexibility

Ma'ayan is not confined to a specific crop or crop-pattern which in turn allows the farmer maximum adaptation flexibility. Consequently, different farmers growing the same crop may utilize the program differently. Experience indicates that in many cases dedicated programs, attempting to be all-inclusive become inflexible, and eventually irrelevant.

On time Information

When information is unavailable when needed on time at a decision point, the decision is taken based on a currently different situation. This can distort the managerial processes. Ma'ayan enables accessing data and information when needed. This is due to the simplicity of entering data as well as extracting reports.

Training and support

Operational proficiency training is a necessary condition for successful information technology adoption, the more so with complicated software [10]. Ma'ayan needs limited training being technically simple enabling adaptation to various production patterns. Regardless, on-line and phone support are available on request without charge. Occasional refresher courses are held on demand.

Adoption and dissemination difficulties

Introducing a new technology to farmers poses obstacles. Some of those encountered by Ma'ayan are listed below:

a. Not all farmers are interested in an computerized managerial information system. Some are satisfied with cost accounting at seasons' end, sometimes not even that.

b. Some of the farmers use other software packages, including Excel spreadsheets or dedicated software which may or may not be adequate.

c. Personal impediments of various kinds.

d. Personal preferences. There are farmers who tried Ma'ayan and decided to quit because they did not find it user-friendly enough, special needs were not met, etc.

e. Dissatisfied farmers will discourage others from using Ma'ayan, even after installation.

f. Marketing of Ma'ayan is non-existent.

g. Awareness of managerial information systems benefits is limited, resulting in situations where they have yet to be internalized.

h. Experience shows that farmers unassociated with the extension service are left behind professionally, which includes the use of software in general and Ma'ayan specifically.

Summary

The above review describes the observed factors responsible for successful adoption of Ma'ayan. This is a case study of information technology adoption in agriculture. The success factors and adoption problems presented in this review are probably applicable to other situations. If so, understanding them can contribute to more efficient planning of on-farm software adoption in the future.

Ma'ayan experience outlines a successful model and pointers for a better understanding of the on-farm managerial information system adoption process.

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