AN ARTIFICIAL INTELLIGENCE PROGRAM: MANAGEMENT LESSONS LEARNED

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ABSTRACT

There are probably as many approaches to incorporating artificial intelligence (AI) technologies into business as there are businesses. The Air Force Logistics Command (AFLC) has taken a low cost, low risk, high pay back approach to the development of AI applications which can improve effectiveness, efficiency, and productivity. This is accomplished with centralized management and decentralized development. Using this approach we have fielded 15 systems and have over 250 under development. These applications vary from electronic system diagnostics to nondestructive inspection. From our experiences we have found that the truly pertinent issues, in developing and fielding AI systems, are managerial rather than technical in nature. This paper will address some of the pertinent managerial issues in the form of lessons learned.

PHASES OF PROGRAM MATURITY

When establishing an AI program, you should expect it to move through three phases. The first phase emphasizes the acceptance of knowledge-based system technology, the establishment of a talent base, and education for both workers and management. The second phase continues the emphasis on technology acceptance while increasing the talent base and number of fielded systems. The third phase begins with the institutionalization of knowledge-based systems. Once the workers accept this technology as a normal course of business, the management aspects of the program are complete. Third phase expansion then focuses on other AI paradigms.

ACCEPTANCE OF THE TECHNOLOGY

The major hurdle in building an AI program is the organization's culture. The only way to gain acceptance is by showing that AI can solve problems while not creating new ones. That is, implementation of an AI solution should not be more difficult than dealing with the problem it solves. The real utility of the technology to solve problems must be clearly demonstrated.

It has been shown that ten percent of the people will use a technology simply because it is new. Another ten percent of the people will never use the new technology and complain about those who do. The first ten percent need to be controlled, the second ten percent ignored. Steps to gain acceptance must be tailored for the remaining eighty percent who will use the technology to solve real problems.

We chose to gain AI acceptance through the use of education and training; and by developing numerous small, practical applications. Our experience has been that simple, low risk, high pay back applications, which solve real problems, will be widely used and endorsed. Then, once in use, enhancements and expansion follow. Because the majority of the applications are mundane, and they work, the organization's fear of the technology is greatly reduced.

CENTRALIZED OR DECENTRALIZED MANAGEMENT

The industry is divided as to the best way to manage an AI program. In an organization as large as AFLC, centralized management was chosen to assure minimal duplication of effort and standardization. Since each Air Logistic Center has a unique character, but common purpose, centralized management also ensures cooperative effort.

CENTRALIZED OR DECENTRALIZED DEVELOPMENT

Once again, the size of the organization is a significant factor in the decision as to where to develop applications. If the organization is small enough that it can be served by a single development shop, acceptance factors are minimized. If the organization is large, and centralized development is chosen, acceptance can be a serious problem.

While the staff agency can set policy and create procedures, it is virtually impossible to direct users to willingly accept an AI application. Our concern has been that applications developed by a centralized office would not be readily accepted because of the "not invented here" syndrome. To assist in the quest for acceptance, we elected to create a decentralized (i.e. field level) development capability. All AI projects are defined by the individuals with the problem. These individuals are at the lowest possible organizational level.

PROJECT SIZE

Limiting a project's size is a direct way of reducing both cost and risk. We in AFLC have made a conscious decision to be risk averse by building a history of success via many simple projects. As such, we have elected to reach as many organizations as possible by developing simple and mundane projects. This does not mean we avoid the more difficult and complex problems. Our approach for these is to "divide and conquer." Solve the big problem by incrementally solving its constituents.

STAND ALONE OR INTEGRATED APPLICATIONS

This decision involves the availability of current development tools, as well as risk and complexity. While the most effective applications are integrated, they may be too difficult to attempt during early phases of the program. If you start with a stand alone application, consider carefully where it might lead if enhanced. There are several important questions which need to be addressed: can the application be scaled upward; should the application be integrated into a larger system once additional functions are added; if the future calls for integration, is anything being done during development which will preclude a smooth transition?

PROJECT SELECTION

This point is relatively simple if you are concerned about acceptance. The user is generally far more familiar with the details of a problem than are the Headquarter's staff. Therefore, the users should be the ones to define the problems while the staff reviews and approves. The review and approval process generally involves issues of duplication, benefits, financial pay back, and funding sources.

BENEFIT METRICS

There must be some measurable benefit gained from the use of the technology. Defining good metrics has proven elusive. Much of the DoD has accepted return on investment (ROI) as the standard measure of AI benefit. In this calculation, a system's estimated return is divided by its estimated cost. This number is then multiplied by an arbitrarily defined number of years (for AFLC it is three years). AFLC management directed that all applications should show a return on investment not less than 7 to 1, the HQ USAF has selected 10 to 1, and the DoD 20 to 1. This ROI has the tendency to report only efficiency improvements, that is, doing a given job faster. However, the real promise of AI is effectiveness--improving consistency, reducing errors, speeding the training of new employees, and freeing experienced employees from drudgery. Unfortunately, representing increased effec tiveness in hard, cold numbers is difficult--quantifiable ef fectiveness metrics are few and far between. Until these metrics are developed and recognized, some of the very real benefits of AI will not be fully recognized.

EDUCATION

A three tiered education program was established. Specifically targeted were senior managers, other management, and workers. Management had an intuitive feel that the technologies would improve productivity. However, they needed a better understanding of the limits and potential of the technologies before supporting their implementation. Thus, for our senior management, we provide meetings and briefings by senior management from industry. These peer meetings allow our senior management to better understand the potential of AI. Middle management receives a two hour workshop which provides a grounding in the technologies and examples of practical applications. For the worker level we implemented two one week courses. The first course is an introduction to artificial intelligence and knowledge engineering. The second course covers knowledge-based system programming and the M.1 shell. During this course the student develops an application to solve a particular problem within their own office.

To date there have been over 1300 people through these courses. This training has helped create a foundation of AI knowledge and advocates for the technology.

STANDARDS

AFLC is currently working on two different levels of standardization: tool and code. Tool standardization is necessary because user-developers like to use the very latest shells--ignoring life cycle impacts. Standardization does not mean selecting one tool to the exclusion of all others. It means reduced proliferation as a means of promoting long-term maintainability. AFLC currently has eight standard shells. When a user requests permission to use a non-standard shell, the shell must provide a new capability in order to be accepted. The second level of standardization applies to the code level. We are currently in the process of developing a knowledge-based system "Elements of Development Style" guidebook. This guide will help developers standardize on good, fundamental software engineering practices.

CONCLUSION

We in AFLC have found AI can provide productivity gains for virtually all our organizations. This productivity, however, is based on the successful integration of the management factors discussed above. While this list is by no means complete, it does provide insight into several lessons learned. We are convinced that one of the keys to our success is the focus on small, inexpensive, user driven, applications that save time and money and improve the quality of AFLC's products and services. In short, mundane projects, with anything but mondane benefits.