Demand for More MIS Empirical Research

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Abstract

This paper reviews the current status of MIS research and describes the research methodologies. The empirical research is emphasized. The status of empirical research in Taiwan is discussed, especially from the graduate program training. It concludes with the suggestion that more emphasis should be placed on empirical resarch in Taiwan.

Keywords: Empirical Research; Research Methods

1. Introduction

The Management Information Systems (MIS) discipline is referred to as Information Management (IM) in Taiwan. It is about fourteen years since the first IM undergraduate department was established at Fu-Jen University in 1981. However, in local conferences or journal, there are few papers discussing the MIS research and its methodologies. The purpose of this paper is to provide such a discussion.

The remaining of this section briefly reviews the current status of MIS field. Section 2 provides the MIS research cycle and describes the methodologies, especially introduces empirical research methods. Section 3 emphasizes the importance of empirical research. Section 4 discusses the current situation of empirical research in Taiwan, especially from the aspect of graduate education. Section 5 concludes this paper with the suggestion.

1.1 The Immature MIS Field

According to Keen's definition [25], *MIS* is "the effective design, delivery and use of information systems organizations". *MIS research* is "the systematic investigation of the development, operation, use and/or impact of an information (sub)system in an organizational environment" [21]. A *field* is a common ground on which members define the area and its important measures [9]. An *reference dis-*

cipline is an established field to which one looks to get an idea of what good MIS research would look like, if one could ever do it [25]. MIS has many reference disciplines: computer science, management science, management, organization behavior, political science, economics, accounting, etc. Mis field has been argued as a "fragmented adhocracy"[5], criticized as no cumulative tradition and no theoretical base [25]. Even up to now, Cheon et al. [9] assess the changing maturity of the MIS field over the past 10 years and conclude that there is little indication of change in maturity.

2. MIS Research Methodologies

According to Kolb et al.'s "learning cycle" [26], learning might start with the experience of an event or stimulus —— concrete experiences, which the individual then observes it and reflects upon in trying to make sense of it. This might lead to formation of abstract concepts and generalization, which testing in new situations creates new experiences that enable consequent reflection, observation, and ultimately new rules. This learning cycle describes how human beings learn and is similar to Straub's "scientific research cycle" [31] though the diagrammatic representations are different.

In Figure 1, the right hand side of the cycle corresponds to **exploratory research**, in which **induction** is applied to construct explanations and theories. It is a theory-building process and mainly relies upon qualitative, non-empirical methods. The left hand side of the cycle corresponds to confirmatory research, in which deduction is applied to test theories so as to create new experiences or observations. It is a theory-testing and mainly relies upon quantitative, empirical methods.

In the literature, there are a number of papers discussing MIS research methodologies, e.g., [1,2,7,8,9,12,19,20,21,23,24,28,29,30,31,32,33,34,36] The MIS research can be classified to three categories in Figure 2:

1. **Modelling**. A model is an abstraction of reality. Modelling is the process of creating the abstraction that preserves the essential properties of a complex system, but suppresses much speific details. A theoretical model includes (1) *a set of constructs*; (2) *the laws of interaction* of constructs; (3) *boundaries* within which the theory is expected to hold; (4) *system states*; (5) *propositions and hypothesis* [15].
2. **Implementation**. In implementation, a prototype system is designed, constructed and used on the basis of the theoretical model.
3. **Empirical Studies**. In empirical studies, the unobservable, abstract concepts are operationalized into observable empirical measures; the data are gathered and analyzed in an attempt to verify the hypothesis. The purpose is to check the impact of the above constructed information system on a person, group, organization, and society.

The methods (such as thinking) of relating to modelling and implementation are hard to be described precisely and taught. However, there are some rigorous require-ments for conducting empirical studies.

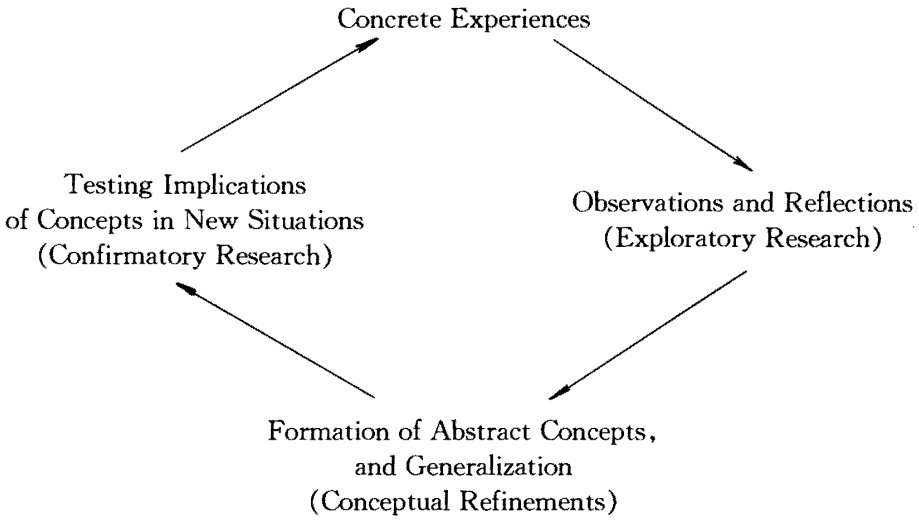

Figure 1: The Learning Cycle — the basis for Scientific Reseach

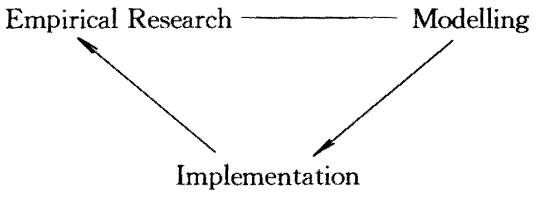

Figure 2: The MIS Research Cycle

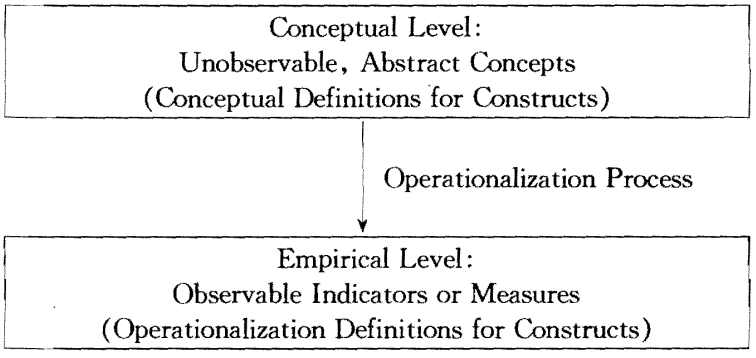

Figure 3: Operationalizing Constructs

2.1 Empirical Research

An important stage in empirical studies is the *operationalization* process; that is, translation of abstract concepts into indicators or measures that enable observations to be made. How do we measure an abstract concept, such as, *User Information Satisfaction* [22]? It is important to have both conceptual definitions and operationalization definitions for each construct in empirical studies. The two key points are to define the constructs precisely in the conceptual level and to have validated instrument to measure them, as shown in Figure 3.

Instrument Development The instrument development is a sophisticated and iterative process. It starts with specifying domain of constructs, generating sample of items, collecting data for pretesting, purifying measure, collecting new data for pilot testing, assessing reliability, assessing validity, and developing norms [10].

Reliability and Validity ***Reliability*** refers to the degree to which observed scores are free from errors of measuremet. ***Validity*** refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from the measures [14]. It refers to the usefulness of inferences drawn from test scores for a given purpose under a prescribed set of conditions [11]. That is, it, in general, refers to the extent to which a claim or conclusion is based on sound logic [13]. A measure is *valid* when the differences in observed scores reflect true differences on the characteristic one is attempting to measure and nothing else. A measure is *reliable* to the extent that independent but comparable measures of the same construct of a given object agree [10].

Assume that:
X_O is the observed score;
X_T is the truce score;
X_S is the systematic sources of error;
and X_R is the random sources of error.
then $X_O = X_T + X_S + X_R$
If $X_R = 0$, the measure is reliable.
If both $X_R = 0$ and $X_S = 0$, the measure is valid.
So, reliability is a necessary condition but not a suffcient condition fofor validity.

The *reliability coefficient* is mathematically defined as the ratio of true score variance to observed score variance [11]. There are several types of reliability coefficients, such as *coefficient of consistency*, *coefficient of stability*, *coefficient of equivalence*, etc. [11,14]. There are also several types of validity, such as, content validity, criterion-related validity, construct validity, internal and external validity [4, 11, 14].

Empirical Research Methods There are a number of empirical research strategies or methods. Based on the methods classified by [1, 9, 20,30, 34], we have the following.

- **Laboratory Experiment**. A laboratory experiment is taken place in a unnatural setting —— laboratory, in which the experimentrer

has control over the assignment to groups, controls and manipulates independent variables and measures dependent variables.

- **Field Experiment**. A field experiment is taken place in a natural setting, in which the experimenter manipulates independent variables while exerting as much control as the situation permits over other, possibly confounding variables, and measures dependent variables.

- **Field Study**. A field study is ex post facto in nature. It is taken in a natural setting, in which no independent variables are manipulated while measuring dependent variables.

- **Sample Survey**. A sample survey is taken from a large sample in a natural setting. No manipulation can be done though influences of confounding variables are "controlled" statistically.

- **Case Study**. A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations) [3]. The researcher may have little or no *priori* knowledge of what the variables of interest will be and how they will be measured.

There are other methods [4, 19, 24], such as, **simulation** (a natural system and real-world-like events are replicated and dependent variables —— participants' behaviors are measured); **action(participative) research** (the researcher is a participant in the implementation of a system); **longitudinal study** (behaviour is measured at a number of prints in time during a finite period of tmie); and **archival (document) research** (primary or secondary documents are examined), etc.

The point is that no strategy is more appropriate than others for all research purposes. For example, case studies are useful in formulating hypotheses, not testing hypotheses; laboratory experiments are usful in maximizing internal validity, not external validity. The selection of research strategies should be guided by purpose of the research, resources available to the researcher, and other considerations [30].

There are some data collection methods, such as interviews, questionnaires, and observation, which might be used concurrently in a selected research strategy.

3 The Importance of Empirical Research

The usage of research methods is one of evaluation criteria by which Cheon et al. [9] apply to assess the maturity of MIS field.1 They claim that if MIS field could become more mature, research methods that explain phenomena through hypothesis testing would be applied more often than research methods that describe or construct phenomena. All the methods related to modelling and implement-ation are for describing phenomena —— exploratory research. Besides, there are some empirical research methods, e.g., case study, for exploratory research.

Modelling and implementation research certainly have their value, especially for basic understanding of a phenomenon, creating a model to capture the real-world system properties and providing a prototype to show its feasibility. However, there are too many "frameworks" and "models", and too few "well-anchored theories" in the MIS field [35]. Initial exploratory research should be followed by theory-building so as to contribute to the building of a cumulative research tradition. Immplementation, the design and construction of a system, might be useful and is also an "intrinsically satisfying experience" [35]. However, Weber [35] wonder how much such work contribute to progress in the MIS field. He calls this as "the lure of design and construction" snd suggests that the implementation should be based on some theory of information systems that can be used to predict hte likely success of failure of a design, and these predictions can be tested empirically.

MIS research is the systematic investigation of the development, operation, use and/or impact of an information (sub)system in an organizational enviromnent. Keen [25] suggests "research-with-practice"—— the research should point towards practice. We need to apply empirical research methods to understand what real impact of the implemented system or proposed model on an individual, group, organization, inter-organizational environment, or society.

Though there is still very little change in maturity with respect to the criteria that used by Cheon et al. [9], empirical research has increased in US, Canada and Europe. Hamilton and Ives [20] reported that MIS research published in journal articles during 1970-79 employed a surprisingly high (70.1%) percentage of nonempirical research strategies. However, the percentage declined down to 43% during 1977-85 according to the survey by Farhoomand [16]. In addition, 17.6% of the empirical studies during 1970-79 adopted the laboratory experiment strategy [20]; the ratio increased to 23.3% during 1980-89 [9].

4 Empirical Research in Taiwan

In Taiwan, the local MIS journals are in their infancy. The *Information Management* published by *the Society of Information Management* just had its first issue. Though there was a high percentage of empirical research papers in the first issue (five out of seven), we cannot conclude that empirical research gains its deserved attention because the sample is still to few.

There are six graduate schools of information management (IM) in Taiwan – National Sun Yat-Sen University (NSYSU, established in 1989), Nationl Chiao-Tong University (NCTU,1989), Nationl Central University (NCU,1991), Nationl Cherg-chi University (NCCU,1992), Tam-Kang University (1992), and Da-Yeh Institute of Technology (DYIT, 1993) though some graduate schools of management or business administration offer MIS major in their master programs. Three of universities (NSYSU, NCTU and NCU) have begun Ph.D. programs since Fall 1994. Others

only provide master programs.

In the following, the empirical research in Taiwan will first be observed from two phenomena in MIS graduate progaram. Then, papers published in annual *Conference on Information Management, Taiwan* will also be examined. The data about Taiwan are from this research and are based on the archives.

The Phenomenon 1 —— the "Research Methods" Course In U.S. and Canada, MIS graduate programs offer master degree which is either MBA-oriented or MS-oriented (thesis required). A MS-oriented student is usually required to take the "Research Methods" course. The course contents of the "Research Methods" should include the following:

- To introduce the student the following
  - Measurement Reliability
  - Measurement Validity
  - Different Data Collection Methods
  - Different Research Strategies
- To give the student a preliminary training to write a research proposal and give criticisms on journal papers.

It is not a course in data analysis or statistics, so no particular expertise in statistics will be assumed, although familiarity with some statistical analysis techniques would be helpful. Idally, it would be a two-semester course. The first semester covers the measurement theory, research strategies and data collection methods (and introduces some analysis techniques if time permits). The second semester could focus on the training of research proposals and parper reviews. There would be some related courses. If we consider this "empirical research course" as the middle, its upper would be some discussions on all research methods (no matter what empirical or not) from several philosophical perspectives; its lower would be some advanced statistics or analysis courses.

Graduate education in Taiwan is more MS-oriented. However, currently only NCU, Tam-Kang University and DYIT have required their graduate students to take "Research Methods" course (one semester). Others offer it as an elective course[1].

The Phenomenon 2 —— the Master Theses The first graduates in NCTU and NSYSU were 1991, in NCU were 1993, and in NCCU and Tam-Kang University were 1994. DYIT has not had graduates yet. During the period between 1991 and 1994, there were 258 master theses. This research has reviewed their abstracts and the sections of resarch methods. Also, the particular sections or chapters describing empirical studies (if any) were quickly browed through.

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[1] NCCU first offered this course as an elective course in 1993, did not provide it in 1994, but will switch to treat it as a requisite course beginning in Fall 1995.

As shown in Table 1, only 66 (about 25.58%) theses were related to empirical research. Others (about 74.42%) were related to modelling and implementation[2].

Table 2 further classifies these 66 empirical master theses by research methods (strategies) and types.

The classification of research methods is based on Section 2.1. However some atuhors in literature [20, 21, 34] do not distinguish "sample surveys" from "field studies". For comparison the table combines these two categories. However, we should note that the key difference between sample surveys and feild studies is that in the typical field study the "sample" is not a random one, and the population to which generalizations might be made is left unspecified; while in the typical sample survey influences of compounding variables are "controlled" statistically [30]. According to this strict distinction, all of those theses in column 4 of Table 2 are field studies, not sample surveys.

About research types, there are two choices in the literature: one is based on the keyword classification scheme of Barki, Rivard, and Talbot [6]; the second is based on the framework of information system (IS) research framework presented by Ives, Hamilton, and Davis [21]. For those reviews of MIS research in the literature, only one used the first choice [1]; others applied the second choice [9, 16, 20, 21]. Therefore, the second choice are also adopted here for comparison.

A brief description of the Ives et al. framework of IS research is described here. Readers should check their paper [21] for details. It includes three groups of variables:

1. **Environmental Variables** include five classes of environmental variables: external, organizational, user, IS development, and IS operations.
2. **Information System Variables** include three classes of IS variables: IS content, presentation form, and time of representation.
3. **Process Variables** includes three classes of variables: development, operation and use.

Based upon thexe three variable groups, five categories of IS research topics are derived:

1. **Type I:** involves variables within a single variable group from any single of three groups: environmental, process, or IS.
   For example: testing hypothesis that data entered online (*IS* variable) will be more accurate (*IS* variable) than data entered offline; or testing hypothesis that IS delivered within budget (development *process* variable) will be perceived by user as being of a higher quality (use *process* variable) than those that are above budget.

[2] Among these 192 theses, six had short "empirical studies" sections at end of their theses. However, they just used very few artificial data to try their models. This paper does not count them as "empirical research".

Modelling & Implementation	Empirical Studies	Total
192	66	258
74.42%	25.58%	100%

Table 1: MIS Master Research in Taiwan During 1991-94

Recearch Types	Research Methods					Total	Percent
	Laboratory Experiment	Field Experiment	Field Study & Sample Survey	Case Study	Archival Research (Secondary Data)		
Type I: A Single Variable Group	2	0	11	3	11	27	40.91%
Type II: Relationship between Environment & Process Variable Groups	1	0	22	6	0	29	43.94%
Type III: Relationship between Process & IS Variable Groups	0	0	0	2	0	2	3.03%
Type IV: Relationship between Environment & IS Variable Groups	1	0	1	1	0	3	4.55%
Type V: Relationships among all Groups of Variables	1	0	3	1	0	5	7.57%
Total	5	0	37	13	11	66	
Percent	7.57%	0%	56.06%	19.70%	16.67%		100%

Note that among these 66 master theses:

having explicit hypotheses: 25

having pretest: 5

having discussed reliability and validity: 14

having operationalization definitions for variables: 18

Note that among 13 master theses applying case studies, 5 were single-case studies.

Table 2: Empirical MIS Master Research in Taiwan During 1991-94

2. **Type II**: examines the influence of one or more variables from the *environmental* variables group on the *process* group measures.
   For example: testing hypothesis that organizations located in rural areas (external *environmental* variable) will incur signifcantly higher system operation cost (operation *process* variable) than will their urban counterparts.
3. **Type III**: focuses on the influence of *IS* variables on *process* variable measures.
   For example: testing hypothesis that an online IS (*IS* variable) will require more time to develop (development *process* variable) than an offline IS.
4. **Type IV**: examines the relationship between *environmental* variables and *IS* variables.
   For example: testing hypothesis that organizations facing higher uncertainty in the marketplace (external *environmental* variable) will have a shorter reporting interval (*IS* variable).
5. **Type V**: examines relationships between variables from each of the three groups.
   For example: testing hypothesis that there will be an interaction effect between the IS presentation model (*IS* variable) and user psychological type (user *environmental* variable) on decision quality (use *process* variable).

Research Methods As shown in Table 2, among these 66 theses, 37 (56.06%) of them were field studies, 13 (19.7%) were case studies, 11 (16.67%) applied archival research (use secondary data to test their models), and only 5 (7.57%) took laboratory experiment method. No one were field experiment. Comparing with the review during the period 1980 to 1989 reported by Cheon [9] (among 463 empirical articles they reviewed, 59.6% were field studies, 16.2% were case studies, 23.3% were laboratory experiments, only 0.9% were field experiments), the distribution pattern were somewhat similar. However, our laboratory experiments were still too few, and the field experiments were lacking.

Among the 13 case studies, 5 (38.46%) were single-case designs. As discussed by Benbasat et al. [3], multiple-case designs are desirable when the intent of the research is description, theory building, or theory testing. Multiple-case designs allow for cross-case analysis and the extension of theory.

The questionnaires as data collection method were the most common in those field studies or laboratory experiments. However, few took pre-tests in Taiwan. Only some gave operationalization definitions for construct variables. The reliability and validity issues of questionnaires were seldom addressed. That is, most of those instruments were not validated.

In addition, among those 66 theses, only 25 gave explicit hypotheses to test. Without hypotheses, the themes of theses would easily get lost. Unless their works were in exploratory or hypotheses generation stages, the contributions would be unclear.

Research Types As shown in Table 2,

research types I and II had most empirical studies, other types (III, IV and V) were relatively less popular. The distribution pattern were similar to the review during the period 1980 to 1989 reported by Cheon [9] (among 463 empirical articles they reviewed, the percentages of Type I, II, III, IV, and V were 52.1%, 25.5%, 14.7%, 2.8%, and 5.2%, respectively).

Discussions for Few Empirical Studies There are several possible reasons for this thesis research phenomenon.

- **IM in Taiwan is more computer science oriented.**

  As observed by Farn [17] in 1992, the faculty profiles for most of IM departments in Taiwan are quite imbalanced: most have very strong computer science, industrial engineering, and operation research mix, and lacking management background in general and MIS background in particular. Liang [27] also pointed out: graduate students in Taiwan are more knowledgeable in "information technology", but have much less sense in "business" or "management". This phenomena are owing to historical background, and in general have little changes even to date. As a result, some facuty members still only conduct purely computer science type of projects.

- **No appropriate research method training.**

  As mentioned in the above phenomenon 1, the research methods course has not been given much attention in Taiwan. As also mentioned in Section 2, there are some rigorous requirements for conducting empirical studies. Without appropriate training, IM students would not know how to proceed empirical studies. In addition, there is a serious problem of lacking appropriate teachers. A high percentage of faculty members (even some graduating from MIS departments) might not know what contents the "research method" course should contain.

- **Empirical research might need much resoures.**

  To be a "quality research", an empirical study needs a sophisticated and iterative process to develop its instrument. In addition, no matter what kind of research methods are applied, the requirements of time and monetary resources on researchers cannot be avoided. In comparison, modelling or implementation in the Taiwanese master level might not require much personal resources or might apply the resources provided by universities.

- **The linkage between academy and industry is weak.**

  An empirical research needs respondent's (or interviewee's) cooperations. It would be even better if the copperations come from industry —— field studies or even field experiments. However, in Taiwan, the links between IM academics and practitioners are weak. Examples of business sponsoring research projects are few.

Papers in Annual Conference on Information Management, Taiwan To get some crosschecking, the papers in annual *Conference on Information Manegement, Taiwan*[3]

are also examined here. However, we should note that (i) the different nature of journals and conferences (the paper acceptance rates and informality are much higher in conferences); (ii) one issue of the conference proceedings only had abstracts, not full papers, i.e., those 57 papers in the second conference (1991); (iii) some papers in conferences were in fact the results of previous master theses.

As shown in Table 3, only 35 (about 19.77%) theses were related to empirical research. This number is slightly lower than the ratio (25.58%) in master theses during the same period. Others (about 80.23%) were related to modelling and implementation.

Similar to Table 2, Tables 4 also further classifies these 35 empirical papers by research methods and types. Comparing these two tables, we can find that the distribution patterns of the papers and master theses among research methods and types are quite similar.

5. Conclusions and Suggestions

MIS field is still immature. Greater emphasis should be placed on testing theories and constructing empirically based theories.

On the academical side, in order to contribute more to this field, we need more empirical research in Taiwan. On the practical side, we also need empirical research to understand what and how the impact of information systems on organizations and society in Taiwan. The IM graduate program *in Taiwan* should strengthen the "Research Methods" course training to teach students how to conduct empirical research and how to review other's papers on empirical studies. Academics in IM departments should recognize that they belong to business colleges, and research-with-practice is key to establish the IM discipline features and to contribute MIS research. More research should be on the effectiveness, utility, and management aspects of information systems. There might be a need for faculty retraining and development programs. Alternatively, IM departments might recruit more faculty members with management or MIS degree.

It is essential to consider the reliability and validity of an instrument. The instrument should be pre-tested, pilot tested, and validity. Without validated instruments, the results of empirical studies would not be convincing. Case studies are valuable, but a single case used for exploration may be better followed by a multiple-case study. Graduate students should be instructed to write down their hypotheses and figure out how to operationalize the constructs in empirical studies. Without these, the empirical studies would not be rigorous.

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[3] The conference were called *National Conference on Information Management* during 1990 (1st) to 1992 (4th), and called *International Conference on Information Management* sence 1993 (5th).

Modelling & Implementation	Empirical Studies	Total
142	35	177
80.23%	19.77%	100%

Table 3: MIS Papers Published in *Conference on Information Management, Taiwan* During 1991-94

Recearch Types	Research Methods					Total	Percent
	Laboratory Experiment	Field Experiment	Field Study & Sample Survey	Case Study	Archival Research (Secondary Data)		
Type I: A Single Variable Group	4	0	12	2	5	23	65.71%
Type II: Relationship between Environment & Process Variable Groups	0	0	9	2	0	11	31.43%
Type III: Relationship between Process & IS Variable Groups	0	0	0	0	0	2	0%
Type IV: Relationship between Environment & IS Variable Groups	0	0	0	0	0	2	0%
Type V: Relationships among all Groups of Variables	0	0	1	0	0	1	2.86%
Total	4	0	22	4	5	35	
Percent	11.43%	0%	62.86%	11.43%	14.28%		100%

Note that among these 35 papers:

6 only having their abstracts, not full papers in *Conference*

8 also appeared in Table 2, i.e., were master theses

11 having explicit hypotheses

3 having pretest

6 having discused reliability or (and) validity

3 having operationalization definitions for variables

Table 4: Empirical MIS Papers Published in *Conference on Information Management, Taiwan* During 1991-94

It is recommended to try field experiments in Taiwan to test MIS theories in business organizations. However, it would need more cooperation from industries. It is also recommended to consider type III, IV research, and finally the most sophisticated Type V research.

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