影響臺灣私立大學研究績效的關鍵因素之研究

A Study on the Critical Factors Influencing Research Performance at Private Universities in Taiwan

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摘要

本文首先探討組織學習、行動研究及績效管理之參考文獻，並提出一些新的發展。其次，本研究為增進學校「研究績效」(此即大學校院主要的競爭優勢關鍵要素)，乃設計一個系統架構模型，包括：組織關心要事(如：問題、目標等)[獨立變數]；組織學習、樂在行動[中介變數]；及組織績效[依賴變數]四個重要變數。最後，本文使用問卷調查及行動研究方法學評估本校現前之研究情境，其影響研究績效關鍵因素的發現、分析及其改善之行動，可提供臺灣私立大學校院提升其教師研究績效有價值的經驗及資訊。

關鍵詞: 組織學習、行動研究、研究績效

Abstract

Kurt Lewin (1946) first brought up the phrase “action research”. Action research (AR) is a methodology that uses an action spiral of planning, action, observation and reflection (including evaluation) to find facts, solve problems and improve performance. In 1990s, Peter Senge advocated to build the learning organization and practice five disciplines. He implicated that we need to learn and act effectively and fast than the competitors on the rapidly changing marketplace.

This paper first reviewed the literature of organizational learning, action research and performance management, and brought up some new developments. This study designed a systematic framework to increase the research performance (i.e. main competitive advantage of university) at Chienkuo Technology University (CTU) in Taiwan. The framework included organizational concern (e.g. problem and goal, etc.), organizational learning, willingness to act, and organizational performance. Finally, this paper used survey questionnaire and AR methodology to assess the current research situation. The findings, analysis and initial action for improvement through implementing the key factors influencing research performance at CTU should bring out some valuable experiences and information for other Taiwanese private universities.

***Keyword*:** Organizational Learning, Action Research, Research Performance

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1. INTRODUCTION

1.1 Background of the Research

Recently, the decreasing population has raised strong competitive pressures recently in the educational circles in Taiwan. The problems pose real threats to the majority of universities and colleges in Taiwan. Good universities were first selected by students to pursue their studies. A good university always possesses excellent research performance and fine teaching quality. Therefore, to accelerate and enhance the research performance and teaching quality of universities and colleges should be priority.

1.2 General Research Question

Given the above background, the main research question is:

How can organizational learning be used to increase research performance at private universities and colleges in Taiwan?

The corollary research question (i.e. main sub-question) is:

What are the critical factors influencing research performance at Taiwanese private universities and how can we act on it from what we have learned?

1.3 Objectives of the Study

There are three main purposes of this study:

1. To bring about some academic contributions of action research,
2. To integrate and apply organizational learning and action research method to improve research performance of private universities, and
3. To try to make a contribution by using of action research in the area of research performance.

2. LITERATURE REVIEW

2.1 Learning Organization (LO) and Organizational Learning (OL)

Peter Senge (1990) simply defined the learning organization (LO): As an organization which continuously enlarges and creates the future competencies. In such an organization, the staffs constantly promote their competencies of visions of achievements. The LO possesses five disciplines -- personal mastery, improving mental models, building shared vision, team learning and systems thinking.

Kim and Mauborgne (1993) considered that organizational learning (OL) is a capability to help an organization adopting effective action. Dixon (1999) put together 11 different definitions of organizational learning but included 4 common viewpoints: (1) expect to increase knowledge for improving action; (2) recognize the pivot relationship between an organization and environment; (3) possess the community being able to share ideas or thinking; and (4) harness the condition for organizational change.

Pai (2004) deemed that learning organization is a special kind of organization. Organizational learning is generally correlated with organizational activities; therefore, organizational learning is an important activity in a learning organization.

2.2 Basic Definition of Action Research (AR)

Kurt Lewin (1890-1947) first brought up the phrase “action research” and exerted to encourage “action researchers”. Action research is a methodology that uses an action spiral of planning, action, observation and reflection (including evaluation) to find facts, solve problems and improve performance. (Lewin, 1946; Abraham, 1997; Goldspink, 2003)

Argyris, Putnam and Smith (1985) pointed out that action science developed from the theories including two scholars -- John Dewey and Kurt Lewin. John Dewey criticized the inadequacy of separating knowledge and action; and set up an exploratory theory to integrate theory with practice. This thinking is the origin of action science.

There are many terms for action research, including action method, deep action method, interaction research, role research, drama research, action-oriented research and action science. (Dash, 1999)

Action research is popular among those education-focused universities, colleges, high schools and junior high schools, but is not understood at the technologic universities and colleges (such as CTU) in Taiwan. There tend to be less action researchers at the technologic schools. (Pai, 2004)

2.3 Basic Method of Action Research

Action research is a methodology. It comprises the goals of both action and research, similar to much of the research conducted with qualitative approaches (APMI, 1997).

The following is a detailed explanation of action research method.

1. **Action**: Communities or organizations need to initiate the programs to change their current situations as well as to improve or solve problems.
2. **Research**: Researchers, clients and the larger community need to understand the problems and causes to encourage the experience and knowledge growth.
3. **Action Research**: It combines both action and research, with the belief that one can take some actions to improve one’s life and job practices, and constantly adjusts the actions by systematic research to improve the performance. Action is to improve the practices, such as for better problem solving skills; while research is to enhance the experiences or knowledge, such as for the understanding of the problems, for improving the strategies, or for professional growth, etc. (Wu & Wu, 2002)
4. **Action Research Method**: It is to emphasize the action, followed by the accompanied research as fringe benefit. The research is conducted by direct involvement so as to enhance the understanding. The outcomes of the action research are to change the current

situation, solve the problems, and the learning performance by these participants. Two approaches can be employed as follows.

(1) To achieve the understanding, and obtain the experiences and knowledge with proper action.

(2) To guide or adjust action with the help of the sufficient understanding and knowledge.

2.4 Action Research Spirals/Cycles and Improvements

Basic AR spiral includes four steps: planning, action, observation and reflection (Zuber-Skerritt, 1991). The AR is a powerful and effective learning mode that was accepted by the academic circle (McNiff & Whitehead, 2002).

Griffiths (1990) pointed out that action research is progressed by a self-reflective spiral/cycle – planning, action, observation and reflection, through the real trial-and-error processes undertaken. In this spiral/cycle, feedbacks appear immediately and constantly in various forms.

Pai (2004) tried to integrate action research cycle with the system theory model (i.e. input, process, output, feedback and control). The integrated model is shown in Figure 1. The new systematic AR spiral/cycle added the control function as the role of CPU in a computer. The action researcher is a main controller; the action group can supply some good suggestions to help the action researcher executing and monitoring the action plans.

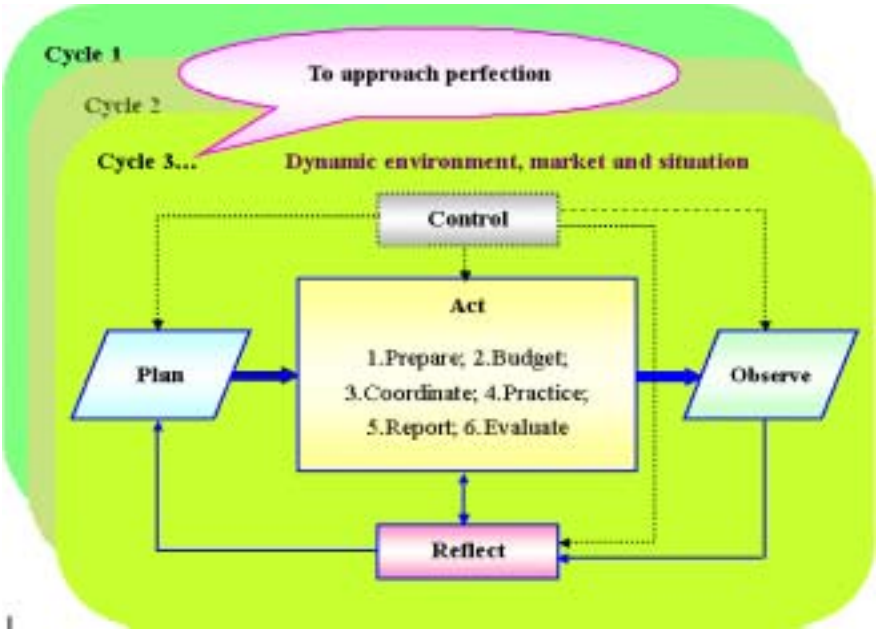

Figure 1 The Systematic Action Research Spiral/Cycle

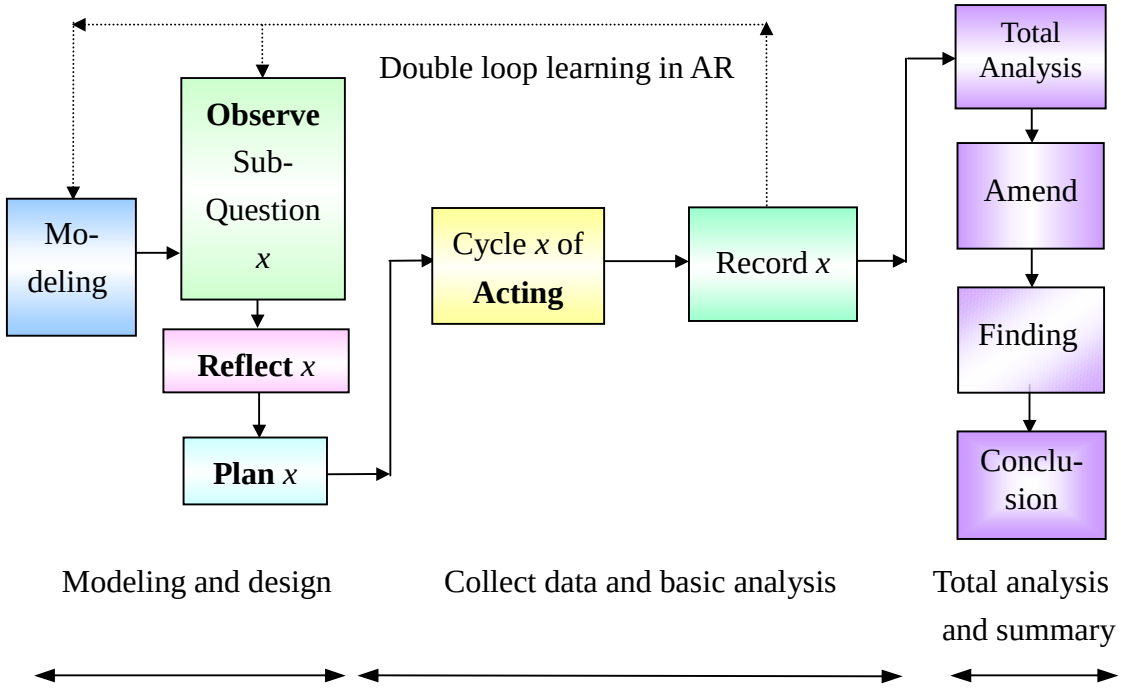

Figure 2 The Process Flowchart of Action Research (*x*: 1~3…)

(Source: COSMOS corporation; adapted from Yin, 1994)

2.5 Conducting Process Flowchart of the Action Research

The idea of AR flowchart adopted the modified process of case study (Yin, 1994; Pai, 2004). The cycle *x* (*x*: 1~3…) and report *x* in Figure 2 need some basic analyses. There are some differences between the AR and case study that we should be careful about.

2.6 Educational Action Research

2.6.1 Relations Between Action Research and Education

In the educational domain (e.g. the school-based and teacher-led situations), action research is conducted by the educational practitioners who participate in the operations of practices, and researches systematically collect the data, analyze the problems, propose plans to improve performance, execute actions, and examine carefully the impacts of the reform.

Educational action research is normally conducted in real educational environments to foster change by the staff members, especially the president, directors, and teachers. The research results are used for educational reform to enhance the educational and service quality (Wu & Wu, 2002).

Educational AR emphasizes that the teacher is a researcher. Its main characteristics are the changes arising from actions and collaborations between the action researcher and the person being researched.

Action researchers are concerned about what actions should be taken for intervention, what collaborative supports should have from the person being researched and the

organization, and how they are put together to improve the situation.

Another important characteristic is reflection by the researcher. Action research on the education area attempts to impose the proper actions into the process of the teaching, research and service, to make positive changes (Wu & Wu, 2002).

2.6.2 Benefits for Teachers and Scholars Participating in the Action Research

There are five main benefits for teachers and scholars to participate in action research (Wu & Wu, 2002; Pai, 2004).

1. It provides teachers with new views and insights into teaching, research and service areas.
2. It helps teachers pay more attention to the details of teaching, research and service, and focus on improving real problems.
3. It further investigates the gap between the results of practices and the preset goals, and thinks about how to bridge it.
4. It integrates teaching and research together. Teachers can not only use and pass the knowledge being discovered, but also can produce new knowledge and experiences through their own action research. This helps solve the problems at hand and improve the performance.
5. It changes teachers' thinking, behavior, performance and get better evaluation and satisfaction from students and the educational institution.

2.7 The Meaning and Process of Action Learning (AL)

Action learning (AL) isn't a course; but a practical project and collaborative learning process through doing, working and learning synchronously (e.g. experience/knowledge sharing, meetings, discussions, challenging assumptions, raising issues, making suggestions or decisions, etc.); AL can supply staff and leaders with new methods and ideas for their work, management and development (Weinstein, 1998; Dash, 1999; Goldspink, 2003).

Both AL and AR assume that learning comes from active experience. The form of AR is more systematic and stricter than AL. All AR projects are the AL projects, but the converse does not hold true (source: http://alp.polyu.edu.hk/ar/ar_frm.html). The AL is a type of organizational learning that can be used by way of **a**ction learning meeting (i.e. action group meeting) and the like.

2.8 Performance Management and Performance Appraisal

English (1991) pointed out when the organization would design the system of performance management, the leaders should invite their staff to participate. Thus, the staff can make some contributions, be willing to accept the system and execute their tasks.

Marien (1992) deemed the traditional performance appraisal of research and development had three shortcomings: (1) emphasize the outcome but not process, (2)

emphasize short-term outcome but not long-term planning and effective cooperation, and (3) focus on the leaders but not the customers or staff. To improve the shortcomings, the leaders can adopt serial cycles of meeting including staff with customers, staff with managers, managers with leaders to link and achieve organizational objective.

Lebas (1995) believed the performance is not equal to organizational accomplishments in the past; it should include the potential for successfully executing the action planning to achieve prospective target.

Lee (1996) explained the system of performance management is a kind of method for improving performance. Its main advantage is helping the staff to clearly understand their responsibility and organizational goals; its disadvantages of appraisal are interfering with the morale of some staff, staff resistance and can be managers' pain. These disadvantages can be improved through the action meetings that include proper staff to participate.

2.9 The Correlation between Organizational Concern, Organizational Learning, Action Research and Organizational Performance

Slater and Narver (1995) noted that there is complementarity between market orientation (i.e. an organizational concern) and organizational learning because market orientation and organizational learning together are useful to enhance organizational performance. Hwang (1999) found that organizational learning is an intermediary variable that is shown in Figure 3. (Lin, 2001)

Furthermore, action research is a more systematic and stricter form of action learning. Action research can be more useful to enhance organizational performance (OP). There is complementarity between organizational concern (OC) and organizational learning (OL); and action research (AR); and between organizational learning and action research.

We need to think, learn, act and solve something when we face the difficult problems or tasks. Therefore, the conceptual framework of this study (see Figure 3) is a logical research framework.

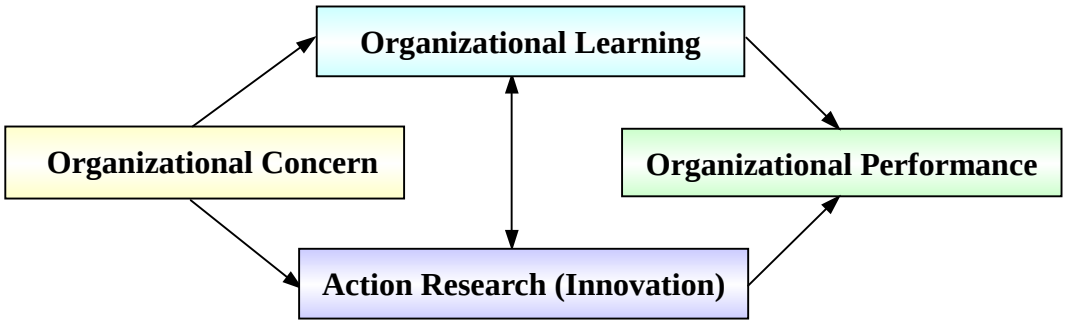

Figure 3 The Basic Relationship and Conceptual Framework of OC, OL, AR, and OP

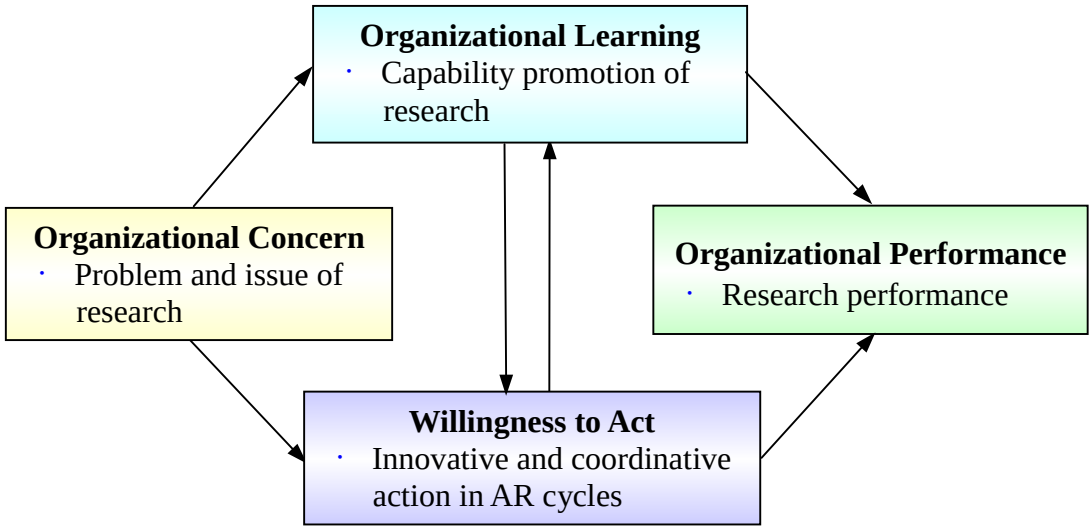

Figure 4 The Conceptual Framework (OL-WA Model) of this Research

3. RESEARCH DESIGN AND METHODOLOGY

3.1 Research Framework

The basic conceptual framework/model of the study is presented in Figure 3. According to the literature review, Figure 4 can be developed from Figure 3. This study adopts the framework (OL-WA model) for improving the problems of research.

3.2 The Definition of Operational Variables

According to literature review and this research framework, operational variables are:

1. **Independent** variable: The **organizational research concern**
2. **Intermediate** variables: The **organizational learning** and **willingness to act** based on research
3. **Dependent** variable: The **organizational research performance**.

According to Figure 4, organizational learning (OL) and willingness to act (WA) mutually influence each other. Next, the AR is a methodology through some action cycles. Therefore, the cyclic and dynamic concepts of the OL-WA model are shown in Figure 5.

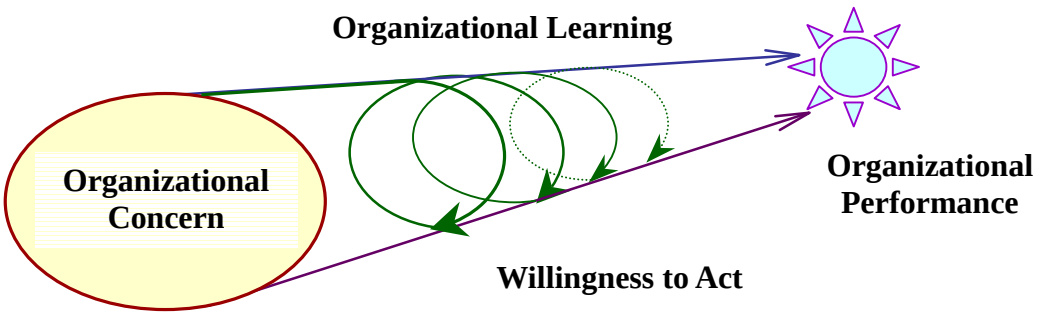

Figure 5 The Cyclic Concept of the OL-WA Model

3.3 The Methodology of Action Research

Action research (AR) is a methodology that has been explained in section 2.2~2.7. Action researchers may apply different research methods to obtain qualitative and quantitative data in order to examine seriously a special situation. Besides improving the real situations, it can help discover the common phenomena or theory behind the situations.

3.4 Data Collection Methods and Action Research Cycles

3.4.1 Planning of Leaning, Study and Improvement Action at CTU

This research plan would address the main sub-question (as outlined in section 1.2). The key contents of survey and action research of this study at CTU include:

Part I: To hold some internal seminars, conferences and collect the opinions and data of teachers using the method of survey (the anonymous questionnaires).

Part II: To collect the opinions of specialists and professors using the method of organizational learning and action learning meeting.

Part III: To collect the teachers' research results and statistics.

Part IV: To find the key factors affecting research outputs and to have trial implementation.

3.4.2 The Action Cycles at CTU

1. **Cycle 1:** Organizational learning of research capability promotion. (Pai, 2004)
2. **Cycle 2:** Revised plan from Cycle 1. (i.e. this paper focuses on Cycle 2)
3. **Cycle 3:** Revised plan from Cycle 2.

According to AR Cycle 1**,** the CTU's teachers responded that the introductory seminar (i.e. internal organizational learning) about how to produce technical reports is relatively helpful to them. But the function of organizational learning was still uncertain whether it can help their research work or not at CTU. The journals and literature databases were important and necessary for teachers at CTU, indicating some good phenomena.

Second, the study (through survey, in-depth literature review including meeting records of R&D improvement from national universities, and action research in Cycle 1) found 25 important factors and ways that can improve the teachers' research performance at national/private universities and colleges in Taiwan that were presented in Table 1. This paper designed and surveyed the second questionnaire that used the 25 factors in AR Cycle 2.

Third, the study (in Cycle 1) reflected that administrative obstacles, interferences and delays were a very negative factor that affected some teachers' research work and morale.

Fourth, we observed the teachers' opinions in Cycle 1. The leaders at CTU need to modify their decisions of research issues and topics in Cycle 2; and some teachers need to improve mental models and actual outputs.

Fifth, the three research results were the teachers' attitude scales, actual outcome, and

Table 1 The 25 Important Factors for Improving the Research Performance at Universities

Type	Items / Factors
System- Determined	1.1 To offer more budgets for research rewards.
	1.2 To draw up the rules of research reward, including its fair distribution.
	1.3 To encourage academic staff promotion and salary increase.
	1.4 To urge inter-department and inter-college research to improve the quantity of papers.
	1.5 To carry out staff evaluation system effectively and enhance research management.
	1.6 To enhance research climate and innovation culture on campus.
	1.7 To invigorate self development by encouraging non-PhD staff working towards a Ph.D. and to improve all lecturers' research capability.
	1.8 To improve the research environment (including space, hardware, software, materials) and resource sharing.
	1.9 To purchase more books, journals and literature databases.
	1.10 To obviate the administrative obstacles, interferences and delay.
	1.11 To reduce the administrative burdens of academic staff members.
	1.12 To offer the research-type academic staff members more flexibility in teaching loads.
	1.13 The Research and Development Department should strive for more collaborative projects with industries.
People-Determined	2.1 To employ more excellent academic staff members with Ph.D. degrees.
	2.2 To differentiate the academic staff members into three types including research, teaching and general types for better division of specialization.
	2.3 To employ full-time researchers to increase the research output.
	2.4 To enroll more good postgraduates and promote the quality of research.
	2.5 To have English academic staff members assisting academic staff members in editing English papers.
	2.6 To establish research teams led by research-type professors.
	2.7 To demand ourselves for more personal effort in research.
	2.8 To employ research assistants or current general staff be available to help staff members in research.
Interaction-Determined	3.1 To conduct workshops on organizational and team learning to improve the academic staff members' research capabilities.
	3.2 To form and strengthen research groups which support each other.
	3.3 The leaders and administrators should develop some feasible improvement plans with clear directions and expected outcomes.
	3.4 To bring out an integrated solution of research problems.

Note: The **interaction theory** was brought out by M. Lynne Markus in 1983.

finding. The correlation between the teachers' research attitude and actual outcome was uncertain (in Cycle 1).

Sixth, the employee satisfaction can significantly increase organizational performance. Thus, the leaders should modify the policies of research according to the major suggestion from teachers at CTU in Cycle 2.

The above-mentioned six important problems were found in Cycle 1 that helped this study to decide the main focus problems in Cycle 2. This paper executed the methods including survey, improvement, remonstration, suggestions, consultation, and planning (see Table 7) in Cycle 2.

4. FINDINGS AND ANALYSIS

4.1 Data Analysis and Findings in AR Cycle 2

The second survey was executed on September 6, 2004. The basic statistics of the second questionnaire (T1~T25) of teachers' research is shown in Table 2~Table 5.

Table 2 Basic Analysis of the Dimensions of the Second Questionnaire at CTU

No.	Count	Dimensions	Mean	Rank	Basic Analysis
1-13	13	System-Determined	4.342	1	The system-determined factor is most important.
14-21	8	People-Determined	4.092	2	The people-determined factor is second in importance.
22-25	4	Interaction-Determined	4.053	3	The factor of interaction theory is third in importance.

Table 3 The Average, Standard Deviation and Rank of the Second Questionnaire

No.	T1.1	T1.2	T1.3	T1.4	T1.5	T1.6	T1.7	T1.8	T1.9	T1.10
Mean	4.551	4.341	4.377	4.261	3.978	4.239	4.138	4.616	4.565	4.551
Stdev	0.605	0.740	0.696	0.708	0.850	0.689	0.898	0.571	0.604	0.651
Rank	S04	S08	S06	S09	S21	S11	S14	S01	S03	S05
No.	T1.11	T1.12	T1.13	T2.1	T2.2	T2.3	T2.4	T2.5	T2.6	T2.7
Mean	4.587	4.138	4.101	4.065	3.942	3.949	4.355	3.942	4.072	4.254
Stdev	0.702	0.889	0.738	0.898	1.072	0.891	0.723	1.079	0.971	0.774
Rank	S02	S15	S16	S18	S23	S22	S07	S24	S17	S10
No.	T2.8	T3.1	T3.2	T3.3	T3.4					
Mean	4.159	3.986	4.065	3.942	4.217					
Stdev	0.795	0.888	0.856	0.972	0.817					
Rank	S13	S20	S19	S25	S12					

Note: The items of T1.1~T3.4 are shown in Table 3-1.

Table 4 Basic Analysis of the Other Suggestions of the Second Questionnaire at CTU

No.	Count	Rank	Basic Analysis
1	79	1	The **incentive system** is more effective in improving research outputs.
2	39	4	Individual and teamwork is effective in improving research outputs.
3	40	3	**Organizational learning** is effective in improving research outputs.
4	16	5	The evaluation system is less effective in improving research outputs.
5	78	2	The **overall research environment** is more effective in improving research outputs.

Table 5 The Top Ten Important Factors Influencing Research Outputs at CTU

No.	Dimensions	Rank	Important Factors
1.8	System	**1**	To **improve the research environment** (including space, hardware, software, materials) and **resource sharing**.
1.11	System	**2**	To **reduce the administrative burdens** of academic staff members.
1.9	System	**3**	To **purchase more books, journals and literature databases**.
1.1	System	**4**	To **offer more budgets for research rewards**.
1.10	System	**5**	To **obviate the administrative obstacles, interferences and delay**.
1.3	System	6	To encourage academic staff promotion and salary increase.
2.4	People	7	To enroll more good postgraduates and promote the quality of research.
1.2	System	8	To draw up the rules of research reward, including its fair distribution.
1.4	System	9	To urge inter-department and inter-college research to improve the quantity of papers.
2.7	People	10	To demand ourselves for more personal effort in research.

4.2 Reliability and Validity

1. The participants of the survey and its **reliability analysis**:
   (1) The response rate: It is (138 / 340) * 100% = 40.59%.
   (2) The Cronbach's Alpha (standardized item alpha) of internal consistency of the second questionnaire survey is explained in Table 6 (use SPSS package, T1~T25).
   (3) The results of Table 1~Table 6 are approximately consistent. The key factors in Table 5 are more accurate than the other suggestions in Table 4.
2. **Validity analysis**: the supporting evidences about the effectiveness of this study in AR Cycle 2 are presented in Table 7 (see section 4.3).

Table 6 Reliability Analysis of the Second Questionnaire at CTU

No.	Count	Dimensions	Cronbach's alpha Standardized item alpha	Internal Consistence
1-13	13	System-Determined	0.9012	Excellent
14-21	8	People-Determined	0.8316	Fine
22-25	4	Interaction-Determined	0.8620	Fine
1-25	25	Total 25 Items	0.9358	Excellent

Table 7 The Findings, Execution and Improvement in AR Cycle 2

Problems / Issues / Weaknesses	Found From	Adopted Methods	Findings, Execution or Improvement in AR Cycle 2
The function of organizational learning was still uncertain.	AR Cycle 1	Survey	Organizational learning is effective in improving research outputs, but it is not the key factors. (see Table 4-3 & Table 4-4)
What are the key factors in the 25 factors? (see Table 3-1)	AR Cycle 1	Survey	The 25 important factors were surveyed, sorted, and analyzed in AR Cycle 2. (see Table 4-4)
Administrative obstacles, interferences and delays	AR Cycle 1	Remon-strate	The office of accounting was asked to take improvement actions by president Shyu at CTU.
The leaders at CTU need to modify their decisions on research issues.	AR Cycle 1	Suggest	President Shyu agreed to purchase more literature databases and raises the subsidy for teachers taking part in the seminars and conferences.
The correlation between the teachers' research attitude and actual outcome was uncertain.	AR Cycle 1	Consult	Professor Dr. Yang, Zhu & Lin, E. C.T. (2004) replied that the correlation between the teachers' research attitude and actual outcome was not significant.
The leaders should modify the policies of research based on the findings.	AR Cycle 1	Suggest and planning	President Shyu agreed to hold more seminars and conferences of improving research at CTU in 2005.
Research environment	AR Cycle 2	Suggest	President Shyu indicated to the directors of departments to buy more devices and software for teachers' research step by step.
Administrative burdens	AR Cycle 2	Suggest	The problem will be improved following the development at CTU in the future.
Books, journals and literature databases	AR Cycle 2	Suggest	President Shyu agreed to buy/collect more books and literature databases.
Research rewards and budgets	AR Cycle 2	Suggest	President Shyu agreed to raise the subsidy for teachers taking part in the seminars and conferences.
Administrative obstacles	AR Cycle 2	Remon-strate	The offices of accounting and R&D were asked to take improvement actions by the leaders at CTU.

4.3 The Execution and Improvement in AR Cycle 2

The problems or weaknesses were found from AR Cycle 1 and Cycle 2 that have been improved (see Table 7).

4.4 Recent Suggestions and Decision of the Action Learning Meeting

The action learning meeting in Cycle 2 was convened by President Shyu at CTU on December 30, 2004. Six professors brought out their opinions and suggestions for improving the problems of annual appraisal system and research performance. The record and resolution will be presented and executed by the action researcher in Cycle 3 in the first half year 2005. The most important decision that was made by President Shyu was that the professors should actively lead the academic research and guide other academic staff members revising their papers, research projects or technical reports.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The main contributions and implications in this study are:

1. **Academic contributions**:

This study integrated the action research cycle with system theory model, as shown in Figure 1. The system theory model is adopted in engineering, information technology and management areas. The systematic action research cycle is a relatively new development.

The cyclic and dynamic conceptual frameworks of the OL-WA model (see Figure 4 and Figure 5) merge two methods including organizational learning and action research that are valuable innovations and development.

2. **Practical contributions**:

This study on AR Cycle 2 obtained the useful experiences of action research by using of organizational learning and survey in the area of research performance. The research findings on the action reflections, five critical factors, and problems improvement (see Table 5 and Table 7) would be useful for CTU, other private universities and colleges in Taiwan that are interested in improving their research performance and competitive advantage.

This study took a few steps in doing action research. It is still a long way for the leaders of Taiwanese private universities and colleges aspiring to promote their research performance through action research and organizational learning.

5.2 Research Limitations

There are three research limitations in this study that are explained as follows.

1. Limitations of measurement: Because this study used 5-point Likert scale to measure the observed and latent variables of the second questionnaire (Q2), these replies are respondents' subjective judgment. And action research is only a study in an organization.

The other universities/colleges are some different situations from CTU.

2. Limitations of modeling: This OL-WA model including four latent variables: organizational concern, organizational learning, willingness to act, and organizational performance. The background data (e.g. scale, type, and situation) of universities/colleges maybe influence the variables. This study has not discussed these factors.

5.3 Recommendations

According to the study, this paper has four suggestions:

1. To promote the research and innovation capabilities are the critical success factors for improving the competitiveness for universities, industries and countries. Therefore, we should continuously survey, learn, and act to improve research and innovation capabilities.

2. In Cycle 2, the action research assisted this study and CTU to find some valuable information and develop some actions. Thus, this study will research and think again the action research methodology in depth for the AR Cycle 3.

3. Knowing the more important factors for continuously improving the research performance in Table 5, Table 7 and in-depth literature review, this study will revise the plan in AR Cycle 3 at CTU in Taiwan.

4. The promotion of research performance includes four evaluative parts that the study will observe and assess in AR Cycle 3: (1) improving mental models (by attitude scale), (2) promoting research capability, (3) improving actual results; and (4) modifying the annual appraisal system.

5. The other universities and colleges can use the second questionnaire (Q2, Table 4) to survey their academic staff members and promote their research performance.

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