Innovative Knowledge Management:

Concepts for Organizational Creativity and Collaborative Design

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Chapter 5
Innovation in New Technology and Knowledge Management:
Comparative Case Studies of its Evolution during a Quarter Century of Change

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ABSTRACT

The research on which this chapter is based monitors the evolution of IT innovations and their effect on human emotions, including longitudinal influential factors, and examines some of the resulting syndromes, which are termed Computer Fear Syndrome (CFS) and User Alienation Syndrome (UAS). The research involves an analysis of the empirical data derived from several case studies and concludes with a funnel model that explains appropriate management action and puts forward new ideas for developing knowledge management systems in a variety of organizations that may alleviate or prevent such syndromes in the work place.

INTRODUCTION

This comparative research depicts and explains the evolution of organizational innovation through the adoption and deployment of information systems. There are two cases that have been carefully and thoroughly investigated for years. The first is the M Company, one of the top two computers groups in Taiwan, which developed corporate publishing systems in 1988. The second was the C Company, the largest telecommunications group in Taiwan, which brought in knowledge management (KM) systems for corporate training in 2004.

There are differences in the objects and the objectives of innovation between the two cases. Technically, the corporate publishing systems are desktop based; relatively compact local working groups while the knowledge management systems are web-based, with more sophisticated, boundaryless environments. The goals of the former systems were to reduce labor and increase sufficiency of production. The purposes of the latter intended to share intelligence and to encourage creativity

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through collaboration. In the early days of computerization, the Computer Fear Syndrome (CFS) was a conceptual threat while the User Alienation Syndrome (UAS) may be a subconscious threat at present.

It is worthy of note that there are more similarities in the processes of innovation of the current case with the first case that occurred more than a quarter of a century ago. The fundamental corporate decision setting is also the same as before. Management, as always, has to comply with innovative ideas, investment and risk at the same time. The goals of expected efficiency whether in physical profits or in mental productivity have also remained the same over the years. The individual user's behavioral factors involved in implementation and results of innovations have also always needed to be identified. The organizational factors in management actions are worthy of constant re-examination. Yes, there are many intriguing, even novel, variables that may affect innovations, according to the vast body of related literature. However, how many of these are fundamentally influential?

This research attempts to reveal, by selective quantitative and qualitative evidence from very fruitful resources, which factors are changeable and which are likely to stay in place for a very long time. The author/researcher concludes with several statements that may be helpful for those who want to adopt new technology, especially, in acquiring knowledge management systems in the future. Discussion of the measurement of the efficiency of knowledge management or latent, unstructured psychological constructs have also been amended according to the specific requirements of the present. The researcher of this study was the Director in charge of the Innovation Project for the M Company and a consultant for the C Company.

CASE 1: M COMPANY

The Problem

Around the mid 1980's, business began to seriously consider bringing in PC-based information systems to replace labor intensive work.[1] One of management's great concerns was that of the Computer Fear Syndrome (CFS). CFS referred to computer anxiety or negative attitudes toward adopting computing work and predicted that employees with CFS would performance poorly. (Wu, 1995). When computers "invaded" human life, some researchers argued as to whether the computer was "a threat or a promise?" (Cherry, 1971) They thought that senior persons or novices who were used to a traditional work environment would express negative attitudes towards computers. If they began to learn computing tasks, they would be slower and make more errors than new employees. The Fear Syndrome, generated by an anxiety of failure, might also limit their performance. (Caldeira &Ward, 2001) (Shneiderman, 1980). So, management had two choices: First, if the CFS did widely exist; they would have to recruit new, young employees and let the current workers go. Second, if the CFS did not really cause significant harm, they would need to provide training programs for current employees and educate them about the EUC environment.

The CFS was also cautiously perceived and discussed in Taiwan. Hung and Xu (1988), based on a survey of government organizations, found that staff employees who reported themselves as having the CFS was 20%. However, the range of the CFS that was recognized and evaluated by supervisors was bewilderingly greater, from 4.4% to 48.2%. Since the evidence was inconclusive, the reaction of different companies varied. The publishing business used to be a highly labor intensive industry, and was interested in computerization. (Bjorn-Andersen, Earl, Holst & Blunden, 1982) (Young, 1988). Thus, the U Company, one of the top two publishing companies in Taiwan, was the

first one to launch the computerized publishing process around 1985. (Boldt, 1987) It decided to hire a brand new crew to learn the EUC process and to work for the Department of Typesetting and Composition.

It did not even bother to ask current employees if they wanted to change. Because of this decision, the U Company had to transfer current employees to other jobs, such as security, or to pay for their layoffs. Obviously, the cost of this policy was enormously expensive. There were, and are, not many companies that could afford to make such a move. (Wu, 1984b, 1984a). The M Company made a different decision.

Case Description

The M Company was one of the top two computers groups in Taiwan whose business covered systems integration, PC manufacturing, distribution and other related information services. The H Company was one of the M Company's subsidiaries and ran business in cultural and educational fields. It published a magazine on computers, provided computer training programs, and ran media campaigns for its clients. In 1987, the Board of Directors of the M Company determined to spin off the H Company and let it extend its business independently. The researcher, who used to be the Vice Director of the Computerization Project of the U Company, was invited to become the Chief Executive of the H Company and took responsibility for the H Company's innovations.

The researcher proposed that the M Company and the H Company work together to develop Desktop Publishing (DTP) Systems for the H Company's operation. The idea was that if the new systems were to be successful in meeting the H Company's mission requirements, it would create a new DTP total solution and initiate a new market of corporate/personal publishing. (Wu, 1985).

Examining the U Company's experience, its computerization design could be categorized as a "Simulation Model" that maintained the conventional organization and kept both its Editorial Department and Composition Department. The publishing processes had remained the same; the writers and editors stayed on, using old forms of manual operation. Compared to the U Company, the H Company's design was a "Reengineering Model" that altered all processes and entirely removed the Composition Department. It was expected that the writers/editors would cover writing, typesetting, page design and composition at the same time.

This project also wanted to answer the following questions:

1. How can we measure the evaluation of the innovation of DTP?
2. What is the extended evidence of the CFS on IT innovation?
3. What are the factors that may affect the IT innovation?

An academic research project was designed and conducted along with the Product Planning Project. (Wu, 1995)

Methodology

Overview

We examined the idea of User Psychology that attempted to establish theories on computer users in the early days of the birth of the PC. It presented a distinct field of the "Human Aspects of Computing" Study both in computer and management sciences after the 1980's. (Moran, 1981) (Ramsey, 1979). Researchers have observed plenty of variables that might affect, even determine users' behavior. Among them, Newell's (1972) user's behavior formula and Moran's (1981) follow up especially drew our attention. After a thorough and careful discussion, we chose two sets of dependent variables (DV) to evaluate the efficiency of DTP. Since time and errors were always employed as users' performance indicators by information

systems designers (Card, Moran & Newell 1980; Shneiderman, 1979; Walther & O'Neil, 1974), one set of DVs was users' Performance measured by their work efficiency (speed) and quality (errors) on specific assignments. The second set of DVs was users' Adoption Behavior measured by their psychological acceptance and practice preference.

In practice, we had tested many independent variables (IDV) and demographic variables. Many of them contributed little influence on the DV. For this reason, we ruled out those variables in this final report. We kept two, which are also commonly recognized by previous researchers, for deliberation. These IDVs were users' knowledge (about the system) and users' motivation (to participate in the innovation). In order to observe the CFS, we designed a quasi-experiment to compare the performance of current employees with that of new users.

Quasi-Experiment Design

This DTP was developed from September 1987 and was launched in August 1988. Then, the following quasi-experiment design was summarized as Table 1. A group of seventeen employees of the Editorial Department of the M Company was designated to be the quasi-experimental group, as Group E. Two control groups with the same number of persons as Group E were comprised of college students who had no past experience of traditional publishing. Students from computers and information departments were assigned to Group C, while students from liberal arts departments were in Group A. All groups took the same training courses and same tests before and after training. Word processing (WP) and desk top publishing (DTP) were defined as the core tasks of the computing work. All groups' performances were measured by a final assignment at the end of the training program. Users would be required to input and compose two scripts into one section using a specified layout with WP and DTP. In spelling languages, to input alphabet does not sound a problem, but it requires certain special skills to input Chinese characters. It was also more difficult to compose page layout at that time.

Measurement

Performance was measured by users' speed and errors during their final assignment. WP speed was measured by average words typed during test times. DTP's speed was measured by minutes required for finishing the task. Error was measured by wrong operations during the whole task.

Users' knowledge was measured by a "UKAT" test, which was designed by the Technical Advisory Committee of this Project and modified by pilot studies, with an internal reliability Alpha =.4817. Users' motivation was measured by "MLS" psychometric scales, tested by pilot studies, with an internal reliability Alpha =.7419.

Table 1. Summary of the Quasi-experiment Design

	Pretest	**Training**	**Posttest**	**Online Work**	**Evaluation**
Time		Sep.1988- Feb.1989		Mar.1989- Nov.1989	
Group	E, C, A	E, C, A	E, C, A	E	E
Measurement	Knowledge Motivation		Performance 1. WP 2. DTP Acceptance Preference		Innovation Experience 1. By scorers 2. By users

In-Depth Personal Interview

This procedure recorded users' points of view from their self-report. Each user of the three groups was interviewed after the final assignment to reveal their attitude change of acceptance for and preference of the new DTP, or of and for the old manual tools. Group E was interviewed again six months after their online work. Three scales and questionnaires were employed:

- Acceptance scales: with internal reliability Alpha =.7558.
- Preference scales: with internal reliability Alpha =.6812.
- Innovation Project questionnaires: overall opinions about users' CFS, attitude change, and innovation experience in open-ended form, only for Group E.

Participant Observation and Scorer Evaluation

This method provided the researcher's point of view and evaluation on users' behaviors. The researcher and an associate, who was the Administrative Manager of the M Company, worked together to observe and score Group E users' adoption by structured scales. The observation period, according to the Innovation Theory, was divided into two stages. Stage 1 was before the end of training. Stage 2 was six months after the online work.

Scorer reliability of stage 1 was.7550 ($p<.001$) and stage 2 was.7214 ($p<.001$). One employee in Group E left the M Company and became a missing subject in Stage 2. Another employee became a contract freelancer, but was still included in this research.

Main Result

General Description

Speed Performance varied widely. Performance of errors made no significant variation. Acceptance was above merely good. Preference was in favor of the transition to computing work.

Users' knowledge was barely moderate. Motivation was around the very high level (see Table 2).

WP Performance

Speed

Employees were much better than students. The average speed (words per hour) of Group E was

Table 2. Description of Case 1

Variable	Mean	Std Dev	Minimum	Maximum	N
WP speed	559.88	570.61	88.00	3600.00	51
WP errors	1.04	1.74	0.0	10.00	51
DTP speed	107.37	46.38	10.00	171.00	51
DTP errors	3.57	1.75	0.0	9.00	51
Acceptance	73.35	13.67	36.00	100.00	51
Preference	72.49	17.46	0.0	100.00	51
Knowledge	55.24	19.61	0.0	96.00	51
Motivation	84.88	9.46	69.00	100.00	51
Innovation of Group E					
By Scorers	78.06	8.47	63.75	89.06	16
By Users	73.44	15.26	37.50	100.00	16

Table 3. ANOVA: WP speed by user roles

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	7492254.47	2	3746127.24	20.46	0.00
Within Groups	8787432.82	48	183071.52		
Total	16279687.29	50	325593.75		

1101.88, while Group C was 282.76, and Group A was 295.00. Significant difference was found with ANOVA (see Table 3). Table 4 showed that high knowledge (817.42) was better than low (330.96). Motivation made no difference. Further contrast analysis found that both high knowledge and high motivation would produce the best performance.

Errors
No difference was found in any user factors.

DTP Performance

Speed
Employees were still the best and Group C was better than Group A. The average speed of Group E was 56.94, while Group C was 111.06, and Group A was 154.12. Significant differences among groups were found with ANOVA (see Table 5) and its further contrast. Table 6 showed that high knowledge (74.58) was better than low (136.52). Motivation made no difference.

Errors
No difference was found from any user factors.

Acceptance and Preference

The acceptance was mildly high. There was no main effect between groups, but an interaction between knowledge and motivation was found. Further covariance analysis found that users with high motivation and high knowledge produced high acceptance, while high motivation and low knowledge produced low acceptance. Users generally preferred the new computing work. There was statistical difference between groups, but the individual difference was greater. Users with high knowledge had a positive relationship between acceptance and preference, while those with low knowledge did not.

Innovation Experience

Scorer Evaluation
Both scorers' evaluations were coherent with the results of the quasi-experiment. In Stage 1, users shared a slightly positive attitude towards computing work with no clear CFS. In Stage 2, after users got used to computing work, there was little CFS. Some of the users expressed an attitude change

Table 4. ANOVA: WP speed by knowledge and motivation

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Main Effects	3473491.54	2	1736745.77	6.65	0.00
Knowledge	2398468.87	1	2398468.87	9.18	0.00
Motivation	466807.04	1	466807.04	1.79	0.19
2-way Interactions	528318.25	1	528318.23	2.02	0.16
Explained	4001809.77	3	1333936.59	5.11	0.00
Residual	12277877.53	47	261231.44		
Total	16279687.29	50	325593.75		

Table 5. ANOVA: DTP speed by user roles

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	80614.28	2	40307.13	71.76	0.00
Within Groups	26959.64	48	561.66		
Total	107573.92	50	2151.48		

in favor of computing, while the others kept the same attitude as they had had before Stage 2. No one expressed a worse attitude toward computing than they had started out with.

Self-Report

38% users responded that their attitudes had changed; the remaining 62% kept the same attitude they had had. 31% of users changed from a mutual attitude to a positive one. They explained that they did not realize the complete advantages of computing during the training period until they were very familiar with the new tools. One user, who went from a positive attitude to a neutral, said that she lost her curiosity toward computing when the work became routine. Three users always kept indifferent attitudes, while seven were in favor of computing from the beginning to the end. 94% of users reported that they had interest in computing, and 80% of them were very interested in it. One user said that she "got to do what I got to do." although she was not interested in computing.

During the innovation process, 81% users had met with difficulties; 38% users were not totally satisfied with their work yet. There were some existing problems, but no obvious CFS. Four users preferred the old manual operation in certain periods of Stage 1. When the entire project had been completed, every user stated that they would choose computing work.

Reflection

Evaluation of the Innovation

It is very difficult to formulate an overall, quantitative and qualitative, evaluation for a management policy. (Kaplan & Norton, 1996, 1993, 1992) However, a financial report might reveal some solid evidence. After the analysis of the increase of investment in systems and the decrease of the human labor cost and manual overhead, the annual accounting statement indicated the cost of production had been cut by 28%. Furthermore, the production period had been shortened by 41%. These results provided more flexible time to accept business opportunities; therefore, revenue amazingly increased by 82%. These facts can be considered as a significant testament to the efficiency of the innovations.

Table 6. ANOVA: DTP speed by knowledge and motivation

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Main Effects	49080.76	2	24540.38	19.72	0.00
Knowledge	44846.76	1	44846.76	36.05	0.00
Motivation	341.41	1	341.41	.274	0.60
2-way Interactions	31.60	1	31.60	.025	0.87
Explained	49112.35	3	16370.78	13.16	0.00
Residual	58461.57	47	1243.86		
Total	107573.92	50	2151.48		

CFS: Not a Real Threat

The concern of CFS did not appear in this case study. The current employees had done much better than the other two control groups in every aspect. It seemed it was all right to count on the current employees. A slight attitude change in favor of innovation was found among employees and no one presented negative attitudes. Employees produced significantly successful performances and healthy mental adoptions to the innovation. Past experience did not seem to be a barrier to the management's innovation policy. If there was a real task goal, if the employees wanted to stay, "they got to do what they got to do", one interviewee pointed out.

Other Factors May Affect the IT Innovation

What were the main user factors that would affect user behavior regarding IT innovation? Users' knowledge was the key factor to performance. The statistics showed that people with higher knowledge of computers produced significantly better accomplishments than people with lower knowledge. It would be a good idea to continuously provide onsite training for employees. User motivation seemed not to be a factor in this study, though it was many previous researchers' major concern. (Chintakovid, 2009; Rantapuska, 2002; Stanton, Mastrangelo, Stam & Jolton, 2004). It should be pointed out that users in this study were relatively young. There is a theoretical possibility that age could be correlated to motivation that only affects older persons. Further research might be useful in clearing up this matter. As almost always happens in reality, the new system was defined and selected by the management in business. The employees did not have much say about it before the deployment of the new system. Evidence from the open-ended interviews showed that the new system's usability would affect user's productivity. This might support the idea to include a couple of end users into the decision group during the design and introduction period of the innovation.

CASE 2: C COMPANY

The Problem

In the late 1990's, the concept of "Knowledge management (KM)" burst into the business world with overwhelming force. There were two approaches to explain the practice of KM. The first placed KM as a new design of process and environment that emphasized to "share" and solve specific questions, especially in unstructured domain knowledge. (Hoffman, 1999; Nonaka, 1994; Ruggles, 1998) The second claimed that KM was a new look at information systems, decision support systems, data management and the use of the internet, even though it was a combination of recycled concepts. (Spiegler, 2000) The KM systems in this case were the first type rather than the second type information systems for daily operations. Whether KM is a marketing campaign promoted by IT providers, such as the enthusiastic Microsoft, or not, it triggered a tidal wave that saw business everywhere beginning to install KM information systems. (Alavi, 1999; Grant, 1996). After almost two decade's experience, management did not worry about the CFS or resistance from the employees. However, unlike production and/or management information systems where there are physical indicators to evaluate the efficiency, it is much more difficult to measure the accomplishment of KM systems. Management needed to know what the efficiency of knowledge innovation was. (Hawryszkiewycz, 1999; Huber, 1991). C Company was one of the first large businesses to launch KM systems in Taiwan.

Case Description

The C Company used to be a governmental monopoly agency that regulated, provided and sold all telecommunications goods and services. It did not transform into a governmentally-funded business entity until 1996. The C Company was, and is the single dominant telecom provider in Taiwan and has continuously reaped high profits. Since it still virtually controlled the whole national information infrastructure and network backbone, all other competitors worked, more or less, as its clients. The T Institute is an important division of the C Company and takes the responsibility for training, testing for professions, testing for certificates, production and publishing of training materials, copyrights and circulation. Most employees of the T Institute are tutors with MA or even Ph.D. degree. They belong to three teaching fields: cable telecom, mobile telecom, and data telecom. The T Institute has three branches that are located in different regions of Taiwan. Since the T Institute has played the role as the "brain" of the C Company, management decided to deploy the new KM systems in the T Institute from 2000. In 2003, a midrange manager wanted to investigate the efficiency of the KM systems and initiated a survey project. During this time, the researcher was invited to be the consultant to this Project.

This Project intended to explore the following issues:

1. A measurable evaluation of the innovation of KM.
2. An analysis of the users' performance on KM.
3. What factors may affect the innovation of KM.

This Project was designed and conducted during 2004.

Methodology

Overview

We entered relevant keywords into several famous databases including Science Direct on Site, JSTOR, ACM Digital Library, Academic Research Library, ABI Global, IEEE database and Google Scholar, and we found little useful literature that directly answered our concerns. There were many papers that gave advice on matters prior to KM, or how to establish KM systems. (Kanter, 1999; King, Marks & McCoy, 2002; Nonaka, 1994) (Ruggles, 1998; Vail, 1999) On the other hand, there were few research projects that monitored the efficiency of the KM systems with empirical studies. Brancheau et al. (1993) introduced a 2+2 EUC management model that was based on a comprehensive literature analysis. The two focal components of this model are the organization level and the individual level. The first level focuses on strategy, technology, and management action. The second level considers users, tasks, tools and personal actions. The other two parts of this model are antecedents (i.e. context factors) and consequences (i.e. outcome factors) of users' work. The four components are not independent, but interconnected and dominate the practice of management innovation. This model and other studies correlated with our previous study in 1988 to a degree. However, we wanted to detect the factor of "management action" for this project, although it was a factor that was very difficult to measure.

Most previous studies measured "management action" (or other managerial concepts) by attitude questionnaires that we were not fully satisfied with. We believed that there was not much insight to be gained from the following type of dialogue:

"Do you agree with the importance of management's action?"

"Yes, I agree."

"How much do you agree? Agree? Or strongly agree?"

"Strongly agree."

Thus, we attempted to discover more qualitative data to interpret the influence of"management action" later on. Since the efficiency of KM (DV) was quite conceptual, we decided to use multiple ways of evaluating the innovation of KM. The former four observations were the efficiency of users' behavior. The last was a self-report scale to reflect users' attitude. The five methods we chose to use were as follows.

1. Employee's adoption: whether the interviewees had used the KM systems or not;
2. Applications that the users had processed on the KM systems;
3. Contents that the users shared with others through the KM systems;
4. Collaborations with others that the users had achieved specific goals with via the KM systems;
5. A scale of users' attitudes toward the efficiency of KM systems.

Again, we tried to investigate many IDVs and found that most of them did not play fundamental roles. This Project, concurrently with Case 1, emphasizes that the two most important IDVs were users' knowledge (about the system) and users' motivation (to participate in the innovation). An add-on IDV was management action.

Survey Design

There were a total of 93 tutors from three branches of the T Institute. Therefore, we determined to interview every tutor. A dedicated interviewer was trained and he travelled to every branch of the T Institute to complete interpersonal surveys. He had to make appointments with the interviewees who might not be available when he visited. No interviewee was to be excluded unless the interviewee refused to respond to the survey in person.

Measurement

Employee's adoption, users' applications, shared contents, and collaboration were recorded by the facts, including the interviewees' real behavior. Users' attitude toward the efficiency of KM systems was measured by "EKS" scales that covered curricula, teaching tools and teaching methods. The internal reliability Alpha with after measurement purification was.9790. Users' knowledge was measured by the modified "UKAT" test, which was designed by the Technical Advisory Committee of this Project, with an internal reliability (after measurement purification) Alpha =.8799. This test contained two subsets. One was for knowledge of KM, and the other was for how to use the T Institute's KM systems to accomplish various tasks. Users' motivation was measured by the modified "MLS" psychometric scales with an internal reliability (after measurement purification) Alpha =.9686. These scales also included two subsets. One was for personal motivation, and the other was for interactive motivation should employees wish to share their knowledge through the KM systems.

Main Result

General Description

Sixty two (73%) of the total ninety three employees responded to this survey. The results were very informative; over one third of the interviewees had never used the KM systems for more than three years. All statistical means of the three factual measurements, which reflected the efficiency of users' behaviors, were under mid-points. Even the efficiency reported by the interviewees was a moderate 64.12 on a 100-point scale. Users' knowledge of KM was medium high, while the knowledge in using the installed KM systems was a little less

than mid-level. Motivation, whether personal or interactive, was moderate. (See Table 7).

Adoption

The total adoption rate barely reached 62.9%. There was no difference found between interviewees' knowledge levels and motivation levels. However, there was a significant difference ($P<.01$) between the locations of the branches. The percentage of adoption at the northern branch reached 79.3% while the central branch was 33.3% and the southern branch was 66.7%. The northern branch was located in Taipei, the capital of Taiwan. The southern branch was in Kaohsiung, the second largest metropolitan area in Taiwan.

Users' Applications, Shared Contents, and Collaborations

All of these three indicators were poor sources of significant data. No correlations were found between users' knowledge levels and motivation levels.

Efficiency in Attitude

Significant differences were found both in knowledge and interactive motivation. The higher knowledge level (69.42) reported better efficiency than the lower knowledge level (58.66). The higher interactive motivation level (70.63) reported better efficiency than the lower interactive motivation level (58.66).

Personal Motivation and Age

In the previous case study, we wondered if there was an interaction between motivation and age that had not been revealed in the Case 1. We found positive evidence in this case that personal motivation and age did produce an interaction with the efficiency in attitude. In further contrast, age indicated that older users with lower personal

Table 7. Description of Case 2

Variable	Mean	Std Dev	Minimum	Maximum	Percentage	N
Adoption Yes No					62.9% 37.1%	68
Applications	0.3852	0.2432	0.25	1.00		39
Shared Contents	0.3980	0.24	0	1.00		39
Collaborations	15.3276	11.6456	0	33.33		39
Efficiency in Attitude	64.12	14.93	17	86		38
Knowledge KM KM systems	75.3676 46.37	24.6213 20.29	25.00 0	100.00 86.67		68
Motivation Personal Interactive	64.0556 60.29	14.09 15.53	21.67 24.29	100.00 87.14		39

Table 8. ANOVA: efficiency in attitude by knowledge

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	1013.24	1	1013.24	5.47	0.03
Within Groups	6295.33	34	185.16		
Total	7308.57	35			

Table 9. ANOVA: efficiency in attitude by interactive motivation

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	1787.16	1	1787.16	9.96	0.00
Within Groups	6459.96	36	179.44		
Total	8247.11	37			

Table 10. ANOVA: efficiency in attitude by personal motivation and age

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Personal Motivation	1668.37	1	1668.37	17.96	0.00
Age	353.18	1	353.18	3.80	0.06
Interactions	867.76	1	867.76	9.34	0.01
Residual	2694.26	29	92.91		
Total	146661.64	33			

motivation would report lower efficiency than younger users, while there was no age difference factor in the high personal motivation level. (See Table 10)

Reflection

Evaluation of the Innovation

Though the attitude scales were widely applied in similar studies, we were not comfortable with depending solely on the self-reports. Thus, we employed four more methods to collect substantial behavioral data. Although the efficiency reported by the users' attitudes was moderately above average, all the other four factual and behavioral data were much lower than the mid-level. It would be a fair judgment to conclude that the accomplishment of these KM systems was poor and that the efficiency of the innovation was not truly successful.

UAS: the Comeback of the Deviance of CFS

This case implied a potential User Alienation Syndrome (UAS) that might be a variant of CFS. None of the employees feared computers. On the contrary, they were an elite group; they were tutors and taught specific topics about computers. However, more than one third of the interviewees had never touched the KM systems. It is a fact that the User Alienation Syndrome did exist. And, this might not be a single case phenomenon! In another non-systematic observation, it was found that there was a nationwide project that subsidized some awarded academic organizations to install KM systems. There was an assessment that required every user to process at least two sharing activities, such as to initiate a topic, to respond to a question, to post a document and so on, per month. It ended up with many users asking assistants to run anything, whether relevant or irrelevant, on the KM systems. Usability might be a factor, but not a very influential one. According to the Case 1 in 1988, the usability of the DTP systems had to be recognized as "Very Weak" by today's technical standards. However, all employees had worked very hard on the systems. The User Alienation Syndrome might result from the interaction of systems' characteristics and human nature.

The goal of production and/or management is to produce while the goal of KM systems is to share. Users had to use the former systems to

survive and make their living, while users were quite free to choose if they wanted to use the KM systems to make a dream of their own come true. Human nature, the largest part of it, tends toward a convenient, simple and easy life. Most of a job's duties are normal, stable and routine. Sophisticated employees have already learned a solution to deal with their daily, on-the-job operations. Especially for tenured employees and those who worked for very profitable companies, users have little reason to bother themselves to look for real breakthroughs, much less to conduct a revolutionary battle. The UAS seems to reflect an inborn structure in human nature. One is not able to force employees to use KM systems. All incentives or regulations, such as two posts per month, might be in vain after all. The KM systems might be only for the people who stand beyond the three standard deviations of the normal distribution of human nature.

Management Action

Though many previous studies have concluded "corporate resource" was the main factor that decided the success of information systems adoption, (Caldeira & Ward, 2001) we deduced that the success of an innovation mostly depends on the users. Furthermore, we also found traces of evidence that management takes the responsibility for the quality of innovation.

During the survey of this case, we recorded some heuristic facts as follows:

Management decisions can be made on loose ground. "There were two reasons that the headquarters of the C Company decided to bring in the KM systems. First, it was a novel issue in 2000. Second, they could afford to do it" stated a senior midrange manager who was involved in the original planning. Though the Director of the T Institute approved the maintenance fee every year, he himself had never been involved in the development of these KM systems. The Director defined this survey project as a voluntary and internal opinion exchange instead of the official assessment that was originally purposed after much planning. In fact, the Director considered this position as one "shift" in his career. He was waiting for the opportunity to get promoted and go back to Headquarters. All the evidence and inferences showed that the Director was not truly interested and did not include the KM systems into his priority schedule.

Case 1 of the M Company is a very good comparison. The researcher used to be the Vice-Director of the innovation project of the U Company. Though he held a high position, he was still a relatively young Ph.D. student then. Consequently, the U Company took external advisers' suggestions to establish a "simulation" system environment concerned with CFS, and dropped his proposal for a "reengineering" model. Afterwards, he was invited to the M Company and realized his plan to develop totally different DTP systems from the U Company. Eight years after the researcher left his position; the U Company shut down its "simulation" department and returned to a "re-engineering" environment. It thus paid double cost in human resources, facilities, and wasted a considerable amount of time. Back in the 1980s, the U Company was protected by an old charter law and was able to generate easy revenue.

Without this law, any deficit was very difficult to recover from. The successful experience of the M Company most likely indicates that dedicated executive management does make a difference. It also seemed, according to the T Company and U Company' experiences, that management of easily profitable companies often makes expensive and inefficient decisions.

CROSS EXAMINATION AND CONCLUSION

Evolution

This quarter-century long evolution of systems development is summarized in Table 11.

Table 11. A summary of the evolution of systems development

	Production/Management Systems	**Knowledge management Systems**
Operation	Daily based	Initiative project based
Support	Labor	Intelligence
Main Activity	Work	Share
Goal to Deal with	Routines	Creativity
Usability for	Individual	Collaboration
Efficiency Evaluated	Significantly Successful	Inconclusive
Challenge	CFS: Not found in this case	UAS: Maybe a latent threat
Users' Knowledge	Core factor	Core factor
Users' Motivation	Not significant in this case	Core factor
Management Action	Funnel Model: The executive management of the project	
Other Factors	Did not play core roles in these two cases	

The researcher suggested a "Funnel Model" to conclude how the "Management Action" affects systems' development and efficiency.

At the beginning and pre-planning stage, there are a lot of influential factors:

1. The corporate culture: How to react, or pro-act to external change.
2. The top management's interest and attention.
3. Available technology and choices.
4. The size of investment, related resources and future overhead.
5. The expected efficiency.
6. The internal institution: How the corporation implements a project.

The above factors form a wide range, which is the top opening of the funnel, and interact with each other. However, when the project is entering the practice stage, there is only one determinative and determinant exit of the funnel left. The last factor will be who the executive management in charge of the project is.

Revolution?

An ideal theory is that a rational knowledge process can complement human insufficiency. In the real world, not many people want to admit to their insufficiency. An expected goal is that a sharing environment can trigger human creativity. In reality, most people want to stay on the same track instead of go crazily off in search of innovation. Therefore, the researcher proposed some different (revolutionary?) ideas for the deployment of KM systems in the future.

For Employees vs. For Special Interest Groups

Many KM systems we have seen were developed for "all" employees who belonged to the same functional division. It has ended up with the use of systems becoming just another form of "paper-work". The systems designer may reconsider such an environment useful only for special interest groups and "qualified members". This idea might also promote the image of KM as elitist.

KM Systems vs. KM Community

Many KM systems designers began with the point of view of "systems analysis and design" and assumed that there was a "common user" with "common requirements". Designers often unconsciously set up a fixed interaction framework for users during the deployment of their systems. We might drop the approach of "KM systems" and think about the idea of "KM community" instead. The idea is that we do not bother the shared database and the common usability; we provide an autonomous place for members to use. The sharing process works as if we are going to visit a neighbor's virtual house. He does not live in a dormitory and he has something fantastic in his study waiting for us. Thus, the researcher has initiated the concept of "Member-Driven" design to compare with the popular model-driven, data-driven designs.

Internal KM vs. External KM

Many companies established KM systems for, and limited to, internal employees because there might be a lot of confidential information in the shared database. However, if we recognize that the fundamental purpose of KM is to share, to accelerate imagination, and to work out innovations together, we might open the fence and link to external KM communities. Both "Member-driven" and "External KM" will create technical problems such as the integrity of database, the management of redundant data, and data security, etc. However, it might be worthy trying to resolve these problems, if we want to discover the passion for knowledge that is deeply buried in human nature.

Methodological Issues

Brancheau et al. (1993) criticized the fact that evaluation and review of information systems had almost totally relied on self-report questionnaires. They recommended other approaches such as case studies, experimental designs, and longitudinal methods to solve more problems and to validate earlier findings. They also stated that they were still limited by the scope of the existing research. They attempted to describe a comprehensive profile; however, all of the literature and experiences available to them were from North America, and they lacked research reports from Asia and Europe. They suggested that new research design will be promising. Studies conducted outside the USA are expected to assist in creating a worldwide scope of research.

The researcher indeed agreed with their comments. We designed several behavioral measurements to collect substantial data along with the self-report attitude scales, and took a year's time to depict each case. The comparative results also suggested that the self-report questionnaires method might produce higher optimistic evaluations than exist in reality.

LIMITATIONS AND FUTURE RESEARCH

Owing to the variants of the definition, the KM systems that were employed in daily operation might not fit the discussion of this case study. This research could provide some experience in Taiwan, and might assist in building a worldwide theory and cross-cultural perspective on systems, especially KM systems development. Most of fast developing countries (such as PRC) are bound to go through the evolution trace of the new IT innovation. Research of this field with the international point of view is recommended and expected in the future.

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ENDNOTE

[1] The author uses the term of "information systems" for consistency. Back to that time, the term in practice was labeled as End User Computing (EUC) environment.