VIRTUAL EMPLOYEE MANAGEMENT THROUGH THE INTERNET

Yu-Chien Ko
Department of Information Management
Chung-Hua University (Chinese Taipei)

Rey-Long Liu
Department of Information Management
Chung-Hua University (Chinese Taipei)

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ABSTRACT

Flexibility and stability of workforces are essential for a firm to keep competitive in the market. Both the internal and the external labors should be flexibly organized and coordinated in order to meet the firm's strategic goals in a stable way. In this paper, we explore the systematic methodologies for flexible and stable management of workforces. We propose a computationally plausible model (named VEM) for managing *virtual employees* (VEs) through the Internet. A VE may be an internal labor or an external labor. After being assigned with a specific task of a project, the VE acts as a regular employee of the firm. The position for the VE disappears when he/she finishes the task. Thus the firm may get qualified workforce without suffering from many problems (e.g. skill training, fringe benefits, and layoffs) in hiring regular employees. Mutual understanding between the firm and the VE may be enhanced for further cooperation. On the other hand, due to the diverse backgrounds of VEs (e.g. working styles, available time, and workplaces), the benefits of employing VEs cannot be obtained until a more effective management strategy is implemented. Three major aspects of effective VE management are identified: proactive project management, VE communication, and task evaluation. They are achieved through the Internet so that all the VEs in different workplaces may be linked together as a team. The interactions among the three aspects provide the necessary supports (e.g. VE recruitment, coordination, early warning, and exception management) to the management level of the firm. Thus the firm may flexibly direct various kinds of workforces to their strategic goals.

Keywords: Virtual Employee Management, Proactive Project Management, VE Communication, Task Evaluation, Internet

INTRODUCTION

Flexibly setting up suitable workforces is a critical success factor for most companies. Therefore, the boundaries among the internal departments of a company are being redefined in many ways (e.g. identity, political, task, and authority boundaries [6]). On the other hand, as more and more companies rely on contingent workers (e.g. part-time workers, self-employed workers, business services, and temporary workers), external labors become another valuable human resource to be fitted into the companies [2]. Therefore, to maintain a stable workforce, a company should be able to flexibly organize both the internal and the external labors.

The flexible organization of internal and external workforces is helpful in many ways. It establishes diverse workforces that may promote flexibility, reduce operating costs, and speed up the responses to technological change [3]. External labors often bring new technology and skills to increase competitive capability. Integration of internal and external labors enhances the diverse workforces and stimulates creativity.

Obviously, the above benefits of diverse workforces cannot be obtained until effective management strategies are implemented. Therefore, due to the concerns of cost, risk and productivity, many alternatives (e.g. outsourcing and employee leasing) have been used to find contractors to reduce the management efforts. These alternatives save the cost of recruitment, training, management, and fringe benefits.

However, many companies have been (explicitly or implicitly) in the revolutions of shifting their basis from natural resources to intellectual assets [5]. For those jobs that need intensive intellectual assets and core experiences of the company, qualified and trustable contractors are often difficult to find. Furthermore, the problems of maintenance and trouble-shooting of the products from the contractors are often heavy burdens for the company.

Therefore, more and more contingent workers that are organized and controlled by the company are introduced to the workforce [2]. From the viewpoint of flexible organization boundaries, core workers and contingent workers of a firm should be integrated together to achieve the goals precisely defined by the firm. From the viewpoint of project management, these workers (no matter internal or external) are grouped together to achieve the goal of the project. Thus the workers from different sources and of different backgrounds are integrated on a project-based basis. In the project, each worker becomes a *virtual employee* (VE). Due to the diverse backgrounds of VEs, the management of the VEs is a challenge to both the human resource management community and the information technology community.

In this paper, we explore the ways of effectively organizing and managing the qualified VEs. In particular, we are concerned with the integration of information technologies so that employee management may be supported by an information system. In the next section, we define a concept of VE. In section 3, we propose a model for effectively managing VEs through the Internet. We identify the major functions and their architectures for both obtaining the benefits of VEs and excluding the potential problems

of VEs. Section 4 evaluates the framework from several practical concerns such as costs, risks, and critical success factors of employing VEs. We finally conclude that, through the introduction of information technology, information systems may be developed to support the effective management of VEs, which are fundamental components for establishing flexible and stable workforces.

VIRTUAL EMPLOYEE

When compared with regular employees, a VE is a worker having the following four features:

(1) He/she may be an internal labor or an external labor.

(2) He/she is precisely assigned with a task of a project.

(3) He/she performs his/her task under the control of the project manager of the company.

(4) He/she leaves the project team after finishing his/her task.

A VE differs from a traditional part-time worker in that he/she works in a project-based and task-oriented manner (rather than in a fixed-time and routine-like manner). A VE differs from a traditional outsourcing contractor in that the VE team for a particular project are set up and controlled by the project managers of the company (rather than by the contractors). As each qualified labor (internal or external) is treated as a task-oriented VE, the company may obtain a more stable supply of suitable workforces, which are organized and controlled using project management techniques.

The benefits of introducing VEs

The benefits of employing VEs may be summarized as follows:

(1) The cost (e.g. skill training, fringe benefits, and layoffs) of hiring regular employees may be reduced.

(2) Human resources often play a central role in building competitive advantages for a company [11]. By considering the internal and the external human resources, the strategic goals of the company is more likely to be achieved by qualified workforces.

(3) Diverse work forces may promote flexibility, reduce operating costs, and speed up the responses to technological change [3]. Integration of internal and external VEs may enhance diverse workforces and stimulate creativity.

(4) Through the process of executing VE projects, mutual understanding between VEs and the company may be enhanced for further cooperation. The cost and the risk of hiring inappropriate regular employees may be reduced.

Typical conditions of introducing VEs

As described above, VEs are teamed up in a project-based manner. The conditions of introducing VEs may be summarized as follows:

(1) The company has the core knowledge for conducting the project,

(2) The knowledge is a valuable intellectual asset for the company, and

(3) Qualified workers (internal or external) may be found for the tasks in the project.

The three conditions guarantee that the benefits of VEs are worthy of being pursued.

Critical success factors of introducing VEs

Quality and schedule controls are the major challenges of introducing VEs. Due to the diverse backgrounds of VEs (e.g. working styles, available time, personality, and workplaces), more effective management on VEs is essential. In particular, the critical success factors may be summarized as follows:

(1) Proactive project management: In addition to task definition, assignment, and schedule control, *early warning* and *exception management* are important for VE management. Early warning provides the manager with enough time to deal with the next-stage human resource and schedule requirements of VEs. Exception management provides the manager with the way of managing the exceptions (e.g. quality and schedule) when they occur.

(2) VE communication: Being teamed up in a project, the team members require effective communications to develop common mental and coordination models [4]. Since VEs have diverse workplaces and available time, in addition to normal ways of communications, asynchronous communications through the Internet are required.

(3) Task evaluation: Selecting right VEs and then assigning them with right tasks are critical as well. As described above, a VE may be an internal worker or an external worker. Thus, the performance VEs should be evaluated and recorded for reference in other projects. Thus quantitative statistics are generated to assure quality. This may help to improve customer satisfactions and reduce failures in competitive business environments.

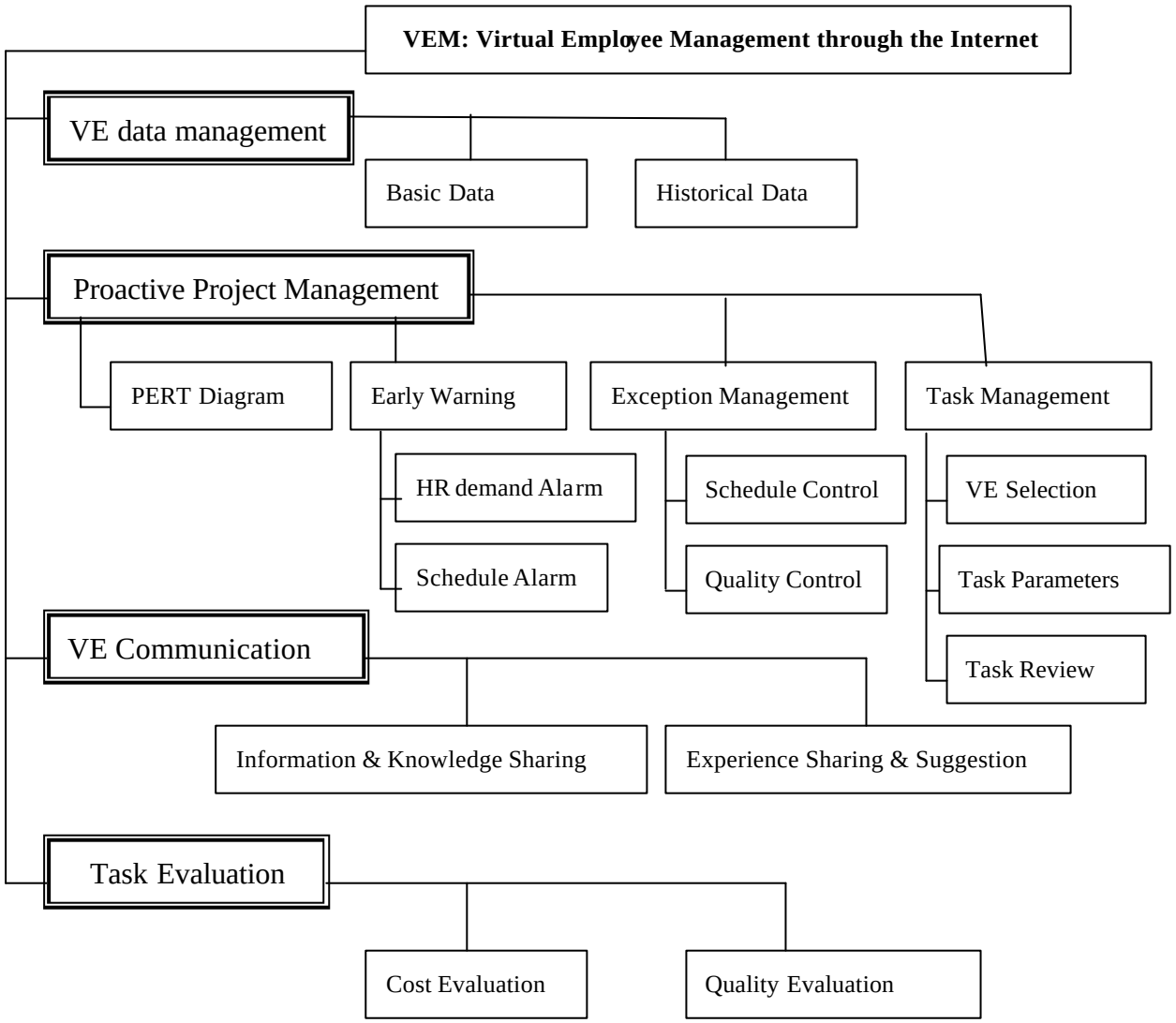

Figure 1. Functional overview of VEM

VIRTUAL EMPLOYEE MANAGEMENT THROUGH THE INTERNET

We propose a computationally plausible model (named VEM) to support VE management through the Internet. VEM aims at supporting the managers in obtaining the benefits of VEs, while at the same time, reducing the problems induced by VEs.

A functional overview of VEM is illustrated in Figure 1. There are four main functions in VEM: (1) VE data management, (2) project management, (3) VE communication, and (4) task evaluation. The context diagram of them is shown in Figure 2.

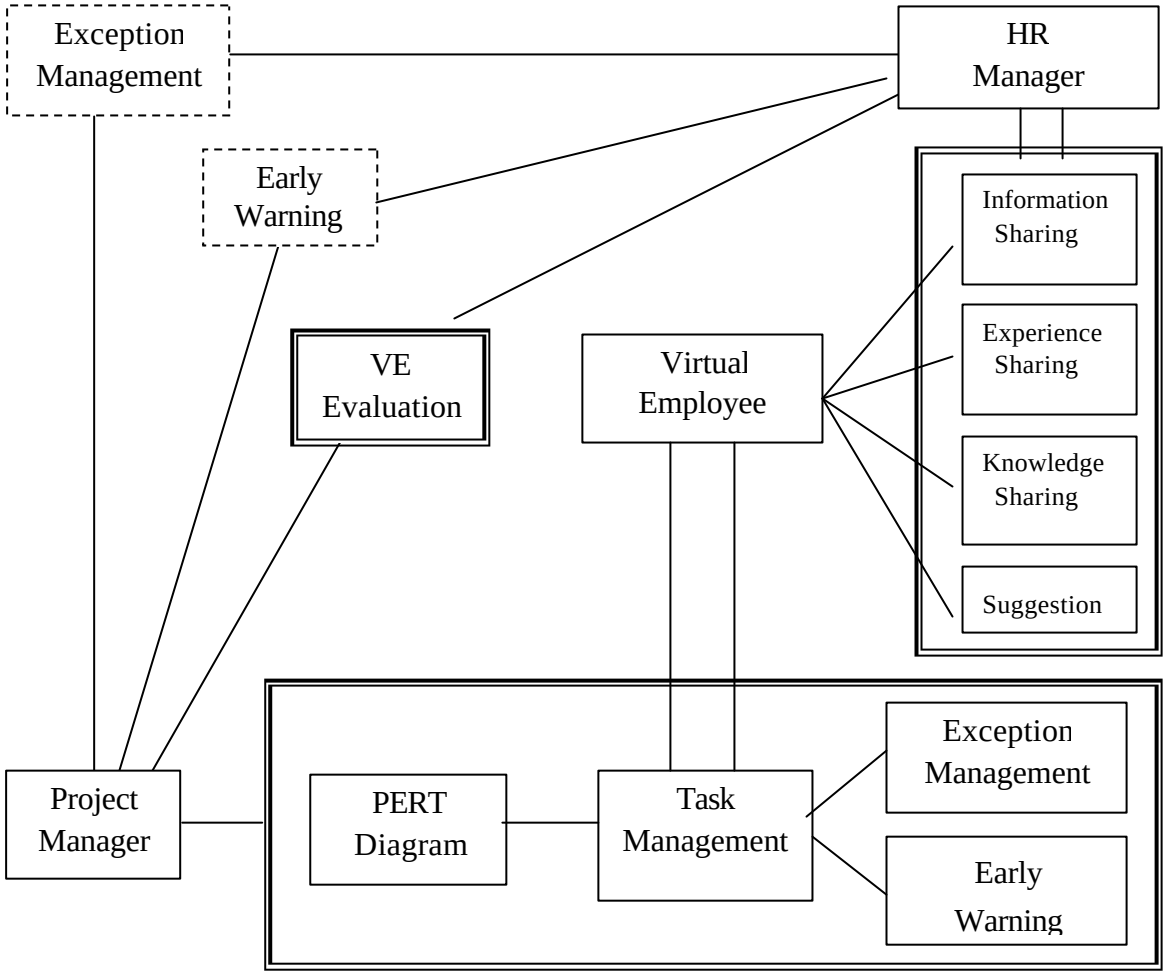

Figure 2. Context diagram of VEM

VE Data Management

The VE data management module processes basic and history data of VEs. Basic data includes VEs' personal information like name, address, sex, birth of date, degree, certificates, available time, ... etc. Historical data includes all the information concerning the performances of the VEs in previous projects. Historical data serves as the basis for rewarding and organizing VEs. It is mainly from the task evaluation module of VEM (ref. Section 3.4). The following aspects of performance data are identified as essential historical data of a VE:

(1) Timeliness of the work completed by the VE,

(2) The quality of the work completed by the VE,

(3) The extend to which the VE shares knowledge with others,

(4) The working altitude of the VE, and

(5) Other problems and contributions of the VE in the project.

VE data may be updated through the Internet so that the most up-to-date information about the VEs may be referenced for VE management.

Proactive Project Management

The proactive project management module proactively supports the manager to control the quality and the schedule of the projects. It includes four functions: (1) task management, (2) PERT diagram generation, (3) early warning, and (4) exception management.

Task Management

The task management module provides a platform for the manager to set up the project and the VE team. It supports task definition, task parameters setting, VE selections, and task review. Through the platform, the manager and the VEs communicate with each other about the current status of each task. Once any events concerning a task (e.g. successfully completed, delayed, ... etc.) is updated, the corresponding sub-modules of project management will be triggered to achieve proactive project management.

PERT Diagram Generation

The module displays the task network and calculates the critical path of the project based on the Program Evaluation and Review Technique (PERT). Due to the exceptions (e.g. quality and schedule exceptions) of the VEs, the critical path of a project may switch from one to another. Therefore, proactively monitoring the change of the critical paths is necessary. The manager in charge will be notified of any change of critical paths. A visual drill-down interface is designed to provide the manager with all information concerning the tasks of the project.

Early Warning

Due to the dynamically changing conditions of VEs, the manager needs a facility of early warning in order to have more time to deal with the critical events that will happen. The facility is *proactive* in the sense that it allows the manager to avoid possible exceptions (rather than dealing with exceptions after they have occurred). The manager is notified before the critical events actually happen.

Two kinds of events are identified to be critical for the manager: human resource demand and VE schedules. The system notifies the manager of the human resource demand of tasks before the needs actually occur for the task. Therefore, the project may be conducted even though some tasks are not assigned with VEs. This is important for VE management, since it is often impractical to assign all tasks with VEs at the initiation stage of the project. Even all tasks are assigned with VEs, uncertainties still exist due to the diverse backgrounds of the VEs.

Similarly, before a task is actually completed, the manager and the VE in charge are

notified to check the schedule. Suitable procedures may be conducted if the task might be delayed. The amount of time that early warning precedes the actual happening of the events is a system parameter that may be set by the manager.

Exception Management

When an exception actually happens, the system should be able to promptly detect it and support the manager in designing solutions to the exception. There are two kinds of exceptions identified in VEM: schedule exceptions (i.e. the task is not completed on schedule) and quality exceptions (the task does not adhere to the quality requirements). Measurable specifications for the exceptions are needed so that the system may effectively detect the exceptions [9].

The exception management facility allows the manager to promptly reorganize the schedules and the resources so that the project may go on smoothly. When reorganizing the schedules and resources, the system supports the manager in pinpointing the problems, redefining the schedules, selecting backup VEs, assigning the backup VEs, and estimating the possible loss due to the exceptions.

VE Communication

The VE communication module provides a platform for the manager and the VEs to share information and knowledge through the Internet. Being set up as a team, the VEs needs to develop and share the same mental models [4]. Due to the diverse workplaces and working time of the VEs, synchronous and asynchronous communications through the Internet are required. Therefore, in addition to common media for communications, a web site that integrates the VEs as a society will be helpful.

In the platform, knowledge and information sharing may be documented for reference in VE management. All the team members may get suggestions and experiences from each other. Mutual understandings among the manager and the VEs may be enhanced through the platform as well.

Task Evaluation

The task evaluation module is a facility for the manager to evaluate and control the cost and the quality of the project. By setting up a set of measurable evaluation criteria, the module monitors the progress of the project. As an exception concerning the overall cost and quality of the project occur, the manager is notified to deal with the situation.

The performance of each VE (ref. Section 3.1) is also monitored and recorded for reference as well. Statistical data of each VE's performance may be used to assign right people with right tasks. This is a major concern of most human resource managers. In VE management, the historical performance data VE is of particular importance.

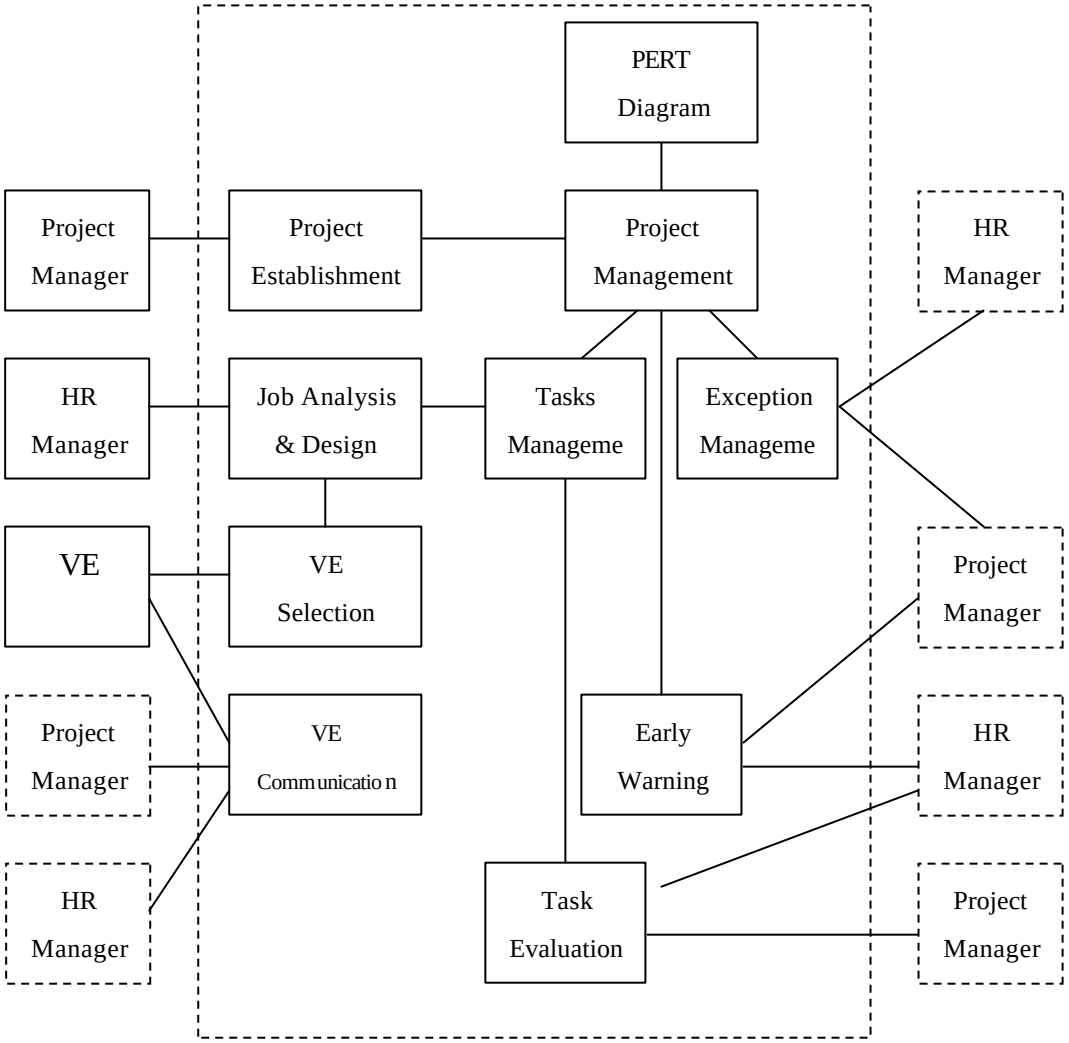

Figure 3. An example flow chart of VEM

An example

A flow chart of VEM is shown in Figure 3. To illustrate the flow, an example is raised as follows. Suppose a senior employee of a company is appointed the manager of a project. The project is to achieve the firm's strategic goal. He works out a task network and defines each task precisely. A team needs to be promptly set up to complete the project. Since this project requires much core knowledge of the firm, he decides to establish a team based on VEs.

After finishing job analysis and design, he scans a VE candidate pool to list qualified VEs either inside or outside the firm. Based on the procedures of VE selection and recruitment, he establishes a two-way communication with each candidate to check their available time and attitudes toward this project. The project manager then collected

feedback information from the candidates and prepares a list of qualified candidates. After interviewing each qualified VE candidate, the VE team for the project is established. The project manager informs the team members and keeps in touch with them through the Internet. The VEs in the team may begin to communicate with each other through the Internet as well.

During the execution of the project, the project manager collects and studies all the information concerning the VEs. He aims at finding and solving any problems that the VEs encounter. Occasionally the manager is notified (by the system) of the human resource demand of some tasks. Before the needs actually occur, the manager arranges suitable VEs for the tasks to avoid the possible exceptions. Sometimes the manager is notified (by the system) of the tasks that should be completed in the near future. He contacts the VEs that are in charge of the tasks. The schedule is checked to avoid possible delays of the project.

The manager encourages all the team members to exchange and share information with each other. Experiences and knowledge concerning the execution of the project are gradually accumulated for later reference. The society and the cooperation among VEs was tightly established through the Internet.

Once an exception or an alarm happens, the project manager is invoked to solve the problem. If a VE does not fulfill the requirements of his/her task, the project manager is notified of whether the critical path of the project is changed. Redeployment of backup VEs and redefinition of original schedules are two common methods to deal with the problem. The project manager selects a method and then initiates whatever managerial actions to implement the method.

The VEs begins to report the completion of their tasks. The project manager evaluates their work from the viewpoints of quality and timeliness. The evaluation results are recorded as historical performance data of each VE. Based on the evaluation, the project manager identifies the ways of rewarding those VEs that have met the requirements of their tasks.

EVALUATION

We have proposed a definition of virtual employees to facilitate the flexible integration of internal and external labors. A computational plausible model VEM is also proposed to effectively manage the virtual employees through the Internet. In this section, we evaluate the framework from the following four perspectives: (1) related work of VEM, (2) benefits of delivering VEM, and (3) critical success factors of VEM. Based on the evaluation, we summarize the future research directions of the work.

Related Work

From the viewpoint of underlying information technology, database technology and Internet computing are relevant to VEM. They serve as the fundamental platforms on which VEM is developed. The maturity and stability of the technology facilitate the implementation of VEM.

Another fundamental technology for VEM is the project management technique. Various techniques and information systems for project management have been developed in literature [7]. Critical Path Management (CPM) and Program Evaluation and Review Technique (PERT) are two popular and well-known techniques closely related to VEM. They have been implemented in some commercialized packages as well (e.g. Microsoft Project 98). They may help the manager to direct the firm's valuable resources to critical tasks in order to speed up the whole project. VEM implements CPM and PERT on the Internet in order to build a suitable platform for managing VEs in different workplaces at different work time.

Redeployment of employees and redefinition of schedules have been identified as effective ways of tackling problems in project management [8]. VEM extends the idea and provides several novel supports to the manager when an exception happens. In supporting the redeployment of VEs, VEM provides a facility to select and set up the backup VEs. In supporting the redefinition of schedules, VEM provides a drill-down interface to redefine the schedules. The items related to the schedules (e.g. cost evaluation) are automatically checked once the change of the schedules is confirmed. In addition, VEM further achieves *proactive* project management in the sense that the system notifies the manager of the critical events that will happen in the near future. Thus the manager may have enough time to avoid exceptions (rather than simply dealing with the problems that have happened).

VEs share some features with outsourcing contractors. An outsourcing contractor completes a project for the company. Thus the cost of project management, labor maintenance, and unemployment compensation liabilities may be reduced for the company [1]. Outsourcing is different from hiring a VE outside the company to perform a task. The major difference is that companies must be in charge of VE management. VEs are preferred when the company is conducting an important project that requires core intellectual assets of the company.

Information and knowledge sharing is essential for enhancing the performance of project teams [10]. Project changes may happen at any time in many ways. Regardless of the specific change, there exists ambiguities and doubts associated with the change. Therefore, VEM provides a platform for the managers and VEs to communicate with each other at any time in any places. The information and knowledge shared among the team members may be further documented for improving VE management.

Benefits of Delivering VEM

The benefits of VEM are twofold: (1) cost and risk reduction in human resource management and (2) quality promotion in project management.

Cost and Risk Reduction in Human Resource Management

VEM aims at supporting a firm to flexibly organize and direct its workforces to its strategic goals. The flexibility of integrating various kinds of workforces may contribute

the reduction of cost and risk to human resource management [3, 6]. In this area, the contributions of VEM may be summarized as follows:

(1) VEs are organized in a project-based manner. They are not appointed to any regular positions of the organization. After the project is completed, the VEs are dismissed. The cost and the risk of reorganizing the organization structure may be significantly reduced.

(2) Only core employees are deployed into the functional groups of the firm. There is no surplus of jobholders. Thus the core intellectual assets of the firm may be accumulated. The cost and the risk of layoffs, turnovers and breeding of human capitals are reduced.

(3) By considering both the internal and external labors, the firm may have a larger basis for recruiting qualified workers. The cost and the risk of human resource training may be reduced.

(4) Tracking and recording the performance of VEs in previous projects may reduce the cost and the risk of inappropriate VE assignment.

The reduction of the costs and the risks provides the firm with more resources for rewarding VEs. Rewarding the VEs stimulates the motivations of the VEs, which in turn, further reduces the costs and the risks of human resource management (ref. section 4.3).

Quality Promotion in Project Management

The quality of VE project management is obviously essential. The key point is that the manager should fully understand the philosophy of their own quality management and be totally committed to the goals [6, 12]. The quality will be promoted based on strong leaderships and measurable management standards. VEM supports the manager in committing the quality controls on VE projects. Its contributions to quality promotion are twofold:

(1) Through VEM, a VE team may be established to bring talented and experienced workers together. The quality of the VE project may be promoted by stimulating creativity and interchanging experiences through the Internet.

(2) VEM supports the manager in managing exceptions such as delayed schedule, defects, and VE turnovers. Its proactive project management facility provides the project leader and the human resource manager with enough time to track and tackle abnormalities. Thus the quality of the project may be promoted, while the risks of project failures may be reduced.

Critical Success Factors of Delivering VEM

Although VEM may provide contributions to human resource management and project management on VEs, other management strategies are still necessary so that the benefits of employing VEs may be actually obtained. The management strategies are

necessary due to the diverse backgrounds of VEs. Each VE may have his/her own available time, working style, workplace, and jobs. The different backgrounds lead to uncertainties in qualities and schedules of VE tasks. VEM is a tool for the manager to monitor and control the uncertainties. Additional management strategies should be set up for reducing the uncertainties and their effects. These strategies become the critical success factors of delivering VEM to the firm:

(1) More efforts should be paid for stimulating effective communications among the diverse workforces of different talents. Although VEM incorporates a platform on which the communications may be conducted through the Internet, traditional media of communications (e.g. telephone, face-to-face, documents) and are still necessary. As described above, a virtual society of VEs may be established through the VEM. All forms of communications should be conducted in a society-based manner.

(2) Suitable policies for rewarding VEs with good performances should be established. As discussed above, the VEs selected for a project are of qualified talents and experiences. They will be dismissed after the completion of the project. A suitable rewarding policy may stimulate the motivations of the VEs.

(3) Task analysis and design should be precisely and completely conducted before setting up the VE team. This involves the clarification of the inter-relationships among tasks. The specification, responsibility, and expected costs of each task should be clearly defined.

Future Work

We are currently extending the framework from the following perspectives:

(1) Implementing all the modules of VEM: All the modules are implemented and run on the Internet.

(2) Developing a technique for automatic VE selection: Currently, VEM records the basic and historical data of each VE. A more automatic VE matching and selection technique is required when there are many VEs in the database. The technique may be used in setting up VE team and selecting backup VE (when an exception occurs).

(3) A comprehensive real test of VEM: The system based on VEM will be delivered to a test site. The performance and contributions of VEM may be comprehensively evaluated in the real test.

(4) Analyzing the feasibility and critical success factors of employing VEs: Based on the system implementation and the real test, the feasibility and the usage of VEs may be re-examined. The ways of employing VEs may be improved from the analysis.

CONCLUSION

In this paper, we propose a definition of virtual employees to flexibly integrate internal and external labors of a company. A team of virtual employees is set up in a

project-based manner. Since the VEs are inherently of different backgrounds, their management becomes a major challenge. Therefore, we propose a plausible computer model VEM to facilitate the effective management of virtual employees through the Internet. Proactive project management, effective communication, and task evaluation are identified as critical components to support virtual employee management. VEM serves as a platform on which the manager may conduct project-related management through the Internet. The system creates a communication channel among all the team members. Critical exceptions and events concerning the project are proactively monitored by the system. The manager is notified when the exceptions and the events occur. Thus the manager may have more time to avoid and deal with exceptions. As the flexibility of workforce organization has been recognized as an essential consideration in current competitive environments, virtual employees and their management information systems may be a way to maintain a stable workforce to meet the strategic goals of a firm.

REFERENCES

Anthony W. P., Perrewe P. L., and Kacmar K. M., 1993, "Strategic Collective Bargaining," in *Strategic Human Resource Management*, Harcourt Brace Jovanovich Inc.

Belous R. S., 1997, "Coming to Terms with Rise of the Contingent Workforce," in *The Human Resource Management Handbook* (Part II), Lewin D., Mitchell D. J.B., and Zaidi M. A. (eds.), JAI Press Inc.

Cascio W. F., 1995, "Diversity At Work," in *Managing Human Resources -- Productivity, Quality of Work Life, Profits*, McGraw-Hill.

Entin E. E. and Serfaty D., 1999, "Adaptive Team Coordination," *Human Factor*, Vol. 41, No. 2.

Hansen M. T., Nohria N., and Tierney T., 1999, "What's your strategy for managing knowledge?," *Harvard Business Review*, March-April.

Hirschhorn L. and Gilmore T., 1992, "The New Boundaries of the Boundaryless Company," *Harvard Business Review*, May-June.

Lotfi V. and Pegels C. C., 1996, "Project Management," in *Decision Support Systems --for Operations Management and Management Science*, Irwin.

Pressman R. S., 1997, "Project Scheduling and Tracking," in *Software Engineering -- A Practitioner's Approach*, McGraw-Hill.

Pressman R. S., 1997, "Software Quality Assurance," in *Software Engineering -- A Practitioner's Approach*, McGraw-Hill.

Sherman A., Bohlander G., and Snell S., 1998, "Creating High-Performance Work Systems," in *Managing Human Resources*, South-Western College Publishing.

Sherman A., Bohlander G., and Snell S., 1998, "The Challenge of Human Resources Management," in *Managing Human Resources*, South-Western College Publishing.

Thomas B., 1995, "Deep Thought," in *The human Dimension of Quality*, McGraw-Hill.