

國立交通大學

經營管理研究所

碩士論文

Trends of The Theory of Planned Behavior :
Using Co-Citation Analysis



計畫行為理論主要趨勢之研究
-使用文獻共引分析方法

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中華民國九十七年六月

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中文摘要

計畫行為理論 (The theory of planned behavior, TPB) 主要探討影響人類行為是意圖，而影響意圖的有態度 (Attitude)、主觀規範 (Subjective Norm) 與知覺行為控制 (Perceived behavior control)，透過這理論可以了解影響行為的因素，不只在心理學與社會學方面討論與使用，教育、健康醫學、電腦學科、管理等廣為流傳。2008年三月調查ISI資料庫中此理論被引用次數高達1,308篇，Ajzen 在1991年發表的論文引用次數高達2,442次，進而想了解此理論的現有發展趨勢與未來動向。藉由文獻共引文分析，運用SPSS軟體的資料縮減、階層集群分析與多元尺度分析，這三種不同面向討論與匯總，找出不同領域的關鍵文章與繪製圖表了解文章彼此相關程度與差異。發現計畫行為理論被引用五十次以上的文章中，主要有三個趨勢：(1) 基礎理論的探究與構念的驗證，進而導入疾病預防與健康問題，如使用保險套行為探討、癌症健康行為、吸煙與大麻行為等；(2) 科技發展延伸此理論，探討人們是否接受新的技術或運用此技術的能力，整合技術接受模式 (The technology acceptance model (TAM))、資訊系統 (IS) 與知識分享 (KS) 等；(3) 加入中介變數探討如體能運動 (PA)。研究發現在2000年後，計畫行為理論延伸與整合其他理論，探討著人類在二十一世紀中最重要的兩個議題：科技變化迅速之影響、健康與運動之生活。

關鍵字：計畫行為理論、理性行為理論、Ajzen、共引文分析。

Trends of The Theory of Planned Behavior : Using Co-Citation Analysis

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Abstract

This paper reviews and analyzes the theory of planned behavior (TPB). As an empirical analysis, the aim of the present paper is to provide insights into further extensions, to identify the main trends, and to show the evolution in the theory of planned behavior (TPB). Co-citation analysis and multivariate methods using SPSS were conducted to produce the correlation matrix and further analysis.

Three main trends are shown to coexist within the theory of planned behavior (TPB): (1) extension or verification of existing body of knowledge or intellectual structure of the theory of planned behavior (TPB); (2) introduction or incorporation of technological related applications or models such as technology acceptance model (TAM), information system (IS), and knowledge sharing (KS); (3) introduction of mediators or mediating variables that incorporate environmental or situational factors to the theory of planned behavior (TPB), such as physical activity (PA). Theories and implication were also derived.

Keywords: the theory of planned behavior, the theory of reasoned action, Ajzen, co-citation analysis.

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I. Introduction

To explain the complexity of human social behaviors is a challenging task for many researchers. Wicker (1969) examined the relationship between attitudes and behaviors, and concluded that attitude did not accurately predict behavior. Since then, social psychologists have tried many ways to improve the predictive power of attitudes. The most widely used models are the theories of reasoned action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980) and the theory of planned behavior (TPB) (Ajzen, 1981, 1991). The theory of reasoned action (TRA) suggests that two determinants of behavioral intention are attitudes toward a certain behavior and subjective norms. The theory of planned behavior (TPB) extends the theory of reasoned action (TRA) to include an additional factor of perceived behavioral control, which influences both intentions and behaviors. Thus, the theory of planned behavior (TPB) deals with the three antecedents of intentions- attitudes, subjective norms, and perceived behavioral control. According to the theory of planned behavior, people act in accordance with their intentions and perceived behavior control.

Since Ajzen fully developed the theory of planned behavior (TPB) in 1991, there are over 2400 articles citing his works and discuss them in the past 17 years (*ISI Web of Knowledge* , March 19,2008). More and More disciplines are integrating his theory and apply it to other fields, such as management science, medical science, education, computer science, etc.

Bibliometrics, the mathematical and statistical analysis of patterns appearing in the published documents, can be used to detect homogenous areas in research networks (Acedo et. al., 2006). One method is called the co-citation analysis, a widely used and powerful approach to study the structure of scientific disciplines and trends. Co-citation analysis records the times that any particular pair of documents have been cited together, so it can be interpreted as a measure for similarity of content of the two documents. Citation times used by co-citation analysis can reflect the value of a document and relationship between these articles. Therefore the more times that the documents are cited, the greater influence they have on the discipline (Culnan, 1987; Tahai and Meyer, 1999). By using this approach in terms of data analytical and graphic display techniques to identify groups of authors, topics, or methods, we can produce empirical maps of prominent documents in various areas and understand how these groups interrelate (White and Griffith, 1981; McCain, 1990, and White and McCain, 1998).

The aim of this study is to explore core the theory of planned behavior (TPB) documents by employing co-citation analysis. For this purpose, core documents are selected from a prestigious database, *ISI Web of Knowledge*, by setting a high criterion of cited times, at least fifty citations. The purpose of this study is to: (1) identify the main trends in the theory of planned behavior (TPB); (2) identify networks of documents belonging to the same school or field; and (3) show the evolution of the theory of planned behavior (TPB), especially regarding how it has affected other fields.

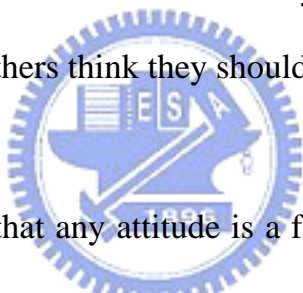
The remaining part of this study contains four main sections. In the following section, the study begins with a review of literatures, including the theory of planned behavior (TPB) and the co-citation analysis; the second section contains a description of the methodology employed, the co-citation technique and statistical methods; the third section presents and discusses the results of the empirical study; and finally, the fourth section presents a summary and discussion of the conclusions to be drawn from this study.



II. Literature Review

2.1 The Theory of Planned Behavior (TPB)

Theory of reasoned action (TRA) (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) indicates that one's intentions influence obvious behavior, while intention in turn is influenced by one personal factor and social influence. The personal factor is termed attitude toward the behavior, indicating the individual's positive or negative evaluation of performing the behavior. The second determinant of intention is termed subjective norm, indicating a person's perception of the social pressures on him to perform or not perform the behavior. Generally speaking, people will intend to perform a behavior when they evaluate it positively and when they believe that important others think they should perform it.



In figure 1, we can see that any attitude is a function of beliefs. When dealing with attitude toward a behavior, most salient beliefs link the behavior to positively or negatively valued outcomes. Subjective norms are also assumed to be a function of beliefs, but beliefs of a different kind, namely the person's beliefs that specific individuals or groups think he should or should not perform the behavior (Ajzen, 1981).

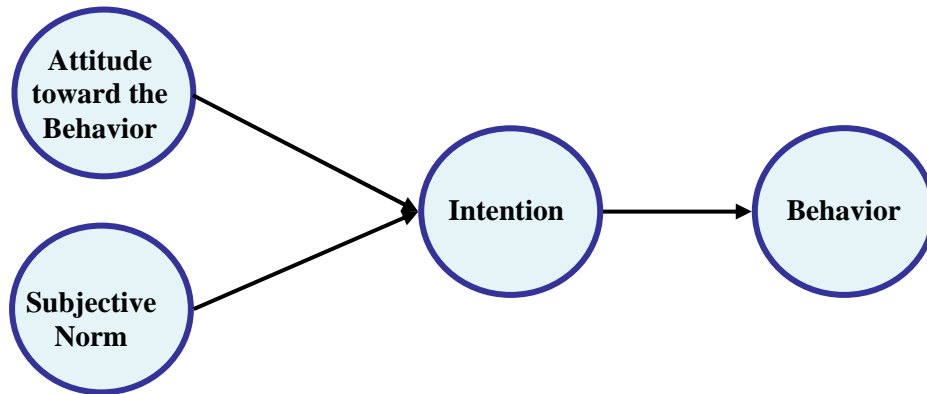


Figure 1 The Model of Theory of Reasoned Action

The theory of planned behavior (TPB) is a well-researched model which is widely used in predicting and explaining human behavior across a variety of settings (Ajzen, 1991). The theory of planned behavior (TPB) is an extension of the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), however, the difference is in its addition of perceived behavioral control, an antecedent variable affecting both intentions and behavior. A major contribution of the theory of planned behavior (TPB) was the notion that intention mediates between attitude and behavior, and that intention predicts behavior more accurately than does attitude (Ajzen & Fishbein, 1977). Thus, the theory of planned behavior (TPB) postulates three conceptually independent determinants of intention. Figure 2 depicts the theory in the form of a structural diagram.

The first predictor is attitude toward the behavior, which reflects feelings of favorableness or unfavorableness towards performing a behavior (Ajzen, 1985, 1991; Taylor and Todd, 1995). The second is subjective norm, reflecting one's perceptions that significant referents (parents, spouse, friends, etc.) desire the

individual to perform or not perform a behavior (Ajzen, 1981; Taylor and Todd, 1995b). Any person or group served as a reference group could exert a key influence on an individual's beliefs, attitudes, and choices, because an individual may conform to his/her referent groups. The last antecedent of intention is perceived behavioral control, defined as the perceived ease or difficulty of carrying out the behavior (Ajzen, 1985, 1991). It reflects the person's past experience, anticipated obstacles, and resources, such as having the opportunity, time, money, and skill required to perform the behavior (Ajzen, 1985, 1991). As a general rule, the more favorable the attitude and subjective norm with respect to a behavior, and the greater the perceived behavioral control, the stronger should be an individual's intention to perform the behavior under consideration.

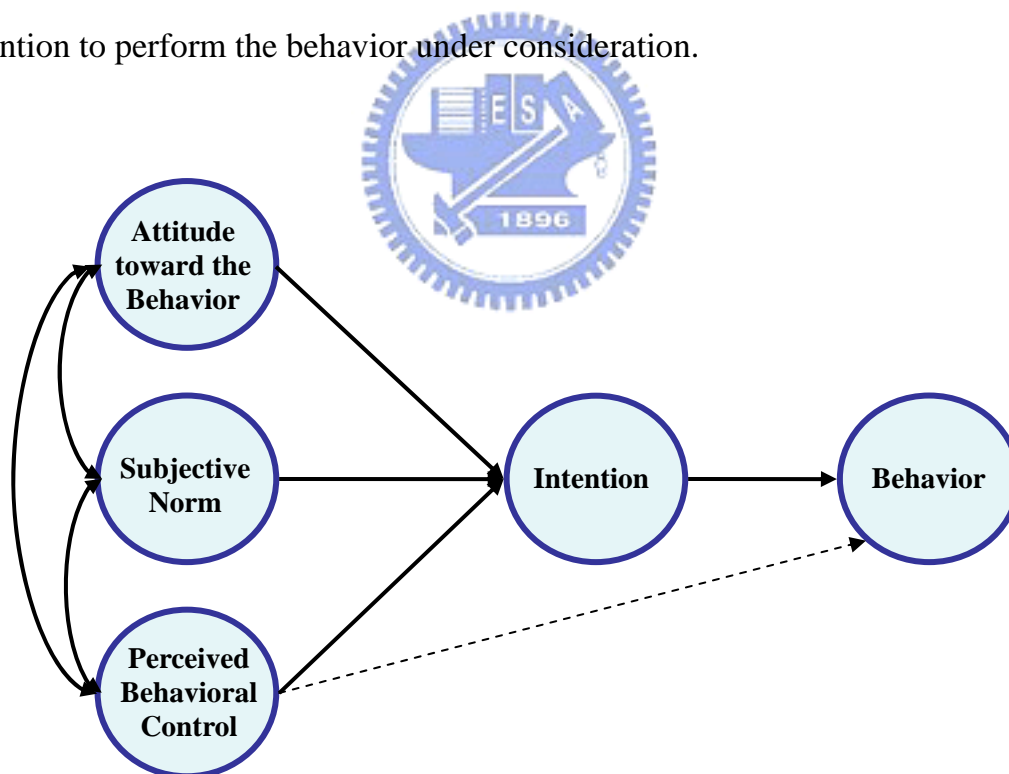


Figure 2 The Model of Theory of Planned Behavior

The theory of planned behavior (TPB) has shown strong predictive validity for a wide range of behavioral intentions and behaviors, including condom use (Albarracin

et al., 2001; Sheeran and Taylor, 1999, etc.), exercise (Hausenblas et al., 1997; Terry and Hogg, 1996; Blue, 1995, etc.), smoking cessation (Norman and Conner, 1999), ethical obligation (Sparks et al., 1995), and leisure (Richard et al., 1996). Even though the theory of planned behavior (TPB) has been applied in such variety fields, these studies have found support for the theory. Support for the theory in general is summarized in a meta-analysis (Armitage and conner, 2000; Sutton et al., 1998; Hausenblas et al., 1997; Marshall and Biddle, 2001, etc.) and review of literatures (Armitage and Conner et al., 2001; Ajzen, 2001; Albarracin et al., 2001; Baranowski et al., 2003; Bock et al., 2005, etc.). However, many studies still concern for the sufficiency of the theory of planned behavior (TPB) and try to improve its predictive power on intentions or behavior by adding variables such as self-efficiency (Sparks, 1997 et al.; White, 1994 et al.; Conner et al., 1998; Godin and Kok, 1996, etc.), locus of control (Ajzen, 1991, 2002, etc.), self-identity (Conner, 1998; Armitage and Conner, 1999, etc.) , etc. In general, even when the improvements were found, but the enhancement of predictive power remains minor. This would suggest the theory's adequacy and applicability to particular domains.

2.2 The Co-citation Method

Explicit references within a certain scientific publications can be used as measures of these external impacts on these scientific environments. If an academic publication receives relatively high quantities citations, it would have a significant scientific impact which can bring broad visibility and scientific recognition (Tijssen et al., 2002). Therefore, an approach by counting the number of times two

documents or authors are cited jointly in the same work, the co-citation method is the one of the most common and objective structuring method. This approach is based on the premise that the more often two documents are cited together, the closer is the relationship between them by addressing the same broad questions (Acedo et. al., 2006). Its aim is to recognize the influential documents, to analyze the connection between them (Tijssen et al., 2002), and to identify closed related groups which is considered to be the same research domain. Co-citation counts can be analyzed and processed by statistical method such as factor analysis, multidimensional scaling (MDS), and cluster analysis to produce maps displaying the relative distances between documents.



III. Methodology

3.1 Co-citation Analysis

Co-citation analysis starts with relative articles that offer reliable and mutual influence (Ramos-Rodriguez and Ruiz-Navarro, 2004) and two advantages in this study. One, co-citation analysis provides a statistical and quantitative approach in investigating the literatures of the theory of planned behavior (TPB). The other, since co-citation analysis requires a large literature database, an extensive browsing through this territory is needed. Thus, a greater insight into the theory of planned behavior (TPB) can also be discovered from this approach (Acedo, et. al. 2006).

The *ISI Web of Knowledge* platform includes resources which provide over a century of back files in the sciences, social sciences, arts, and humanities. It provides a breadth and depth of coverage and search capabilities that allow people to increase the volume of relevant information, to enhance the connections possible via cited reference searching, and to discover long-term trends and patterns in a certain field. *ISI Web of Knowledge* has more than one million users from 81 countries since 1900. Its back files provide access to millions of additional source items and cited references — plus cited reference searching for the entire database, such as Science Citation Index (SCI), Social Sciences Citation Index(SSCI).

In 1971, the Institute for Scientific Information (ISI) undertook a systematic analysis of journal citation patterns across the whole of science and technology. The resultant sample was about 1 million citations of journals, books, reports, theses,

and so forth (Garfield, 1972). A common sequence of steps in document co-citation analysis was shown in Figure 3.

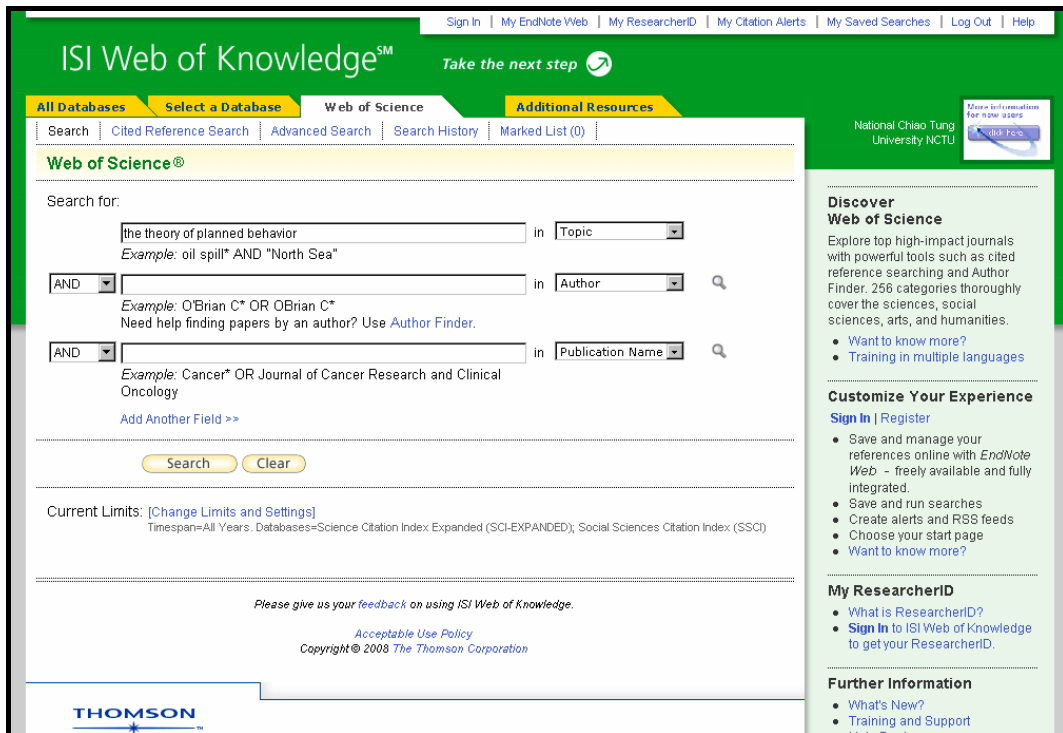


Figure 3 ISI Web of Knowledge's Interface

It begins with typing the keyword 'The theory of planned behavior' in the ISI Web of Knowledge, then coming out a list of more than two thousand documents. The selection of documents was preceded, and the result of 77 documents was identified with the criterion of cited times at least 50 times before the day of nineteenth of March in 2008 (Fancisco et al., 2006). The journal impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The impact factor will help you evaluate a journal's relative importance, especially when you compare it to others in the same field.

Raw co-citation matrix was generated by Microsoft Excel as the following

steps. The first step is to find out the cited references within these 77 documents, following by using the self-build-in function in Microsoft Excel to calculate the co-citation matrix of all the 77 documents. Furthermore, two documents with no cited times were deleted from our core sets. So, the final result of the core set documents was 75 documents in total, and the raw matrix of co-citation frequencies was then obtained. All the selected documents were shown in table 1, 2, and 3. At the same time, 75 documents are cited times in table 4 that let people understand cited times of these documents per year and total times. Table 5 indicates impact factor in journal. Next, the correlation matrix was transformed in SPSS, following by the statistical approaches of factor analysis, multidimensional scaling (MDS), and cluster analysis. The process of the present paper is depicted in Figure 4; more details are described in the next section.

Figure 4 Procedure

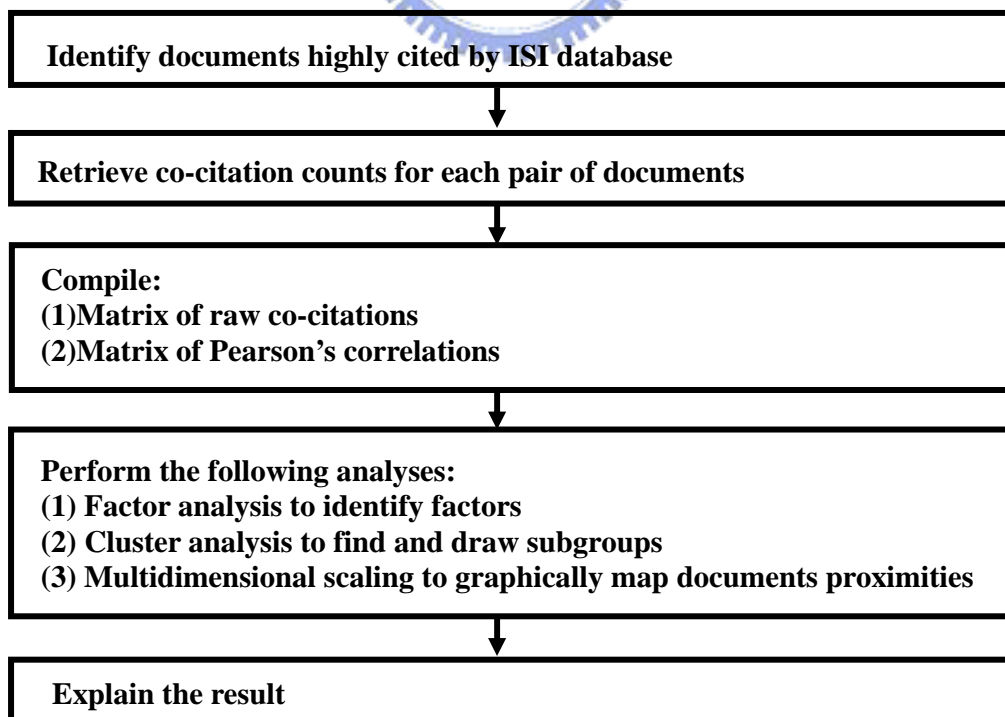


Table 1 Core Set Documents I

No.	Author	Years	Title	Source	Cited Times
1	Ajzen	1991	The theory of planned behavior	Organizational Behavior and Human Decision Processes	2485
2	Godin et al.	1996	The theory of planned behavior: a review of its applications to health-related behaviors	American Journal of Health Promotion	441
3	Armitage et al.	2001	Efficacy of the theory of planned behaviour: a meta-analytic review	British Journal of Social Psychology	395
4	Taylor et al.	1995	Understanding information technology usage - a test of competing models	Information Systems Research	359
5	Venkatesh et al.	2000	A theoretical extension of the technology acceptance model: four longitudinal field studies	Management Science	319
6	Conner et al.	1998	Extending the theory of planned behavior: a review and avenues for further research	Journal of Applied Social Psychology	254
7	Ajzen	2001	Nature and operation of attitudes	Annual Review of Psychology	218
8	Venkatesh et al.	2003	User acceptance of information technology: toward a unified view	Mis Quarterly	211
9	Baranowski et al.	1998	Mediating variable framework in physical activity interventions - how are we doing? How might we do better?	American Journal of Preventive Medicine	196
10	Madden et al.	1992	A comparison of the theory of planned behavior and the theory of reasoned action	Personality and Social Psychology Bulletin	185
11	Albarracín et al.	2001	Theories of reasoned action and planned behavior as models of condom use: a meta-analysis	Psychological Bulletin	161
12	Sutton	1998	Predicting and explaining intentions and behavior: how well are we doing?	Journal of Applied Social Psychology	157
13	Hausenblas et al.	1997	Application of the theories of reasoned action and planned behavior to exercise behavior: a meta-analysis	Journal of Sport and Exercise Psychology	155
14	Venkatesh et al.	2000	Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior	Mis Quarterly	152
15	Beck et al.	1991	Predicting dishonest actions using the theory of planned behavior	Journal of Research In Personality	147
16	Terry et al.	1996	Group norms and the attitude-behavior relationship: a role for group identification	Personality and Social Psychology Bulletin	144
17	Ajzen et al.	1992	Application of the theory of planned behavior to leisure choice	Journal of Leisure Research	144
18	Terry et al.	1995	The theory of planned behavior - the effects of perceived behavioral-control and self-efficacy	British Journal of Social Psychology	124
19	Bagozzi et al.	1995	A comparison of leading theories for the prediction of goal-directed behaviours	British Journal of Social Psychology	122
20	Orbell et al.	1997	Implementation intentions and the theory of planned behavior	Personality and Social Psychology Bulletin	120
21	Sparks et al.	1992	Self-identity and the theory of planned behavior - assessing the role of identification with green consumerism	Social Psychology Quarterly	120
22	Parker et al.	1995	Extending the theory of planned behavior - the role of personal norm	British Journal of Social Psychology	109
23	Ajzen	2002	Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior	Journal of Applied Social Psychology	106
24	Parker et al.	1992	Intention to commit driving violations - an application of the theory of planned behavior	Journal of Applied Psychology	106
25	Dzewaltowski et al.	1990	Physical-activity participation - social cognitive theory versus the theories of reasoned action and planned behavior	Journal of Sport and Exercise Psychology	104

Table 2 Core Set Documents II

No.	Author	Years	Title	Source	Cited Times
26	White et al.	1994	Safer sex behavior - the role of attitudes, norms, and control factors	Journal of Applied Social Psychology	102
27	Ajzen	2002	Residual effects of past on later behavior: habituation and reasoned action perspectives	Personality and Social Psychology Review	89
28	Sheeran et al.	2000	Using implementation intentions to increase attendance for cervical cancer screening	Health Psychology	89
29	Ajzen et al.	1991	Prediction of leisure participation from behavioral, normative, and control beliefs - an application of the theory of planned behavior	Leisure Sciences	88
30	Godin et al.	1993	The pattern of influence of perceived behavioral-control upon exercising behavior - an application of ajzen theory of planned behavior	Journal of Behavioral Medicine	87
31	Armitage et al.	1999	Distinguishing perceptions of control from self-efficacy: predicting consumption of a low-fat diet using the theory of planned behavior	Journal of Applied Social Psychology	86
32	Doll et al.	1992	Accessibility and stability of predictors in the theory of planned behavior	Journal of Personality and Social Psychology	86
33	Courneya et al.	1995	Understanding readiness for regular physical-activity in older individuals - an application of the theory of planned behavior	Health Psychology	85
34	Godin et al.	1992	Predictors of smoking-behavior - an application of ajzens theory of planned behavior	British Journal of Addiction	84
35	Sheeran et al.	1999	Predicting intentions to use condoms: a meta-analysis and comparison of the theories of reasoned action and planned behavior	Journal of Applied Social Psychology	82
36	Baranowski et al.	1997	Theory as mediating variables: why aren't community interventions working as desired?	Annals of Epidemiology	81
37	Kretzer et al.	1998	Behavioral interventions to improve infection control practices	American Journal of Infection Control	77
38	Chan et al.	1993	Determinants of college womens intentions to tell their partners to use condoms	Journal of Applied Social Psychology	77
39	Norman et al.	1995	The theory of planned behavior and exercise - an investigation into the role of prior behavior, behavioral intentions and attitude variability	European Journal of Social Psychology	73
40	Kimiecik et al.	1992	Predicting vigorous physical-activity of corporate employees - comparing the theories of reasoned action and planned behavior	Journal of Sport and Exercise Psychology	72
41	Marshall et al.	2001	The transtheoretical model of behavior change: a meta-analysis of applications to physical activity and exercise	Annals of Behavioral Medicine	71
42	Armitage et al.	2000	Social cognition models and health behaviour: a structured review	Psychology and Health	70
43	Kashima et al.	1993	The theory of reasoned action and cooperative behavior - it takes 2 to use a condom	British Journal of Social Psychology	70
44	Beale et al.	1991	Predicting mothers intentions to limit frequency of infants sugar intake - testing the theory of planned behavior	Journal of Applied Social Psychology	69
45	Conner et al.	1999	Interaction effects in the theory of planned behaviour: studying cannabis use	British Journal of Social Psychology	68
46	Blue et al.	1995	The predictive capacity of the theory of reasoned action and the theory of planned behavior in exercise research - an integrated literature-review	Research In Nursing and Health	68
47	Morrison et al.	1995	Determinants of condom use among high-risk heterosexual adults - a test of the theory of reasoned action	Journal of Applied Social Psychology	65
48	Kaiser et al.	1999	Environmental attitude and ecological behaviour	Journal of Environmental Psychology	64
49	Sparks et al.	1997	The dimensional structure of the perceived behavioral control construct	Journal of Applied Social Psychology	63
50	Milne et al.	2000	Prediction and intervention in health-related behavior: a meta-analytic review of protection motivation theory	Journal of Applied Social Psychology	62

Table 3 Core Set Documents III

No.	Author	Years	Title	Source	Cited Times
51	Courneya et al.	1995	Cognitive mediators of the social-influence exercise adherence relationship - a test of the theory of planned behavior	Journal of Behavioral Medicine	62
52	King et al.	2002	Theoretical approaches to the promotion of physical activity - forging a transdisciplinary paradigm	American Journal of Preventive Medicine	61
53	Sheeran et al.	1999	Augmenting the theory of planned behavior: roles for anticipated regret and descriptive norms	Journal of Applied Social Psychology	61
54	Harrison et al.	1997	Executive decisions about adoption of information technology in small business: theory and empirical tests	Information Systems Research	60
55	Boldero et al.	1992	Intention, context, and safe sex - australian adolescents responses to aids	Journal of Applied Social Psychology	60
56	Reinecke et al.	1996	Application of the theory of planned behavior to adolescents' condom use: a panel study	Journal of Applied Social Psychology	58
57	Lewis et al.	2002	Psychosocial mediators of physical activity behavior among adults and children	American Journal of Preventive Medicine	57
58	Van Der Pligt	1998	Perceived risk and vulnerability as predictors of precautionary behaviour	British Journal of Health Psychology	57
59	Parker et al.	1996	Modifying beliefs and attitudes to exceeding the speed limit: an intervention study based on the theory of planned behavior	Journal of Applied Social Psychology	57
60	Venkatesh et al.	2000	A longitudinal field investigation of gender differences in individual technology adoption decision-making processes	Organizational Behavior and Human Decision	56
61	Sparks et al.	1995	Assessing and structuring attitudes toward the use of gene technology in food-production - the role of perceived ethical obligation	Basic and Applied Social Psychology	56
62	Dishman et al.	1994	The measurement conundrum in exercise adherence research	Medicine and Science In Sports and Exercise	56
63	Craig et al.	1996	Psychosocial correlates of physical activity among fifth and eighth graders	Preventive Medicine	55
64	Raats et al.	1995	Including moral dimensions of choice within the structure of the theory of planned behavior	Journal of Applied Social Psychology	54
65	Parker et al.	1992	Determinants of intention to commit driving violations	Accident Analysis and Prevention	54
66	Theodorakis	1994	Planned behavior, attitude strength, role-identity, and the prediction of exercise behavior	Sport Psychologist	53
67	Baranowski et al.	2003	Are current health behavioral change models helpful in guiding prevention of weight gain efforts?	Obesity Research	52
68	Rai et al.	2002	Assessing the validity of is success models: an empirical test and theoretical analysis	Information Systems Research	51
69	Morris et al.	2000	Age differences in technology adoption decisions: implications for a changing work force	Personnel Psychology	51
70	Norman et al.	1999	The theory of planned behavior and smoking cessation	Health Psychology	51
71	Richard et al.	1996	Anticipated affect and behavioral choice	Basic and Applied Social Psychology	51
72	Bock et al.	2005	Behavioral intention formation in knowledge sharing: examining the roles of extrinsic motivators, social-psychological forces, and organizational climate	Mis Quarterly	50
73	Courneya et al.	1999	Utility of the theory of planned behavior for understanding exercise during breast cancer treatment	Psycho-Oncology	50
74	Courneya et al.	1999	Understanding exercise motivation in colorectal cancer patients: a prospective study using the theory of planned behavior	Rehabilitation Psychology	50
75	Schlegel et al.	1992	Problem drinking - a problem for the theory of reasoned action	Journal of Applied Social Psychology	50

Table 4 Total Citations and Average Citations Per Year

No.	Author	Years	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	Mean
1	Ajzen	1991	0	0	4	16	19	49	59	74	100	102	117	140	169	201	226	303	361	417	128	2485	138.06
2	Godin et al.	1996	0	0	0	0	0	0	0	2	13	29	27	40	41	45	48	58	60	65	13	441	33.92
3	Armitage et al.	2001	0	0	0	0	0	0	0	0	0	0	0	0	10	36	53	75	81	109	31	395	56.43
4	Taylor et al.	1995	0	0	0	0	0	0	3	5	10	8	15	15	19	42	31	55	68	68	20	359	25.64
5	Venkatesh et al.	2000	0	0	0	0	0	0	0	0	0	0	0	3	17	46	28	53	68	81	23	319	35.44
6	Conner et al.	1998	0	0	0	0	0	0	0	0	1	6	14	23	21	31	27	43	34	43	11	254	23.09
7	Ajzen	2001	0	0	0	0	0	0	0	0	0	0	0	2	11	25	27	40	41	62	10	218	27.25
8	Venkatesh et al.	2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	31	64	95	19	211	35.17
9	Baranowski et al.	1998	0	0	0	0	0	0	0	0	1	1	12	9	22	20	23	38	30	27	13	196	17.82
10	Madden et al.	1992	0	0	1	6	5	13	17	6	19	15	12	7	16	10	13	11	13	18	3	185	10.88
11	Albarracin et al.	2001	0	0	0	0	0	0	0	0	0	0	0	2	9	16	18	25	37	40	14	161	20.12
12	Sutton	1998	0	0	0	0	0	0	0	0	1	0	10	12	16	21	16	24	19	31	7	157	14.27
13	Hausenblas et al.	1997	0	0	0	0	0	0	0	0	2	10	10	9	18	10	20	22	24	27	3	155	12.92
14	Venkatesh et al.	2000	0	0	0	0	0	0	0	0	0	0	3	7	23	18	27	31	37	6	152	16.89	
15	Beck et al.	1991	0	0	0	3	3	10	8	5	12	13	8	8	9	11	15	11	17	3	147	8.17	
16	Terry et al.	1996	0	0	0	0	0	0	2	4	4	7	9	13	13	13	13	22	17	19	8	144	11.08
17	Ajzen et al.	1992	0	0	0	0	5	7	12	5	9	10	10	9	18	10	21	14	12	16	0	144	8.47
18	Terry et al.	1995	0	0	0	0	0	0	1	4	12	10	13	11	11	11	10	17	9	4	124	8.86	
19	Bagozzi et al.	1995	0	0	0	0	0	0	1	1	8	12	9	12	10	12	16	13	8	17	3	122	9.38
20	Orbell et al.	1997	0	0	0	0	0	0	0	0	1	9	11	13	11	18	11	17	17	9	3	120	10
21	Sparks et al.	1992	0	0	0	0	2	8	8	2	9	17	6	9	11	10	6	8	9	13	2	120	7.5
22	Parker et al.	1995	0	0	0	0	0	0	5	1	9	12	8	6	9	13	7	11	12	15	1	109	7.79
23	Ajzen	2002	0	0	0	0	0	0	0	0	0	0	0	0	0	11	11	18	30	29	7	106	15.14
24	Parker et al.	1992	0	0	0	1	3	7	10	3	9	4	7	3	7	9	10	14	5	13	1	106	6.24
25	Dzewaltowski et al.	1990	0	0	5	8	7	4	8	5	3	9	8	11	10	2	6	10	7	1	0	104	5.47
26	White et al.	1994	0	0	0	0	0	0	6	4	11	13	14	9	7	10	6	7	6	8	1	102	7.29
27	Ajzen	2002	0	0	0	0	0	0	0	0	0	0	0	0	1	11	8	18	20	23	8	89	12.71
28	Sheeran et al.	2000	0	0	0	0	0	0	0	0	0	0	3	3	14	12	17	18	18	4	89	9.89	
29	Ajzen et al.	1991	0	0	1	2	1	5	0	4	7	2	4	6	7	7	2	12	16	10	2	88	4.89
30	Godin et al.	1993	0	0	0	2	1	5	7	8	7	10	5	10	10	5	6	3	4	2	2	87	5.44
31	Armitage et al.	1999	0	0	0	0	0	0	0	0	0	3	5	13	10	6	12	9	15	8	5	86	8.6
32	Doll et al.	1992	0	0	0	0	3	5	5	5	8	6	5	10	6	8	6	5	10	6	8	86	5.06
33	Courneya et al.	1995	0	0	0	0	0	1	1	2	5	6	8	13	7	10	6	8	13	7	10	85	6.07
34	Godin et al.	1992	0	0	0	2	0	2	9	8	12	9	3	3	3	2	5	12	6	7	1	84	4.94
35	Sheeran et al.	1999	0	0	0	0	0	0	0	0	0	0	2	7	7	15	0	2	7	7	15	82	8.2
36	Baranowski et al.	1997	0	0	0	0	0	0	0	2	2	5	9	7	7	7	10	13	8	7	5	81	6.83
37	Kretzer et al.	1998	0	0	0	0	0	0	0	0	0	1	7	7	10	11	8	10	11	10	2	77	7
38	Chan et al.	1993	0	0	0	0	0	1	8	8	11	3	10	15	7	4	3	10	15	7	4	77	5.13
39	Norman et al.	1995	0	0	0	0	0	0	1	0	3	7	5	9	6	9	7	5	9	6	9	73	5.21
40	Kimiecik et al.	1992	0	0	0	4	4	4	7	2	4	5	3	7	11	2	6	5	4	4	0	72	4.24
41	Marshall et al.	2001	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0	0	0	1	10	71	8.88
42	Armitage et al.	2000	0	0	0	0	0	0	0	0	0	0	0	2	7	12	0	0	2	7	12	70	7.78
43	Kashima et al.	1993	0	0	0	0	2	6	7	8	6	8	7	7	1	6	2	3	5	1	1	70	4.38
44	Beale et al.	1991	1	1	1	5	1	8	13	6	3	4	4	4	5	2	3	3	3	3	0	69	3.83
45	Conner et al.	1999	0	0	0	0	0	0	0	0	0	0	0	9	8	9	0	9	8	9	8	68	6.8
46	Blue et al.	1995	0	0	0	0	0	0	0	2	4	7	4	7	11	8	7	4	7	11	8	68	4.86
47	Morrison et al.	1995	0	0	0	0	0	0	1	6	7	7	8	11	6	7	4	1	4	0	3	65	4.64
48	Kaiser et al.	1999	0	0	0	0	0	0	0	0	0	1	4	4	8	10	6	9	8	12	3	64	6.5
49	Sparks et al.	1997	0	0	0	0	0	0	0	4	4	9	10	6	4	4	9	10	6	4	63	5.25	
50	Milne et al.	2000	0	0	0	0	0	0	0	0	0	0	2	5	4	8	7	11	13	9	3	62	6.89
51	Courneya et al.	1995	0	0	0	0	0	0	0	1	1	3	7	6	11	3	6	6	7	10	1	62	4.43
52	King et al.	2002	0	0	0	0	0	0	0	0	0	0	0	0	4	9	9	15	13	10	1	61	8.71
53	Sheeran et al.	1999	0	0	0	0	0	0	0	0	0	0	0	4	11	5	10	9	14	4	61	6.78	
54	Harrison et al.	1997	0	0	0	0	0	0	0	0	0	0	4	3	6	8	8	9	13	6	3	60	5
55	Boldero et al.	1992	0	0	0	0	4	4	9	5	6	4	5	4	6	1	3	4	4	1	0	60	3.53
56	Reinecke et al.	1996	0	0	0	0	0	0	0	2	6	8	8	8	5	5	6	2	5	3	0	58	4.46
57	Lewis et al.	2002	0	0	0	0	0	0	0	0	0	0	0	2	1	5	12	15	15	7	57	8.14	
58	Van Der Pligt	1998	0	0	0	0	0	0	0	0	0	2	6	7	6	10	5	7	8	5	1	57	5.18
59	Parker et al.	1996	0	0	0	0	0	0	0	0	4	7	5	5	4	8	5	8	4	6	1	57	4.38
60	Venkatesh et al.	2000	0	0	0	0	0	0	0	0	0	0	0	2	6	4	5	10	16	12	1	56	6.22
61	Sparks et al.	1995	0	0	0	0	0	1	2	2	5	4	3	5	8	5	2	7	6	6	0	56	4
62	Dishman et al.	1994	0	0	0	0	0	0	5	0	1	4	8	8	9	6	4	6	4	1	0	56	3.73
63	Craig et al.	1996	0	0	0	0	0	0	0	0	6	4	3	14	4	6	6	9	2	1	55	4.23	
64	Raats et al.	1995	0	0	0	0	0	0	1	1	3	7	7	7	5	6	2	5	3	5	2	54	3.86
65	Parker et al.	1992	0	0	0	1	2	5	3	6	3	0	1	2	2	3	5	6	5	10	0	54	3.18
66	Theodorakis	1994	0	0	0	0	0	0	4	2	4	6	3	4	5	6	4	7	6	2	0	53	3.53
67	Baranowski et al.	2003	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	12	16	13	52	8.67	
68	Rai et al.	2002	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	9	14	16	4	51	7.29
69	Morris et al.	2000	0	0	0	0	0	0	0	0	0	0	0	1	9	8	3	5	12	13	0	51	5.67
70	Norman et al.	1999	0	0	0	0	0	0	0	0	0	0	4	6	2	2	5	11	8	13	0	51	5.1
71	Richard et al.	1996	0	0	0	0	0	0	0	1	2	5	2	3	2	8	6	10	3	9	0	51	3.92
72	Bock et al.	2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	30	6	50	12.5	
73	Courneya et al.	1999	0	0	0	0	0	0	0	0	0	0	0	5	8	3	6	11	6	8	3	50	5
74	Courneya et al.	1999	0	0	0	0	0	0	0	0	0	1	1	6	8	3	10	7	4	8	2	50	

Table 5 Journal Impact Factor

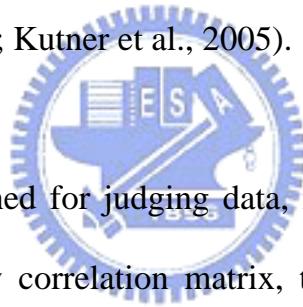
No.	Author	Years	Source	Impact Factor	In 2006
1	Ajzen	1991	Organizational Behavior and Human Decision Processes		1.514
2	Godin et al.	1996	American Journal of Health Promotion		1.703
3	Armitage et al.	2001	British Journal of Social Psychology		1.418
4	Taylor et al.	1995	Information Systems Research		2.537
5	Venkatesh et al.	2000	Management Science		1.687
6	Conner et al.	1998	Journal of Applied Social Psychology		0.566
7	Ajzen	2001	Annual Review of Psychology		11.706
8	Venkatesh et al.	2003	Mis Quarterly		4.731
9	Baranowski et al.	1998	American Journal of Preventive Medicine		3.497
10	Madden et al.	1992	Personality and Social Psychology Bulletin		2.419
11	Albarracin et al.	2001	Psychological Bulletin		12.725
12	Sutton	1998	Journal of Applied Social Psychology		0.566
13	Hausenblas et al.	1997	Journal of Sport and Exercise Psychology		1.457
14	Venkatesh et al.	2000	Mis Quarterly		4.731
15	Beck et al.	1991	Journal of Research In Personality		1.912
16	Terry et al.	1996	Personality and Social Psychology Bulletin		2.419
17	Ajzen et al.	1992	Journal of Leisure Research		0.457
18	Terry et al.	1995	British Journal of Social Psychology		1.418
19	Bagozzi et al.	1995	British Journal of Social Psychology		1.418
20	Orbell et al.	1997	Personality and Social Psychology Bulletin		2.419
21	Sparks et al.	1992	Social Psychology Quarterly		1.298
22	Parker et al.	1995	British Journal of Social Psychology		1.418
23	Ajzen	2002	Journal of Applied Social Psychology		0.566
24	Parker et al.	1992	Journal of Applied Psychology		2.851
25	Dzewaltowski et al.	1990	Journal of Sport and Exercise Psychology		1.457
26	White et al.	1994	Journal of Applied Social Psychology		0.566
27	Ajzen	2002	Personality and Social Psychology Review		3.348
28	Sheeran et al.	2000	Health Psychology		3.693
29	Ajzen et al.	1991	Leisure Sciences		0.667
30	Godin et al.	1993	Journal of Behavioral Medicine		1.348
31	Armitage et al.	1999	Journal of Applied Social Psychology		0.566
32	Doll et al.	1992	Journal of Personality and Social Psychology		4.223
33	Courneya et al.	1995	Health Psychology		3.693
34	Godin et al.	1992	British Journal of Addiction		NA
35	Sheeran et al.	1999	Journal of Applied Social Psychology		0.566
36	Baranowski et al.	1997	Annals of Epidemiology		2.210
37	Kretzer et al.	1998	American Journal of Infection Control		2.489
38	Chan et al.	1993	Journal of Applied Social Psychology		0.566
39	Norman et al.	1995	European Journal of Social Psychology		1.287
40	Kimiecik et al.	1992	Journal of Sport and Exercise Psychology		1.457
41	Marshall et al.	2001	Annals of Behavioral Medicine		2.870
42	Armitage et al.	2000	Psychology and Health		1.636
43	Kashima et al.	1993	British Journal of Social Psychology		1.418
44	Beale et al.	1991	Journal of Applied Social Psychology		0.566
45	Conner et al.	1999	British Journal of Social Psychology		1.418
46	Blue et al.	1995	Research In Nursing and Health		1.337
47	Morrison et al.	1995	Journal of Applied Social Psychology		0.566
48	Kaiser et al.	1999	Journal of Environmental Psychology		1.319
49	Sparks et al.	1997	Journal of Applied Social Psychology		0.566
50	Milne et al.	2000	Journal of Applied Social Psychology		0.566
51	Courneya et al.	1995	Journal of Behavioral Medicine		1.348
52	King et al.	2002	American Journal of Preventive Medicine		3.497
53	Sheeran et al.	1999	Journal of Applied Social Psychology		0.566
54	Harrison et al.	1997	Information Systems Research		2.537
55	Boldero et al.	1992	Journal of Applied Social Psychology		0.566
56	Reinecke et al.	1996	Journal of Applied Social Psychology		0.566
57	Lewis et al.	2002	American Journal of Preventive Medicine		3.497
58	Van Der Pliigt	1998	British Journal of Health Psychology		1.218
59	Parker et al.	1996	Journal of Applied Social Psychology		0.566
60	Venkatesh et al.	2000	Organizational Behavior and Human Decision Processes		1.514
61	Sparks et al.	1995	Basic and Applied Social Psychology		0.644
62	Dishman et al.	1994	Medicine and Science In Sports and Exercise		2.909
63	Craig et al.	1996	Preventive Medicine		2.390
64	Raats et al.	1995	Journal of Applied Social Psychology		0.566
65	Parker et al.	1992	Accident Analysis and Prevention		1.587
66	Theodorakis	1994	Sport Psychologist		0.887
67	Baranowski et al.	2003	Obesity Research		3.491
68	Rai et al.	2002	Information Systems Research		2.537
69	Morris et al.	2000	Personnel Psychology		2.392
70	Norman et al.	1999	Health Psychology		3.693
71	Richard et al.	1996	Basic and Applied Social Psychology		0.644
72	Bock et al.	2005	Mis Quarterly		4.731
73	Courneya et al.	1999	Psycho-Oncology		2.772
74	Courneya et al.	1999	Rehabilitation Psychology		0.851
75	Schlegel et al.	1992	Journal of Applied Social Psychology		0.566

3.2 Statistic Methods

Principal components analysis, the basic premise of principal components analysis (PCA), is the linear relation between any two variables that is best summarized by a regression line. In other words, the variable that represents the regression line as a point cloud contains essential information about both variables. The two variables are thus combined into a single factor. This mechanism can be used to reduce pairs of variables to single dimensions in order to simplify the graphic display of the author included in the matrix. This process initially includes as many factors as are needed for an optimal representation of the set of variables; the actual number of factors is determined by their internal variance. The most widely used stopping procedure to determine how many factors to include is to calculate the eigenvalue of each factor. The group of all factors with an eigenvalue greater than 1 accounts for most of the total variance. Factor analysis, a statistical data reduction method, is used to analyze interrelationships among a large number of variables and to explain these variables in terms of their common underlying factors. The observed variables are modeled as linear combinations of the factors and error terms. This involves finding a way to condense the information contained in a number of original variables into a smaller set of factors with a minimum loss of information (Johnson and Wichern, 2007; Kutner et al., 2005).

Multidimensional scaling (MDS) uncovers underlying dimensions based on a series of similarity or distance judgments by subjects. That is, multidimensional scaling (MDS) may be thought as a way of representing subjective attributes in

objective scales. The central multidimensional scaling (MDS) output takes the form of a set of perceptual maps in which the axes are the underlying dimensions and the points are the products, candidates, opinions, or other objects of comparison. The objective of multidimensional scaling (MDS) is to array points in multidimensional space such that the distances separating points physically on the scatter plots reflect as closely as possible the subjective distances obtained by surveying subjects. That is, multidimensional scaling (MDS) shows graphically how different objects of comparison do or do not cluster. multidimensional scaling (MDS) is mainly used to compare objects when the dimensions of comparison are not known and may differ from objective dimensions which are observable beforehand by the researcher (Johnson and Wichern, 2007; Kutner et al., 2005).



In spite of being designed for judging data, multidimensional scaling (MDS) can be used to analyze any correlation matrix, treating correlation as a type of similarity measure. That is, the higher the correlation of two variables, the closer they will be located in the map created by multidimensional scaling (MDS). Though it is possible to use multidimensional scaling (MDS) with objective distance data and with quantitative variables in general when dimensions are objective and measurable. Nonetheless, because multidimensional scaling (MDS) does not require assumptions of linearity, metricity, or multivariate normality, sometimes it is preferred over factor analysis for these reasons even for objective data. Multidimensional scaling (MDS) is popular in marketing research for brand comparisons, and in psychology research for studying the dimensionality of

personal traits. Other uses include analysis of particular academic disciplines using citation data (Small, 1999) and any application involving ratings, rankings, differences in perceptions, or voting. Sireci & Geisinger (1992), for instance, used multidimensional scaling (MDS) and cluster analysis sequentially to analyze the content of test items, first obtaining similarity ratings of items from a panel of experts, then employing multidimensional scaling (MDS) on this distance data, and then using the multidimensional scaling (MDS) stimulus coordinates as the input data for hierarchical cluster analysis.

Cluster analysis seeks to identify relatively homogeneous subgroups of data in a population. Data formed within this members should be highly internally homogenous (members are similar to one another) and highly externally heterogeneous (members are not like members of other clusters). Cluster seeks to identify a set of groups which both minimize within-group variation and maximize between-group variation. Hierarchical clustering allows users to select a definition of distance, select a linking method for forming clusters, and then determine how many clusters best suit the data. Hierarchical clustering generates representation of clusters in icicle plots and dendrogram that furthest neighbor. In this complete linkage method, the distance between two clusters is the distance between their two furthest member points. This method works well when the plotted clusters form distinct clumps (Johnson and Wichern, 2007; Kutner et al., 2005).

IV. Results

4.1 The Co-citation Analysis

The starting point of the present analysis to identify main trends within the theory of planned behavior (TPB) is the co-citation matrix. All the figures in this squared matrix represent the number of papers which have cited from the rows and the column (core documents), shown in table 6. By using the co-citation matrix, we can obtain Pearson's correlation matrix, shown in table 7. Figures in the correlation matrix indicate the similarity between each pair of core documents. The larger the quotients are, the more similar and closer these two documents are. There are two reasons to adopt correlation matrix instead of co-citation matrix (Moya et. al., 1998; Rowlands, 1999). First, after data are standardized, the scale effects caused by the number of citations made of different documents can be eliminated. Second, the number of zero in the co-citation matrix can be reduced, so can the following problems in the statistical methods. The present study adopted three statistical multivariate methods (factor analysis, multidimensional scaling, and cluster analysis) to reduce the number of dimensions. Our goal is to obtain groups of documents that define subfields and define trends or approaches within the theory of planned behavior (TPB). Furthermore, a two-dimensional graphic representation could be easily interpreted.

4.2 Factor Analysis

Table 9 shows the results of the factorial analysis with varimax rotation. Factor analysis permits us to derive subfields from the correlation matrix. Each subfield corresponds to one extracted factor, and represents a key conceptual theme in the theory of planned behavior (TPB) field. Subfields that exhibit a high cumulative tradition in research are likely to account for a large percentage of the total variance. The amount of variance explained by a factor may be constructed as its contribution to the conceptual foundation of the field. The results show that the presence of four factors explains 94 percent of the variance, shown in table 8.

Table 8 Total Variance Explained

Factor	Extracion Total	% of Variance	Cumulative %
Basic (F1)	32.50697773	43.34263697	43.34263697
Health Issues (F2)	20.57534493	27.43379324	70.77643021
Technology (F3)	11.68263961	15.57685281	86.35328302
Physical Actities (F4)	6.48047893	8.64063858	94.99392160

Rotation Sums of Squared Loadings

Table 9 Rotated Factor Matrix

No.	Factor			
	Basic (F1)	Health Issues (F2)	Technology (F3)	Physical Activities (F4)
27	0.94360925			
1	0.92446486			
12	0.92210171			
35	0.91160431			
23	0.91064077			
7	0.90564219			
3	0.89180574			
28	0.88707507			
6	0.88352242			
11	0.88236730			
42	0.87724173			
53	0.87570022			
50	0.87069325			
2	0.86311253			
20	0.85598173			
45	0.85011712			
48	0.84535292			
70	0.84470865			
58	0.82581898			
31	0.82238394			
16	0.81147738			
71	0.80063072			
37	0.79856478			
59	0.79685325			
19	0.77829923			
18	0.75455202			
13	0.75357484			
22	0.75149079			
49	0.75058928			
39	0.71969242			
32	0.71759178			
21	0.70068531			
26	0.68952390			
29	0.68668327			
74	0.67914855			
64	0.65924640			
46	0.65454256			
51	0.64768733			
33	0.60799399			
65	0.46217335			
40		0.84159025		
55		0.82177722		
38		0.81826334		
44		0.79877934		
30		0.78450106		
43		0.77067413		
17		0.76513293		
25		0.75729961		
47		0.75133071		
75		0.75124849		
10		0.73938172		
34		0.73629174		
66		0.72439782		
56		0.71897358		
15		0.70014061		
24		0.64682489		
61		0.63691375		
73		0.60163708		
54			-0.96723107	
4			-0.95301039	
60			-0.93563648	
69			-0.93359047	
8			-0.89199482	
5			-0.89110996	
14			-0.87193038	
72			-0.84131118	
68			-0.83541386	
62				0.83393674
9				0.83012019
67				0.80126229
41				0.71402281
52				0.70117173
57				0.67189548
36				0.63515246
63				0.54181594



According to the context in the present study, factor 1 represents the basic concept of the theory of planned behavior (TPB), and in addition, it includes some of the representative works of the theory of planned behavior (TPB) including review papers (Ajzen, 1991; Ajzen, 2002; Conner and Armitage, 1998; Ajzen, 2001; Albarracin et al., 2001), some review papers by adopting meta-analysis (Sutton, 1998; Godin et al., 1992; Armitage and Conner, 2001; Albarracin et al., 2001; Milne et al., 2000), and some comprehensive discussion of specific constructs within the theory of planned behavior (TPB) or comparable variables such as self-identity, self-efficacy, locus of control, etc. (Ajzen, 2001; Terry and Hogg, 1996, Sparks and Shepherd, 1992; Bagozzi and Kimmel, 1995; Armitage and Conner, 1999). Furthermore, some longitudinal studies are included to have better understanding the whole concept of the theory of planned behavior (TPB) especially in behavior (Schlegel et al., 1992; Reinecke, et al., 1996). Basically, factor 1 represents the core or basic concept of the theory of planned behavior (TPB).

Factor 2 represents the relational works or application of the theory of planned behavior (TPB) to health issues, including safe-sex behavior such as condom use (Boldero et al. 1992; Kashima et al., 1993; Chan and Fishbein, 1993; Morrison et al., 1995; Reinecke et al., 1996), alcohol and smoking issues (Schlegel et al., 1992, Godin, et al., 1992, Parker et al., 1992), cancer treatment (Courneya and Friedenreich, 1999), and exercise intention (Godin et al., 1993, Theodorakis, 1994).

Factor 3 represents another application of the theory of planned behavior (TPB),

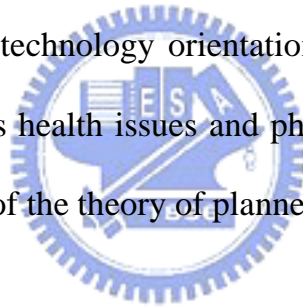
but combined with another popular theory, the technology acceptance model (TAM) (Taylor and Todd, 1995; Rai et al., 2002; Venkatesh and Morris, 2000, Venkatesh and Davis; 2000, etc.). With the advent of technology and information system, the technology acceptance model (TAM) was widely used and incorporated with the theory of planned behavior (TPB). The last factor is applied to physical activity, but with mediator in most documents (Baranowski et al., 1998; Baranowsk et al., 2003; Baranowski et al., 1997; Lewis et al., 2002).

Finally, factor 4 represents the intentions to engage in physical activities (Baranowski, 1998; Sutton, 1998; Dzewaltowski et al., 1990; Kimiecik, 1992; Marshall and Biddle, 2001; King et al., 2002; Lewis et al., 2002; Dishman, 1994), furthermore, mediators are applied in this field (Baranowski, 1998; Lewis, 2002.; Baranowski, 1997).



4.3 Multidimensional Scaling (MDS)

The multidimensional analysis provides a graphic vision of the different trends. We also marked out the three groups based on cluster analysis and the results of factor analysis for comparison. Four phenomena are discussed as follows, and the stress value of multidimensional scaling (MDS) is 0.07748, the r^2 is 0.98758, which indicates a perfect fit for our data. Figure 5 and 6 shows the result of multidimensional scaling (MDS). In figure 5, the y-axis from top to bottom shows the division of application- 'technology orientation' and 'non-technology orientation'. The 'technology orientation' group adopts information technology and information system, and is integrated with the theory of planned behavior (TPB). On the other side, the 'non-technology orientation' group represents more human orientation activities, such as health issues and physical activity. The x-axis shows the extension or application of the theory of planned behavior (TPB).



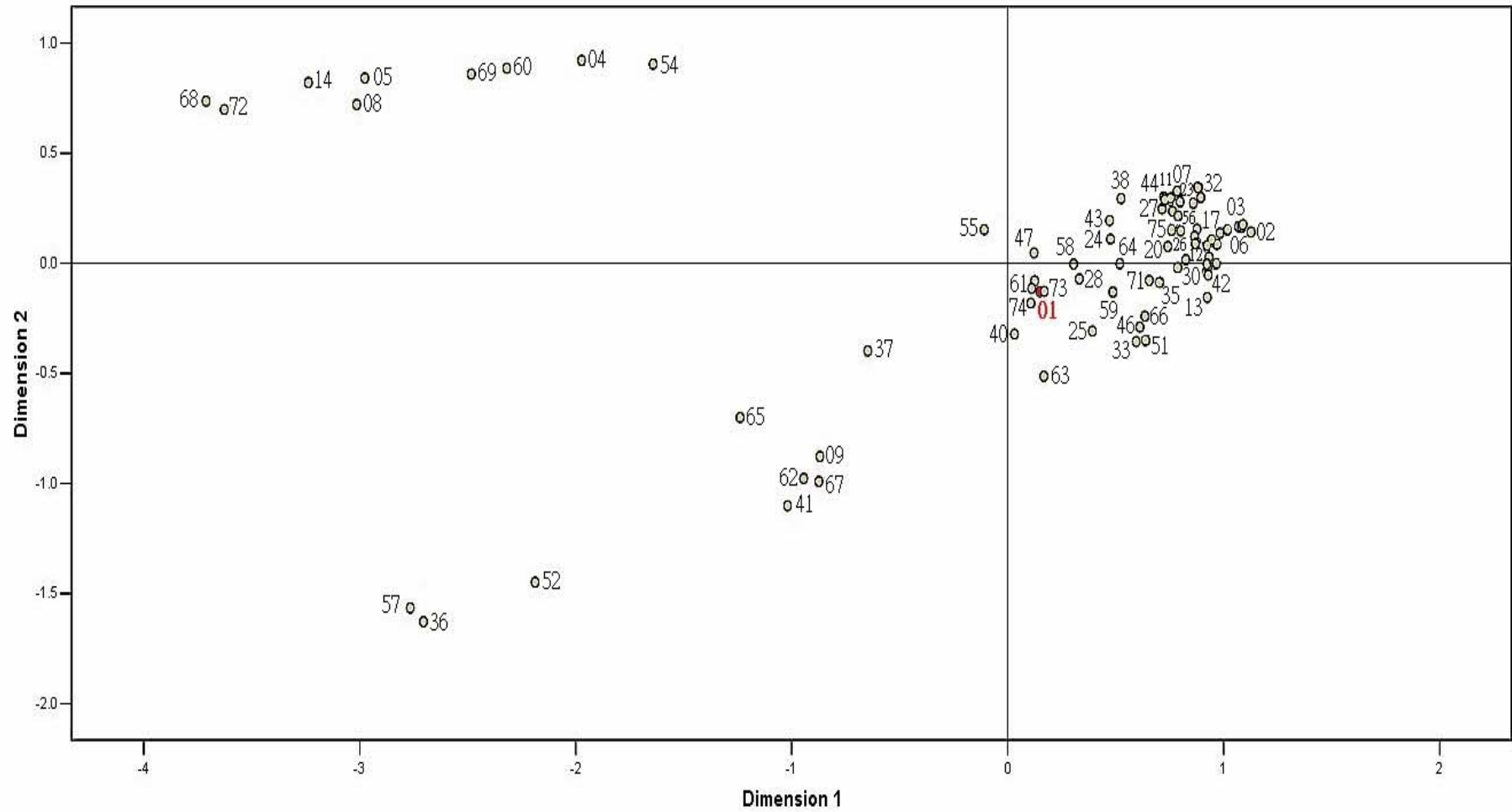


Figure 5 Multidimensional Scaling (MDS)

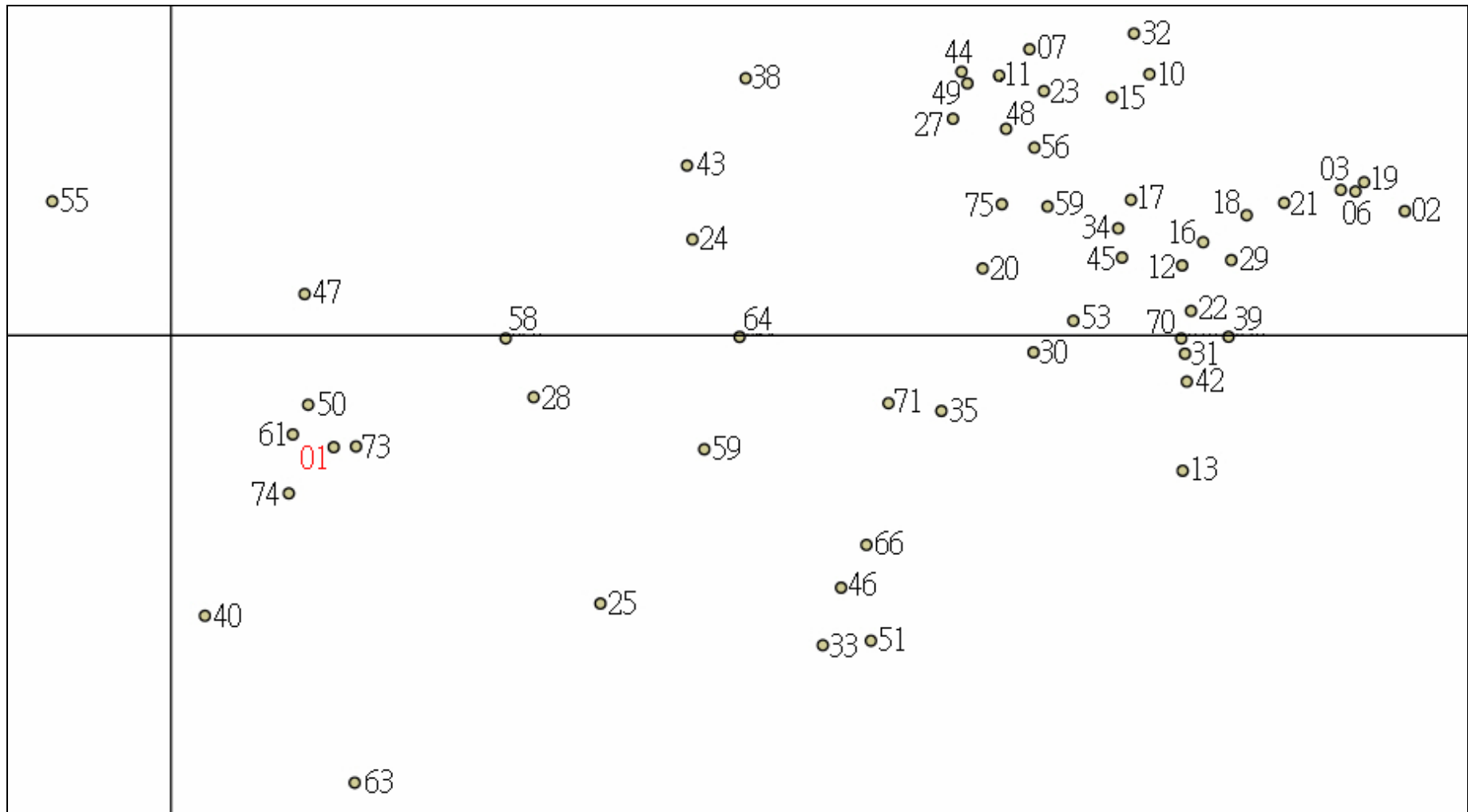


Figure 6 Multidimensional Scaling (Details right of picture)

4.4 Cluster Analysis

Cluster analysis also provides another way to reduce the number of dimensions and to identify the segment of the core documents. Cluster analysis groups the variables with their similarity, attempting to classify them into homogeneous subgroups. Euclidean distance method was used in hierarchical cluster analysis and a dendrogram depicting the complete linkage results, shown in Figure 7. In this study, cluster analysis is not only used for confirming our result from factor analysis, but also used to graph map of multidimensional scaling (MDS).



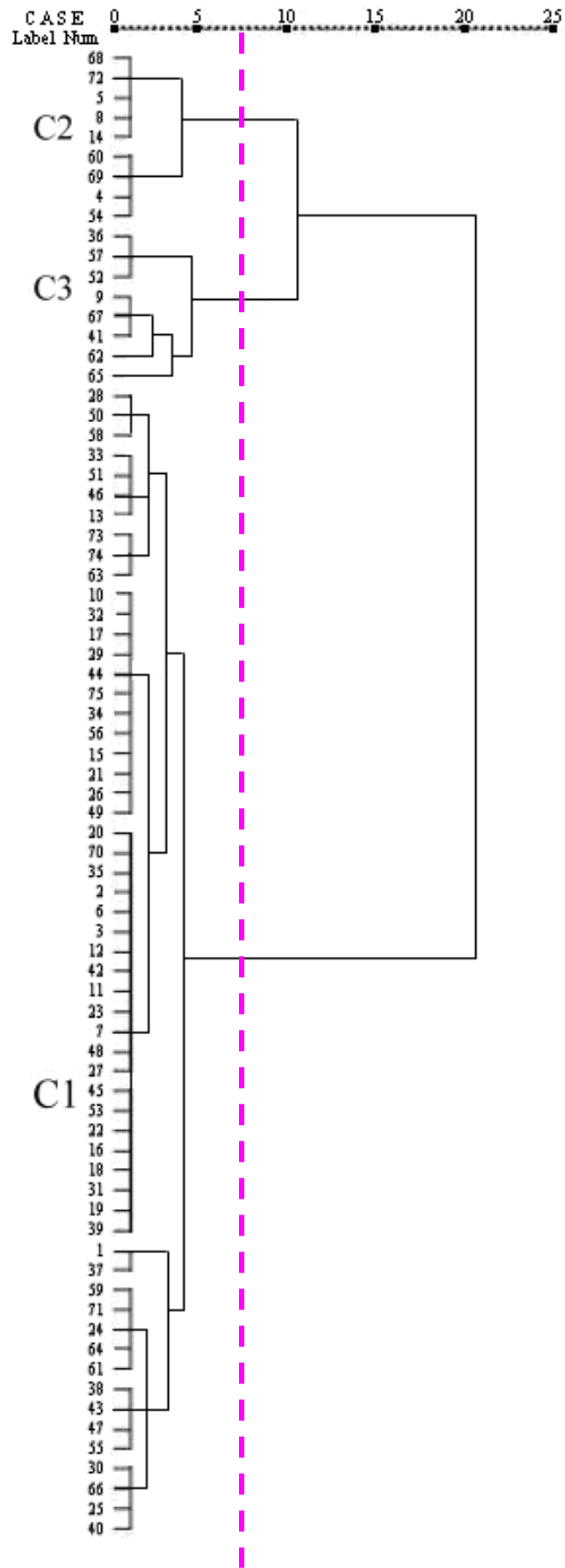



Figure 7 Hierarchical Cluster Analysis

4.5 Discussion

Ajzen fully developed the theory of planned behavior in 1991. There are over 2400 articles citing his article in the past 17 years. More and More disciplines are integrating his theory and apply it to other fields. This study examines present articles of the theory of planned behavior (TPB) by using co-citation analysis. The analysis subjectively takes account of co-citation times of these papers. Co-citation analysis is different from subjectively finding core paper and analyzing its reference to determine the co-citation data. Articles with over than 50 cited times will be considered in this study, which are strictest standard adopted to understand full-view of these studies.



The factor analysis diminishes 75 articles into 4 components, and it can also help to determine most important documents with highest loading, furthermore, integrate cluster and multidimensional scaling (MDS) to a map. In the y-axis, there are two domains with health issues which are condom use for safety sex (Albarracin et al., 2001; White et al., 1994; Sheeran and Taylor, 1999; Chan and Fishbein, 1993; Kashima et al., 1993; Morrison, et al., 1995; Boldero et al., 1992) and intentions of receiving cancer treatments (Sheeran and Orbell, 2000; Courneya and Friedenreich, 1999; Courneya et al., 1999). In the x-axis, three clusters from right to left according to the degree of extensions can be identified as basic theory and health issue, physical activities with mediators, and integration with another theory- the technology acceptance model (TAM). There are two domains, basic (or core) theory group and extensions health issues, within the first identified cluster. The basic

domain with no or little extension at all, including all the documents of the initial the theory of planned behavior (TPB) core papers (Ajzen, 1991; Ajzen,2002, Godin and Kok, 1996; Conner and Armitage,1998, etc.), review papers with meta-analysis (Armitage and Conner,2001; Sutton, 1998; Hausenblas et al., 1997), and more specific constructs comparison (Conner and Armitage,1998; Ajzen,2001; Madden,1992, etc.). Another domain within the first group is health issues with two topics in condom usage and cancer treatment as mentioned above, shown in Figure 8. Other “extensions” groups comprise physical activities and the technology acceptance model (TAM). All these works were published after 1990, some years after the first paper on the theory of planned behavior (TPB), and can be understood as attempts to extend this theory with additional variables such as mediators or integration with other current theories such as the technology acceptance model (TAM). From a more dynamic perspective, the theory of planned behavior (TPB) has developed in two clear directions. The first is discerned by moving along the x-axis of the graph reflecting the trends of theory development. For the group on the right side in figure 8, C1 represents the “core” perspective of the theory of planned behavior (TPB) with little extension. Two sub-groups from right to left according to the degree of their extensions are “core” theory termed C1 and simple application in health issues termed C2. The former discusses the major works of Ajzen’ works (Ajzen,2001,2002; Ajzen and Driver, 1991), the meta-analysis papers in the theory of planned behavior (TPB) (Armitage and Conner,2001; Sutton, 1998; Hausenblas et al., 1997), and more specific discussion in the theory of planned behavior (TPB) construct and related constructs, such as self-efficacy (Ajzen, 2002, White et al.,

1994, Sparks et al., 1997) and self-identity (Sparks and Shepherd, 1992, Conner and McMillan, 1999, Conner and Armitage, 1998). The latter discussed two topics in health issues. One is related to condom use for safe-sex behaviors, and the other is about personal physical health issues, such as cancer treatments (Sheeran and Orbell, 2000; Courneya and Friedenreich, 1999; Courneya et al., 1999), low-fat diet (Raats et al., 1995), smoking and drinking (Norman et al., 1999; Parker et al., 1996, 1995; Schlegel et al., 1992;) and drug usage (Beale et al., 1991). The second group C2 appearing on the upper left part of the diagram is related to physical activity engaging, more than that, most of them are dealing with mediators, such as behavioral processes of change, cognitive processes of change, self-efficacy, decisional balance, social support, and enjoyment, etc.(Baranowski, 1998; Lewis, 2002; Baranowski, 1997). According to the results, we can find the trend of the theory of planned behavior (TPB) not only applied to a certain area but also adopted a mediator to provide a more systematic approach to increase the effectiveness of physical activity interventions. Finally, with greater extension, C3 group on the lower left section taking the perspective of technology information was incorporated with the theory of planned behavior (TPB). From the multidimensional analysis, we can find the trend or application of the theory of planned behavior (TPB) along with the development of current issues such as safe sex for preventing from AIDS, cancer treatments, intentions to engage in physical activities for the threat of chronic disease and obesity, finally to the application of technology acceptance.

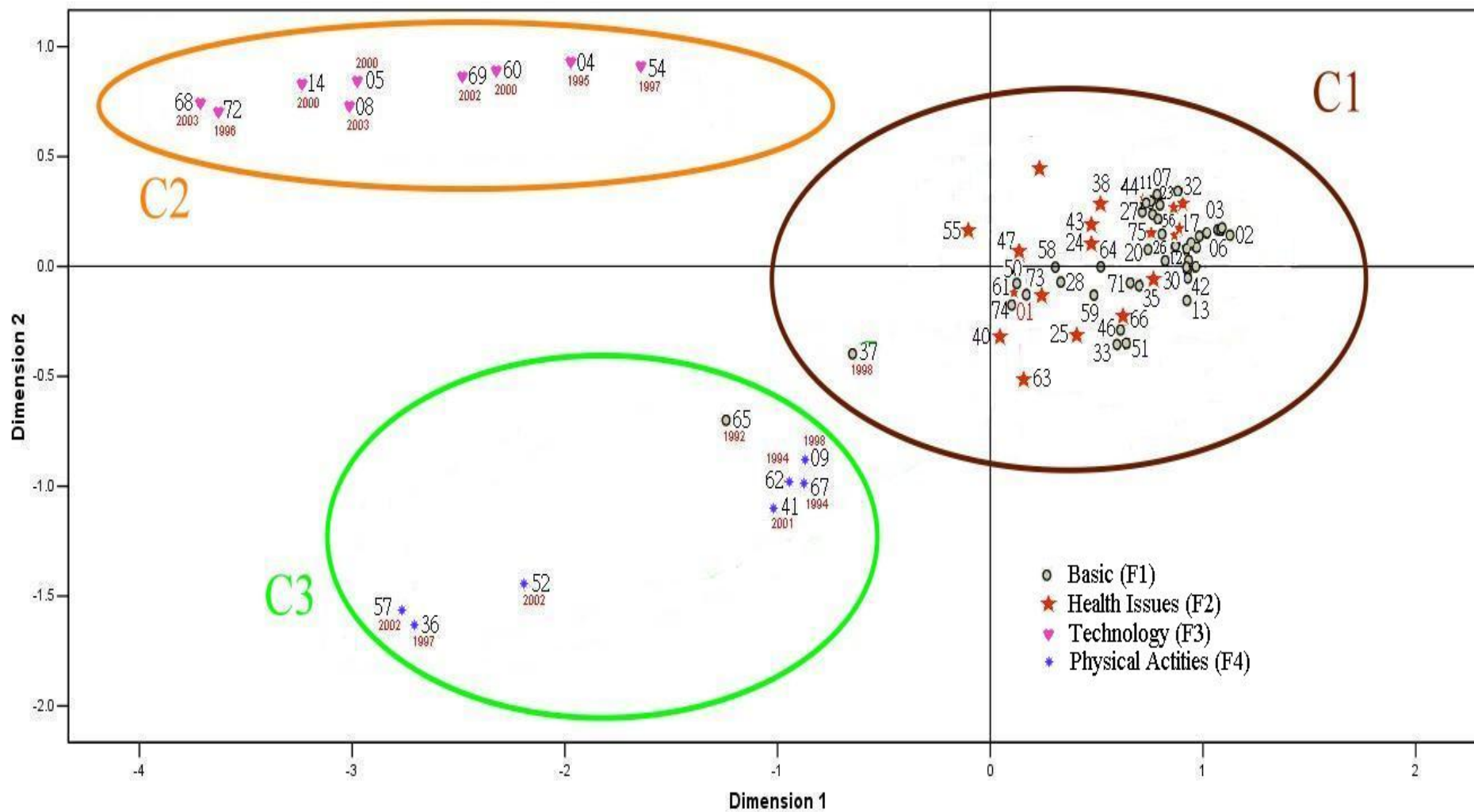
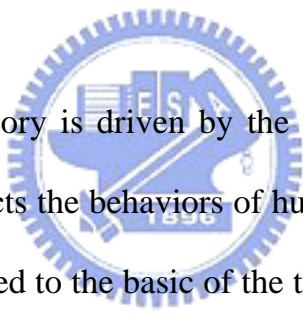


Figure 8 Integrated Map

The difference between factor and the map made by cluster and multidimensional scaling (MDS) is that one focuses on the degree of loading and the other focuses on the distance between two points on that map. The point of the theory of planned behavior (TPB) of Ajzen developed in 1991 is first discovered in the middle of the map, which indicates other articles disseminate from first article without special applications. Furthermore, the evolution of the map is found by longitudinally, which from the evaluation of the theory of planned behavior (TPB) to the topics relative to health, such as the use of condom (AIDS is the most important issue in the 20th century), cancer, sport, healthy diet, and finally the integration with technology and physical activity, shown in table 10.



The development of theory is driven by the environmental concern. The fast evolution of technology affects the behaviors of human beings, and factor 3 (cluster 2) is highly negative correlated to the basic of the theory of planned behavior (TPB) because the construct of the theory of planned behavior (TPB) is changed. People started to discuss issues about technology, and developed the technology acceptance model (TAM). In the recent years, articles are mainly about the issue of technology. After taking further investigation, we found that there are 17 articles out of articles developed after 2000. In the technology group, there were 9 articles in total, but seven of them are developed after 2000 accounted for 41% based on total 17 articles after 2000, in table 10-13. This indicates that the theory of planned behavior is highly applicable to the technology field. The other issue is about physical activity (cluster 3), which discuss the chronic disease prevention, healthy diet, exercise, etc.

Table 10 Comparison between Cluster and Factor in Journal

cluster	Factor No.	Author	Years	Source	Impact Factor In 2006
C1	F1	2 Godin et al.	1996	American Journal of Health Promotion	1.703
C1	F1	3 Armitage et al.	2001	British Journal of Social Psychology	1.418
C1	F1	6 Conner et al.	1998	Journal of Applied Social Psychology	0.566
C1	F1	7 Ajzen	2001	Annual Review of Psychology	11.706
C1	F2	10 Madden et al.	1992	Personality and Social Psychology Bulletin	2.419
C1	F1	11 Albarracin et al.	2001	Psychological Bulletin	12.725
C1	F1	12 Sutton	1998	Journal of Applied Social Psychology	0.566
C1	F1	13 Hausenblas et al.	1997	Journal of Sport and Exercise Psychology	1.457
C1	F2	15 Beck et al.	1991	Journal of Research In Personality	1.912
C1	F1	16 Terry et al.	1996	Personality and Social Psychology Bulletin	2.419
C1	F2	17 Ajzen et al.	1992	Journal of Leisure Research	0.457
C1	F1	18 Terry et al.	1995	British Journal of Social Psychology	1.418
C1	F1	19 Bagozzi et al.	1995	British Journal of Social Psychology	1.418
C1	F1	20 Orbell et al.	1997	Personality and Social Psychology Bulletin	2.419
C1	F1	21 Sparks et al.	1992	Social Psychology Quarterly	1.298
C1	F1	22 Parker et al.	1995	British Journal of Social Psychology	1.418
C1	F1	23 Ajzen	2002	Journal of Applied Social Psychology	0.566
C1	F2	24 Parker et al.	1992	Journal of Applied Psychology	2.851
C1	F2	25 Dziewaltowski et al.	1990	Journal of Sport and Exercise Psychology	1.457
C1	F1	26 White et al.	1994	Journal of Applied Social Psychology	0.566
C1	F1	27 Ajzen	2002	Personality and Social Psychology Review	3.348
C1	F1	28 Sheeran et al.	2000	Health Psychology	3.693
C1	F1	29 Ajzen et al.	1991	Leisure Sciences	0.667
C1	F2	30 Godin et al.	1993	Journal of Behavioral Medicine	1.348
C1	F1	31 Armitage et al.	1999	Journal of Applied Social Psychology	0.566
C1	F1	32 Doll et al.	1992	Journal of Personality and Social Psychology	4.223
C1	F1	33 Courmeya et al.	1995	Health Psychology	3.693
C1	F2	34 Godin et al.	1992	British Journal of Addiction	NA
C1	F1	35 Sheeran et al.	1999	Journal of Applied Social Psychology	0.566
C1	F2	38 Chan et al.	1993	Journal of Applied Social Psychology	0.566
C1	F1	39 Norman et al.	1995	European Journal of Social Psychology	1.287
C1	F2	40 Kimiecik et al.	1992	Journal of Sport and Exercise Psychology	1.457
C1	F1	42 Armitage et al.	2000	Psychology and Health	1.636
C1	F2	43 Kashima et al.	1993	British Journal of Social Psychology	1.418
C1	F2	44 Beale et al.	1991	Journal of Applied Social Psychology	0.566
C1	F1	45 Conner et al.	1999	British Journal of Social Psychology	1.418
C1	F1	46 Blue et al.	1995	Research In Nursing and Health	1.337
C1	F2	47 Morrison et al.	1995	Journal of Applied Social Psychology	0.566
C1	F1	48 Kaiser et al.	1999	Journal of Environmental Psychology	1.319
C1	F1	49 Sparks et al.	1997	Journal of Applied Social Psychology	0.566
C1	F1	50 Milne et al.	2000	Journal of Applied Social Psychology	0.566
C1	F1	51 Courmeya et al.	1995	Journal of Behavioral Medicine	1.348
C1	F1	53 Sheeran et al.	1999	Journal of Applied Social Psychology	0.566
C1	F2	55 Boldero et al.	1992	Journal of Applied Social Psychology	0.566
C1	F2	56 Reinecke et al.	1996	Journal of Applied Social Psychology	0.566
C1	F1	58 Van Der Pligt	1998	British Journal of Health Psychology	1.218
C1	F1	59 Parker et al.	1996	Journal of Applied Social Psychology	0.566
C1	F2	61 Sparks et al.	1995	Basic and Applied Social Psychology	0.644
C1	F4	63 Craig et al.	1996	Preventive Medicine	2.39
C1	F1	64 Raats et al.	1995	Journal of Applied Social Psychology	0.566
C1	F2	66 Theodorakis	1994	Sport Psychologist	0.887
C1	F1	70 Norman et al.	1999	Health Psychology	3.693
C1	F1	71 Richard et al.	1996	Basic and Applied Social Psychology	0.644
C1	F2	73 Courmeya et al.	1999	Psycho-Oncology	2.772
C1	F1	74 Courmeya et al.	1999	Rehabilitation Psychology	0.851
C1	F2	75 Schlegel et al.	1992	Journal of Applied Social Psychology	0.566
C2	F3	4 Taylor et al.	1995	Information Systems Research	2.537
C2	F3	5 Venkatesh et al.	2000	Management Science	1.687
C2	F3	8 Venkatesh et al.	2003	Mis Quarterly	4.731
C2	F3	14 Venkatesh et al.	2000	Mis Quarterly	4.731
C2	F3	54 Harrison et al.	1997	Information Systems Research	2.537
C2	F3	60 Venkatesh et al.	2000	Organizational Behavior and Human Decision Process	1.514
C2	F3	68 Rai et al.	2002	Information Systems Research	2.537
C2	F3	69 Morris et al.	2000	Personnel Psychology	2.392
C2	F3	72 Bock et al.	2005	Mis Quarterly	4.731
C3	F1	1 Ajzen	1991	Organizational Behavior and Human Decision Process	1.514
C3	F4	9 Baranowski et al.	1998	American Journal of Preventive Medicine	3.497
C3	F4	36 Baranowski et al.	1997	Annals of Epidemiology	2.21
C3	F1	37 Kretzer et al.	1998	American Journal of Infection Control	2.489
C3	F4	41 Marshall et al.	2001	Annals of Behavioral Medicine	2.87
C3	F4	52 King et al.	2002	American Journal of Preventive Medicine	3.497
C3	F4	57 Lewis et al.	2002	American Journal of Preventive Medicine	3.497
C3	F4	62 Dishman et al.	1994	Medicine and Science In Sports and Exercise	2.909
C3	F1	65 Parker et al.	1992	Accident Analysis and Prevention	1.587
C3	F4	67 Baranowski et al.	2003	Obesity Research	3.491

Table 11 TPB Trends I (Before 2000 A.D.)

Years	No.	Author	cluster	Factor	Source	Impact Factor In 2006
1991	1	Ajzen	C1	F1	Organizational Behavior and Human Decision Processes	1.514
1991	15	Beck et al.	C1	F2	Journal of Research In Personality	1.912
1991	29	Ajzen et al.	C1	F1	Leisure Sciences	0.667
1991	44	Beale et al.	C1	F2	Journal of Applied Social Psychology	0.566
1992	10	Madden et al.	C1	F2	Personality and Social Psychology Bulletin	2.419
1992	17	Ajzen et al.	C1	F2	Journal of Leisure Research	0.457
1992	21	Sparks et al.	C1	F1	Social Psychology Quarterly	1.298
1992	24	Parker et al.	C1	F2	Journal of Applied Psychology	2.851
1992	32	Doll et al.	C1	F1	Journal of Personality and Social Psychology	4.223
1992	34	Godin et al.	C1	F2	British Journal of Addiction	NA
1992	40	Kimiecik et al.	C1	F2	Journal of Sport and Exercise Psychology	1.457
1992	55	Boldero et al.	C1	F2	Journal of Applied Social Psychology	0.566
1992	75	Schlegel et al.	C1	F2	Journal of Applied Social Psychology	0.566
1992	65	Parker et al.	C3	F1	Accident Analysis and Prevention	1.587
1993	30	Godin et al.	C1	F2	Journal of Behavioral Medicine	1.348
1993	38	Chan et al.	C1	F2	Journal of Applied Social Psychology	0.566
1993	43	Kashima et al.	C1	F2	British Journal of Social Psychology	1.418
1994	26	White et al.	C1	F1	Journal of Applied Social Psychology	0.566
1994	66	Theodorakis	C1	F2	Sport Psychologist	0.887
1994	62	Dishman et al.	C3	F4	Medicine and Science In Sports and Exercise	2.909
1995	18	Terry et al.	C1	F1	British Journal of Social Psychology	1.418
1995	19	Bagozzi et al.	C1	F1	British Journal of Social Psychology	1.418
1995	22	Parker et al.	C1	F1	British Journal of Social Psychology	1.418
1995	33	Courneya et al.	C1	F1	Health Psychology	3.693
1995	39	Norman et al.	C1	F1	European Journal of Social Psychology	1.287
1995	46	Blue et al.	C1	F1	Research In Nursing and Health	1.337
1995	47	Morrison et al.	C1	F2	Journal of Applied Social Psychology	0.566
1995	51	Courneya et al.	C1	F1	Journal of Behavioral Medicine	1.348
1995	61	Sparks et al.	C1	F2	Basic and Applied Social Psychology	0.644
1995	64	Raats et al.	C1	F1	Journal of Applied Social Psychology	0.566
1995	4	Taylor et al.	C2	F3	Information Systems Research	2.537
1996	2	Godin et al.	C1	F1	American Journal of Health Promotion	1.703
1996	16	Terry et al.	C1	F1	Personality and Social Psychology Bulletin	2.419
1996	56	Reinecke et al.	C1	F2	Journal of Applied Social Psychology	0.566
1996	59	Parker et al.	C1	F1	Journal of Applied Social Psychology	0.566
1996	63	Craig et al.	C1	F4	Preventive Medicine	2.39
1996	71	Richard et al.	C1	F1	Basic and Applied Social Psychology	0.644
1997	13	Hausenblas et al.	C1	F1	Journal of Sport and Exercise Psychology	1.457
1997	20	Orbell et al.	C1	F1	Personality and Social Psychology Bulletin	2.419
1997	49	Sparks et al.	C1	F1	Journal of Applied Social Psychology	0.566
1997	54	Harrison et al.	C2	F3	Information Systems Research	2.537
1997	36	Baranowski et al.	C3	F4	Annals of Epidemiology	2.21
1998	6	Conner et al.	C1	F1	Journal of Applied Social Psychology	0.566
1998	12	Sutton	C1	F1	Journal of Applied Social Psychology	0.566
1998	58	Van Der Pligt	C1	F1	British Journal of Health Psychology	1.218
1998	9	Baranowski et al.	C3	F4	American Journal of Preventive Medicine	3.497
1998	37	Kretzer et al.	C1	F1	American Journal of Infection Control	2.489
1999	31	Armitage et al.	C1	F1	Journal of Applied Social Psychology	0.566
1999	35	Sheeran et al.	C1	F1	Journal of Applied Social Psychology	0.566
1999	45	Conner et al.	C1	F1	British Journal of Social Psychology	1.418
1999	48	Kaiser et al.	C1	F1	Journal of Environmental Psychology	1.319
1999	53	Sheeran et al.	C1	F1	Journal of Applied Social Psychology	0.566
1999	70	Norman et al.	C1	F1	Health Psychology	3.693
1999	73	Courneya et al.	C1	F2	Psycho-Oncology	2.772
1999	74	Courneya et al.	C1	F1	Rehabilitation Psychology	0.851

Table 12 TPB Trends II (After 2000 A.D.)

Years	No.	Author	cluster	Factor	Source	Impact Factor In 2006
2000	50	Milne et al.	C1	F1	Journal of Applied Social Psychology	0.566
2000	5	Venkatash et al.	C2	F3	Management Science	1.687
2000	14	Venkatash et al.	C2	F3	Mis Quarterly	4.731
2000	60	Venkatash et al.	C2	F3	Organizational Behavior and Human Decision Processes	1.514
2000	69	Morris et al.	C2	F3	Personnel Psychology	2.392
2001	3	Armitage et al.	C1	F1	British Journal of Social Psychology	1.418
2001	7	Ajzen	C1	F1	Annual Review of Psychology	11.706
2001	11	Albarracin et al.	C1	F1	Psychological Bulletin	12.725
2001	41	Marshall et al.	C3	F4	Annals of Behavioral Medicine	2.87
2002	23	Ajzen	C1	F1	Journal of Applied Social Psychology	0.566
2002	27	Ajzen	C1	F1	Personality and Social Psychology Review	3.348
2002	68	Rai et al.	C2	F3	Information Systems Research	2.537
2002	52	King et al.	C3	F4	American Journal of Preventive Medicine	3.497
2002	57	Lewis et al.	C3	F4	American Journal of Preventive Medicine	3.497
2003	8	Venkatash et al.	C2	F3	Mis Quarterly	4.731
2003	67	Baranowski et al.	C3	F4	Obesity Research	3.491
2005	72	Bock et al.	C2	F3	Mis Quarterly	4.731

Table 13 Proportion

		Before 2000	After 2000	
	Articles	58	17	
Factor	Basic (F1)	31(53.45%)	6(35.29%)	
	Health Issues (F2)	22(37.93%)	0	
	Technology (F3)	2(3.45%)	7(41.18%)	
	Physical Activities (F4)	3(5.17%)	4(23.53%)	
Cluster	C1	52(89.66%)	6(35.29%)	Ajzen:3,review:3
	C2	2(3.45%)	7(41.18%)	
	C3	4(6.90%)	4(23.53%)	

V. Conclusion

5.1 Key Findings and Insights

The goal of this study is to identifying the main trends developed within the theory of planned behavior (TPB) and their influence and dissemination in the most relevant journals in the social sciences. Different from previous review or Meta-analysis, this retrospect article is more comprehensive and strict, conforming the fact that the theory of planned behavior (TPB) has always been proved and applied in management and corporation.

This empirical study is based on a co-citation analysis, more specifically on a co-citation analysis, which has allowed the establishment of relatively reliable frontiers in the evolution of the theory of planned behavior (TPB). Because of the time frame and the methodology of the study, the results present an archival view of the theory of planned behavior (TPB) which is biased in favor of the ideas presented by the senior individuals who have published since the earlier time, even though some of these individuals are no longer active in the theory of planned behavior (TPB) field. Nonetheless, the results have a number of implications concerning the status of the theory of planned behavior (TPB) as an academic discipline (Culnan, 1986).

The results suggest that three main trends are shown to coexist within the theory of planned behavior (TPB): (1) extension or verification of existing body of knowledge or intellectual structure of the theory of planned behavior (TPB); (2)

introduction of mediators or mediating variables that incorporate environmental or situational factors into the theory of planned behavior (TPB), such as physical activity (PA); (3) incorporation with related technological applications or models such as technology acceptance model (TAM), information system (IS), and knowledge sharing (KS). Theories and implications were also derived. After year 2000, the subject of these documents can be categorized into two fields mentioned above.

5.2 Implications

The theory of planned behavior (TPB) has been developed over 20 years and generally applied to many fields, such as in depth individual discussions and review some constructs of basic theories, health issues (sports, cancer, weight losing and diet control, and AIDS prevention by using condom), integration with the technology acceptance model (TAM) and discussion of technology trend and its application, and combination with physical activity related to human health and sports. The study enables future researchers to understand the theory of planned behavior (TPB) more quickly, and to focus on the direction or domain they want to follow, and to find the key or core paper. Furthermore, future researchers can introduce the theory to every aspects of practice and understand how to integrate different theories and constructs.

In the future, researchers may help dealing with the following the category and finding the subject and direction they need. Moreover, researchers can have a better

understanding of the theory planned behavior and its trend. This research is the first article to use co-citation analysis in the theory of planned behavior (TPB), and provides a thorough summary of the theory of planned behavior (TPB) through co-citation analysis and multivariate analysis. Therefore, the result can be used as a stepping stone for further studies of the theory of planned behavior (TPB). This study give two important issues in 21st century which are technology and exercises with human that influence all of the academic community.

There may also be some hidden problems of these articles which do not appear in the abstract or overview on the surface. The dynamic nature of citation which counts on *ISI Web of Knowledge* might affect the result. This study uses high cited times articles, but there may be some loss of other articles in low cited times, like recently articles from 2004 to 2008. However, we believe this effect is minor or insignificant.

Future researchers can use the result of this article as a base to extend or integrate other theories and research methods. Based on this study, more innovative research can be conducted and applied to other different research fields.

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