MANAGEMENT CONCERNS ON COMPUTER FEAR SYNDROME: AN EMPIRICAL STUDY OF A PUBLISHING COMPANY

Wu, Tung-Xiung
Department of Information Management
The World College
Taipei, 116, Taiwan, ROC

Abstract -- This study found the Computer Fear Syndrome was not very serious, though some factors did affect users' behavior. Computing innovation with the current employees is possible and encouraged for management policy.

SPECIFIC OBJECTIVE

The management of publishing media was concerned about the Computer Fear Syndrome (CFS), which assumed current employees with certain characteristics would produce poor behavior with computing work and barricade the new technology innovation.

Thus, this study attempted to:

1. Discover how the employees are related to the CFS.
2. Provide suggestions for the management policy.

LITERATURE REVIEW

Management Concerns

The innovation of computing work and the development of personal operating environment accelerated and became a key management and research issue that was summarized as ' End-User Computing (EUC) Management' by Brancheau and Brown [4] at the end of 1993.

Another related idea of User Psychology on management was also established earlier. It presented a distinct field of the 'Human Aspects of Computing' study both in computer and management science after 1980's. [10][12]

Brancheau et al. introduced a 2+2 EUC management model that based on a comprehensive literature analysis. The two focal components of this model are organization level and individual level. The first level focuses on strategy, technology, and management action. The second level considers user, task, tool and their personal action.The other two parts of this model are antecedents i.e. context factors and consequences i.e. outcome factors of computing works. The four components are not independent but interconnected and dominate the practice of management innovation.

This model and various pioneering studies ventured the profile and importance of this research area

Computer Fear Syndrome (CFS)

Computer Fear Syndrome (CFS), also referred as computer anxiety or negative attitude toward adopting computing works, indicates users with certain factors would produce poor behavior.

When the computers 'invaded' human life, people began to think of computer as 'threat or promise?' [7] Then researchers observed that senior persons or novices with negative attitude towards computers learned computing tasks more slowly and made more errors. The fear syndrome, generated by an anxiety of failure, may also lower

their performance. [5][13]

CFS was also widely perceived and generally discussed in Taiwan, but empirical studies were limited. Hung and Xu [9], based on a survey of government offices, had some interesting findings:

1. Users who reported that they had CFS were not many; while users who clearly denied that they had CFS was not in plenty, either. Both percentages were around 20%. The others had no opinion.

2. Supervisors recognized the portion of the staff who had CFS was 4.4% to 48.2%.

3.The number of staff confessed that they felt increasing CFS or anxiety after computing works was 37.8%; while they reported that they got physical uncomforting or health problems reached 74.3%.

Although Hung et al. described CFS was ' not very serious ', their data showed the considerable relevance of CFS. Their study also implied that CFS might appear as users' physical forms instead of their attitude or cognition.

CFS and Publishing Media

Because of computers' significant contribution on word processing, it provides a great attraction to the publishing media. [3][17][21] Even the non-publishing business spends 3% to 7% volume of their revenue on publishing related expense for preparing paper works, according to a report on the Fortune magazine. It is an international trend that publishing would be put on the first schedule to consider computing innovation. [2][16]

However, it would be inevitable to cause CFS and current employees' resistance because of its structural factor in this huge, labor intensive and old-fashioned industry. There were many cases reported both in USA and UK that union interfered or delayed the management's decision. Human resource needs new planning in this new age. [1]

Consequently, management began to think of replacing all employees for computing innovation. One of the earliest publishing businesses that innovated computing works is the United Daily News Group in Taiwan. They took two years to successfully change the printing department into computerization from 1980. Management dismissed the aged employees and transferred the young ones to guards, drivers, couriers, and other labor workers.

The author, as the executive researcher, participated the next project to introduce computing systems into editing department. [18][19][20] The company did not implement the planning until eight years later. One of the most important reasons of delay was that the CFS worried the management. It seemed that the CFS of intellectual workers was a more difficult problem that concerned the decision makers. They were not as easily replaceable as operating workers.

User Factors

Researchers have observed plenty of variables that might affect, even determine users' behavior.
A heuristic formula suggested by Newell[11] was:

user's goal +
task structure +
user's knowledge +
user's processing limits = user's behavior.

Moran[10] deduced this formula into two dimensions: user types and user interface (e.g., tool). User types by his definition were including two types. One is role type or task type. Role types are categorized by who they are, what task is. Another is knowledge type. This type is somewhat correlated with experience.

Brancheau et al. [4] concluded four dimensions that might affect user's behavior, as follows:

1. End User
   - Personal: motivation, intention, participation, age,...
   - Education/Experience: knowledge, skill, ability,...
2. Task
   - Position: role characteristics, job role, functional area, position level,...
   - Specific task: task types, routine/non routine,...
3. Tool
4. End User Action: tool utilization, support options,...

Though the terms are different from each other, the implication is coherent and related.

For this research's specific interest, three user factors were selected as independent variables (IDV) for investigation.

These IDVs were users' role (as employee of a publishing company), users' knowledge (about computing), and users' motivation (to join the innovation).

Performance and Adoption

The first distinguished dimension to reflect user's behavior is their performance. Moran[10] suggested seven ways to evaluate user's behavior, which are: functionality, learning (time), (working) time, errors, quality, robustness, and acceptability. In which, time and errors are clear quantitative scales to measure user's performance, while the other ways are more qualitative.

Time and errors are always employed as users' performance indicators by computing systems designers. [6][14][15]

The second dimension with more theoretical base is user's adoption.

Brancheau et al. noticed the development of computing could be a process explained by diffusion and innovation theory.[8] According to the change of time series, if the user's adoption is getting better, it will reflect CFS' decreasing simultaneously. The idea of user's adoption is similar to Moran's acceptability.

Thus, the author chose two dependent variables(DV) to observe CFS. One of DVs was users' performance measured by their working speed and errors on specific assignments. The other DV was users' adoption measured by their psychological acceptance and practice preference.

Methodological Issues and Further Improvement

Brancheau et al. [4] criticized that researchers in this field had relied almost totally on interview and questionnaires. They recommended other approaches such as case study, experimental designs, and longitudinal method to testify the problems and to validate the findings.

They also stated that although their attempt to describe the profile of EUC management was comprehensive, they were still limited by the scope. All the experiences were from North America and lack of research reports in Asia and Europe.

New research design will be promising. Studies conducted outside the USA are expected to assist to extend a worldwide scope.

METHODS

On the basis of the prior studies, a longitudinal case study of three methods was designed in a 26-month research period.

The case was a publishing company's editing department with 17 editors, which just began to innovate electronic publishing in Taipei, Taiwan. The author was also the innovation project director of the case ' M Company '.

The relatively small size of ' M Company ' was an important reason of why it was chosen to be investigated.

The three methods employed were the following: quasi-experiment, personal interview in depth and participant observation.

Project schedule was as follows:

Sep., 1987- Sep., 1988 preliminary study: tools evaluation and selection
Sep., 1988- Feb., 1989 quasi-experiment
Mar., 1989- Nov., 1989 personal interview in depth
Sep., 1987- Nov., 1989 participant observation

Quasi-experiment

Design

Employee of M company was designed to be the quasi experimental group as Group E. Two control groups with

the same number of persons as Group E were college students who had no past burden of traditional publishing working experiences. Students from computing related departments were assigned in 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) are defined as the core task goal of the computing works. All groups' performance would be measured by a final assignment at the end of training program. Users would be required to reorganize two scripts into one section under certain layout with WP and DTP.

Measurements

User role: categorized by their real role.

Role of Group E: with real task goal, and without computing background.

Role of Group C: without real task goal, and with computing background.

Role of Group A: without real task goal, and without computing background.

Users' knowledge: measured by a 'UKAT' test, which designed by the technical advisory committee of this project and modified by pilot studies, with an internal reliability Alpha =.4817.

Users' motivation: measured by a 'MLS' psychometric scales, tested by pilot studies, with an internal reliability Alpha =.7419.

Performance: measured by users' speed and errors of their final assignment. WP's speed unit was seconds for processing 1000 words. DTP's speed unit was minute for 2 pages. Errors counted by wrong operations.

Personal Interview in Depth

This procedure formed users' point of view from their self-report. Each user of three groups was interviewed to reveal their attitude change of acceptance and their preference on new computing or old tools after the final assignment.

Group E was interviewed again at six months later.

Three scales or questionnaires were employed:

Acceptance scales: with internal reliability Alpha =.7558.

Preference scales: with internal reliability Alpha =.6812.

Project questionnaires: overall opinions about users' adoption, CFS, and attitude change of innovation in open-ended form, only for Group E.

Participant Observation

This method provided a researcher's point of view as evaluation on users' adoption. The author and an associate, who was the administrative manager of M Company, worked together to observe and score the users' acceptance of Group E by structured scales. 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 training.

Score reliability of stage 1 was .7550 ($p<.001$) and stage 2 was .7214 ($p<.001$).

One employee in Group E left M Company and became missing subject in stage 2. Another employee became a case-by-case freelancer, but still included in the research.

RESULTS

General Description

Users' knowledge was barely moderate. Motivation was around very high. Performance of speed was widely various. Performance of errors made no significant variation. Acceptance was above good grade. Preference was in favor of computing work.

(See Table 1)

Table 1. Description

Variable	Mean	Std Dev	Minimum	Maximum	N
Knowledge	55.24	19.61	0.0	96.00	51
Motivation	84.88	9.46	69.00	100.00	51
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
Adoption of Group E					
By Users	73.44	15.26	37.50	100.00	16
By Scorers	78.06	8.47	63.75	89.06	16

WP Performance

Speed Employees were much better than students. Average speed of Group E was 1101.88, while Group C was 282.76, and Group A was 295.00. Significant difference was found with ANOVA (see Table 2.1). Table 2.2 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 promote best performance.

Errors No difference was found in any user factors.

Table 2.1. ANOVA:WP Speed by User roles

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	7492254.471	2	3746127.235	20.463	.000
Within Groups	8787432.824	48	183071.517		
Total	16279687.294	50	325593.746		

Table 2.2. ANOVA: WP Speed by Knowledge and motivation

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Main Effects	3473491.538	2	1736745.769	6.648	.003
Knowledge	2398468.869	1	2398468.869	9.181	.004
Motivation	466807.041	1	466807.041	1.787	.188
2-way Interactions	528318.226	1	528318.226	2.022	.162
Explained	4001809.765	3	1333936.588	5.106	.004
Residual	12277877.529	47	261231.437		
Total	16279687.294	50	325593.746		

DTP Performance

Speed Employee was still the best and Group C was better than Group A. 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 3.1) and further contrast. Table 3.2 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.

Table 3.1. ANOVA:DTP Speed by User Roles

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Between Groups	80614.275	2	40307.137	71.764	0.0
Within Groups	26959.647	48	561.659		
Total	107573.922	50	2151.478		

Table 3.2. ANOVA:DTP Speed by Knowledge and Motivation

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif. of F
Main Effects	49080.756	2	24540.378	19.729	.000
Knowledge	44846.756	1	44846.756	36.054	.000
Motivation	341.409	1	341.409	.274	.603
2-way Interactions	31.596	1	31.596	.025	.874
Explained	49112.352	3	16370.784	13.161	.000
Residual	58461.570	47	1243.863		
Total	107573.922	50	2151.478		

Acceptance

The acceptance was mildly high. There was no main effect between groups but an interaction of knowledge and motivation was found. Further covariance analysis found that users with high motivation and high knowledge would produce high acceptance while high motivation and low knowledge would derive low acceptance.

Preference

Users generally would prefer the new computing work. There was statistical difference between groups, but the individual difference was wide.

Adoption

For Group E, who had higher acceptance would more prefer computing work. Group C and A did not have such correlation.

Users with high knowledge had positive relationship between acceptance and preference while low knowledge did not.

Users' motivation provided as the same result as the factor of knowledge.

Innovation

Scorer Evaluation Both scorers' evaluations were coherent with the results of the quasi-experiment. In stage 1, users kept a mutual or slight positive attitude towards computing work with no clear CFS. In stage 2, users got used to computing work, CFS was little. Part of users expressed attitude change in favor of computing, while the others kept the same. No one was getting worse.

Self-report Six users responded their attitude change, the other ten kept the same. Five users were from mutual attitude to positive. They explained that they did not realize the complete advantages of computing during the training period until they were very familiar with computing tools. The user, who was from positive attitude to mutual, said that she lost her curiosity and imagination on computing when the works became routine. Three users always kept indifferent attitude while seven were in favor of computing from the beginning to the end.

Fifteen users reported their interests in computing, and twelve of them were very interested in. One user said that she got do what she got do, although she was not interested.

During the innovation process, thirteen users had met difficulties, six users were not totally satisfied with their works yet. There were some existing problems, but not obvious CFS. Four users would prefer old manual operation in certain period of stage 1. Every user stated that they would choose computing work after all.

CONCLUSIONS AND SUGGESTIONS

Conceptual CFS

There were some user factors would affect their behavior of computing works, but the conceptual CFS was not very serious.

User role would be the most important factor. It seemed all right to count on the present employees. If there was a real task goal, if the employees wanted to stay, 'they got do what they got do' as one interviewee pointed out.

User knowledge would be influential to the outcome of computing task.

User motivation seemed not a factor in this study, further consideration would be discussed next.

EUC Management

It could be a strong support for making an innovation policy. EUC environment might be inevitable for publishing media, even for all kinds of business.

A slight attitude change in favor of innovation was found from employees and no one grew negative attitude. Employees produced significantly successful performance and well psychological adoption. Past experience might not necessarily to be a barrier for the management's innovation policy.

It could be a good idea to require proper knowledge while recruiting new persons or to provide training for employees.

Though computing tool was not a core topic in this study, evidence, from the open-ended interviews, showed that tool's capability would affect user's productivity. Since the publishing media is a highly cultural related industry, the cultural aspects of tool, such as non-spelling word processing, will be another management concern.

Limitation

Users in this study were relatively young. It might need further research on senior persons.

It might be a theoretical possibility that age would be correlated to motivation. It would also explain the reason why the user motivation was not a factor in this study.

Future

This research could provide some experience in Taiwan, and might assist to build a worldwide theory and cross-cultural perspective on EUC management.

Most of developing countries (such as PRC) are bound to go through the trip of CFS and related problems for the trend to establish computing management. Research of this field in developing area is recommended and expected in the future.

REFERENCES

[1]Bergsven, Gail E.
1981 Human Resource Planning in a New Age; in Haigh et al. (eds.) Communications in the 21 Century; NY: Wiley; ch.11 [2]Bjorn-Andersen, Niels, Michael Earl, Olav Holst & Enid Blunden
1982 Industry Case Studies of Microelectronic Applications: The Printing and Publishing Industry; in Bjorn-Andersen et al.(eds.) Information Society: for Richer, for Poorer; NY: North-Holland; p.287-97 [3]Boldt, John R.
1987 Electronic Publishing; Taipei: Paper presented at 1987 Strategic Industry Conference
[4]Brancheau, James C., & Carol V. Brown
1993 The Management of End-User Computing: Status and Directions; ACM Computing Surveys; Vol.25,No.4:437-79
[5]Card, S. K., T. P. Moran & A. Newell
1982 The Psychology of Human-Computer Interaction; NY: Erlbaum
[6]Card, S. K., T. P. Moran & A. Newell
1980 Computer Text-Editing: An Information-Processing Analysis of a Routine Cognitive Skill; Cognitive Psychology, No.12, p.32-74
[7]Cherry, Colin
1971 World Communication: Threat or Promise? A Social- Technical Approach; NY: Wiley, ch.5,6
[8]Gabor, Dennis
1970 Innovations: Scientific, Technological, and Social; London: Oxford Univ. ch.4

[9]Huang, K.L. & Xu, M. L.
1988 A cultural and Psychological study on Office Automation of Governmental Organization in Taiwan; Taipei: Committee of Research and Auditing
[10]Moran, T. P.
1981a An Applied Psychology of the User: Guest Editor's Introduction, Special Issue on the Psychology of Human Computer Interaction; ACM Computing Survey; 13(1): 1-12
[11]Newell, A. & H. A. Simon
1972 Human Problem Solving; Prentice-hall, Englewood Cliffs, N.J.
[12]Ramsey, H. & M. Atwood
1979 Human Factors in Computer Systems: A Review of the Literature; Englewood, NJ: Office of Naval Research, Technical Report SAI 79 111 DEN;
[13]Shneiderman, Ben.
1980 Software Psychology; Cambridge, MA: Winthrop
[14]Shneiderman, Ben.
1979 Human Factors Experiments in Designing Interactive Systems; Computer; Vol.12, No.12: 9-18
[15]Walther, George H. & Harold F. O'Neil, Jr.
1974 On-line User-computer Interface: The Effects of Interface Flexibility, Terminal and Experience on Performance; in 1974 National Computer Conference; Montvale, NJ: AFIPS Press; p.379-83
[16]Wu, Tung-Xiung
1990 Users' Behavior at the Changing Period of Computerized Editing: A Case Study of INFOHIT Magazine; Journalism Research; No.43:153-78
[17]Wu, Tung-Xiung
1987 The Coming of Computing News Media: A Technical Perspective for the Deregulation of Journalism in Taiwan; Automation; No.38:168-70
[18]Wu, Tung-Xiung
1985 Toward Computing News: The Goal of News Information System Project; Journal of the United News Group;No.30:36-41
[19]Wu, Tung-Xiung
1984b Report of Requirement Analysis on News Information System; Journal of the United News Group; No.22:78-84
[20]Wu, Tung-Xiung
1984a The Planning of News Information System; Journal of the United News Group; No.20:17-39
[21]Young, Richard
1988 Electronic Publishing; Taipei: Computer Aided Publishing Conference