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Relationships among Socio-Technical Systems and Creativity

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บทคัดย่อ

การวิจัยที่เกี่ยวข้องกับระบบสารสนเทศ (IS) ในปัจจุบันยังไม่ได้มีการนำเสนอและอธิบายประเด็นที่เกี่ยวเนื่องกับความคิดสร้างสรรค์ของบุคคลและความคิดสร้างสรรค์ของทีมงานในองค์กร ทั้งนี้ความคิดสร้างสรรค์เป็นสิ่งที่มีความสำคัญไม่เพียงแต่สำหรับบุคคลทั่วไปแล้ว แต่ยังมีความจำเป็นอย่างยิ่งสำหรับองค์กรด้วย อย่างไรก็ตามงานวิจัยหรือเอกสารทางวิชาการที่มีในปัจจุบันยังไม่ได้เชื่อมต่อกับองค์ความรู้ในปัจจุบันเกี่ยวกับทฤษฎีของระบบสารสนเทศเท่าที่ควร ดังนั้นในงานวิจัยนี้ จึงมีวัตถุประสงค์เพื่อสร้างความเชื่อมโยงระหว่างทฤษฎีของระบบสารสนเทศและทฤษฎีทางจิตวิทยา เพื่ออธิบายถึงความคิดสร้างสรรค์ในองค์กร ซึ่งขึ้นอยู่กับปฏิสัมพันธ์ระหว่างเทคโนโลยีสารสนเทศกับระบบสังคม โดยผู้วิจัยได้นำเสนอสมมติฐานที่สำคัญและโครงสร้างเป็นรูปแบบของกรอบแนวคิดที่ใช้สำหรับการวิจัย ซึ่งผู้วิจัยใช้การวิเคราะห์ปัจจัยสำรวจ (FFA) และการวิเคราะห์ปัจจัยยืนยัน (CFA) ในกระบวนการพัฒนาเครื่องมือในการวิจัย และการสร้างแบบจำลองสมการโครงสร้าง (SEM) ใช้สำหรับการทดสอบสมมุติฐาน ผลการวิจัยแสดงให้เห็นว่าความคิดสร้างสรรค์ของทีมงานมีผลต่อนวัตกรรมขององค์กร แต่ความคิดสร้างสรรค์ของบุคคลไม่ส่งผลต่อนวัตกรรมขององค์กร นอกจากนี้ความคิดสร้างสรรค์ของทีมงานขององค์กรมีผลต่อความคิดสร้างสรรค์ของแต่ละบุคคล นอกจากนี้ยังพบว่าเครื่องมือสนับสนุนความคิดสร้างสรรค์ (Creative supporting tools) มีอิทธิพลต่อความคิดสร้างสรรค์ของทีมงาน แต่ไม่มีหลักฐานสนับสนุนว่าเครื่องมือสนับสนุนความคิดสร้างสรรค์นั้น มีอิทธิพลต่อ

ความคิดสร้างสรรค์ของแต่ละบุคคล ยิ่งไปกว่านั้น ผลการวิจัยยังแสดงให้เห็นว่างานสร้างสรรค์ (Creative task characteristics) มีอิทธิพลต่อทั้งความคิดสร้างสรรค์ของทีมและความคิดสร้างสรรค์ของแต่ละบุคคล ส่วนการอภิปรายและข้อเสนอแนะถูกนำเสนอในงานวิจัยนี้ต่อไป

คำสำคัญ : โซซิโอเทคนิคคอล, ความคิดสร้างสรรค์, นวัตกรรม, องค์กร, ระบบสารสนเทศ

Research Title: The Diffusion of E-Payment Systems in Thailand

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ABSTRACT

Information system (IS) research has not yet been used to explain individual and team creativity in organizations. Creativity is important not only for individuals but also for organizations. However, although we deem creativity as important, we have not yet connected it with the current findings in IS theory. In this research, the objective is to draw a connection among theories in IS and psychology to explain creativity in organization, which is based on the interaction among information technology and social systems. We then present key hypothesizes and constructs as a form of a conceptual framework. We use exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) during the process of instrumental development. Structural equation modeling (SEM) is used for hypothesis testing. The results show that team creativity positively influences organization innovation, but individual creativity does not positively influence organization innovation. In addition, team creativity positively influences individual creativity. Creative supporting tools positively influences team creativity but there is no evidence supporting that creative supporting tools positively influences individual creativity. Moreover, the results show that creative task characteristics positively influences both team creativity and individual creativity.

keywords: socio-technical systems; innovation; creativity; and information technology

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Wornchanok Chaiyasoonthorn

Watanyoo Suksa-ngiam

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Innovation is one of the most challenging organizational developments around the world. Organization scientists often ask how the author can make our organizations and employees more innovative. The author realizes that becoming innovative is a way to achieve competitive advantage. In the modern competition where firms do not often compete in routine jobs and processes, the author require innovation and creativity to make products, services, and processes better and different than those of our competitors. Creativity is required for national development. For example, California's creative industries contribute $293.8 billion dollars to its economy (Romero, 2015). This suggests that creativity is a key to surviving in the current economic environment.

The author would like to know why some people are creative. This question has been concerned by both academic and practical worlds (Shneiderman et al., 2006). Creativity is driven by both our intrinsic motivation and extrinsic motivation (Amabile, 1996; Deci, 1975; Deci & Ryan, 2000). Creativity is driven by several factors. Some factors are individual, but several are environmental and procedural. It is a common belief that creativity occurs only for smart people. However, this is a false belief. Creativity is often from the combination of ideas including existing old ideas (G. Cook, 2014). Old ideas can come from other people in or outside the organization. For many cases, creativity and design occur from scientific processes; the interaction between design teams and users

is a process (Hevner & Chatterjee, 2010; Hevner, March, & Park, 2004). Creativity is not always from a single person but other people and society.

Creativity should be viewed as a flow of information. Creativity requires information. Information is very important for design and decision making as explained by Simon's bounded rationality (Simon, 1972). Rationality requires information as an input to the decision process. Humans make the decision when they have the right information, and when we cannot obtain some information, we cannot have creativity (Csikszentmihalyi, 2014b, 2014a). When people are given new information, then they can change their ways of looking at the same problem (Csikszentmihalyi & Sawyer, 2014). The rise of information technology (IT) generates the vast among of information flowing inside the organization. IT is a common tool to flourish creativity and accomplish work. However, we do not know how much influence of IT affects innovation and creativity when considering all important factors to consider. Also, research in information systems does not address this point. Most of the literature does not connect innovation, creativity, and information systems and technology. Most publications in information systems explain why organizations and people use technology but a small number of publications explain why organizations and employees achieve desired goals such as performance, innovation, and creativity. A much smaller number of publications explain creativity and innovation.

The objective of this paper is to develop a theoretical model showing the flow of causations explaining organization innovation. Our research question involves answering what drives organizational innovation. However, this paper focuses on a conceptual model for a field survey testing. The author organizes the paper as follows: literature review, methodology, results, discussions, and conclusion. The study rises following question.

1.2 Research Question

What drives organizational innovation?

1.3 Research Objective

The objective of this paper is to develop a theoretical model showing the flow of causations explaining organization innovation.

CHAPTER 2

LITERATURE REVIEW

2.1 Theoretical Background

Creativity is a precursor to innovation. Creativity is often viewed as art. Hence, one's creativity is different from others. However, in contrast to this conventional belief, researchers believe that creativity can be studied by using rigorous research approaches (Shneiderman et al., 2006). Many researchers have studied creativity in organizations. However, a model depicting casual linking among innovation, creativity, and IT has not been yet developed. This makes a gap in the literature. The author requires a theoretical model showing IT as a key to determine innovation of an organization.

One of the possible theories that researchers can use to theorize IT is enhancing organizational innovation a socio-technical theory. The socio-technical approach argues that we design information systems based on the interaction between social and technical systems in organizations. Organizational structure, people, technology, and tasks are the elements of socio-technical systems (Bostrom & Heinen, 1977a, 1977b). These elements are vital for organizational innovation, and this theory represents technology as a facilitator of information flows in an organization.

To manage information effectively, we need to match the interconnection between social systems and technical systems because these two have connections that can change the strategic management of organizations. Socio and technical systems can change work systems of departments (Bostrom & Heinen, 1977b). To change organization, we cannot change only one system, but we need to consider the entire system, which includes both

socio and technical systems (Bostrom & Heinen, 1977a). When we understand how IT can be managed to facilitate the flow of information, we might understand how IT enhances organizational innovation.

Orlikowski (1992) proposes a structuration theory, which is highly associated with socio-technical systems. This theory offers a way of considering technology in its socio-historical background. She believes that information technology is construction between objective and subjective reality that is socially constructed. Human beings and technology interact and change each other when technology is used (Orlikowski, 1992). She (Orlikowski, 2000) explains that the use of technology requires both structure and agency. Orlikowski also mentions that a structure is a set of substructures, such as productivity technology, relationship management, task structures, organizational structures, and incentive structures. Agency is a set of facilities, norms, and structures (Orlikowski, 2000). Orlikowski's research reinforces the notion that social and technical systems are the key to developing organizational innovation. These systems interact and drive innovation as a way to boost organizational performance.

Psychologists also have studied creativity. Well-known research in psychology is Csikszentmihalyi's findings. Csikszentmihalyi (2014b) theorizes three keys concepts of understanding creativity; these concepts are 'the domain,' 'the field,' and 'the individual,.' 'The domain' refers to a set of standards of skills, key elements, and rules (Csikszentmihalyi & Robinson, 2014). 'The field' points to people who act as the judge or referee allowing the idea to be accepted (Csikszentmihalyi, 2014b). Finally, 'the individual' means the creative process of a creative individual (Csikszentmihalyi & Sawyer, 2014). Individual characteristics can make a direct impact on individual creativity.

These characteristics are skills, knowledge, thinking style, value, trait, and so on (Anderson, Potočnik, & Zhou, 2014). Creative people are dependent on their vision, enjoyment, skills, and processes as well as gatekeeper people who allow a creative idea to flourish (Csikszentmihalyi & Getzels, 2014; Csikszentmihalyi & Robinson, 2014). Innovation is a result of the integration of multiple information domains (Csikszentmihalyi & Sawyer, 2014). Csikszentmihalyi's research implies an interactive process of creativity among individual, procedural, and social factors. The author see resembling aspects of Csikszentmihalyi's research and socio-technical systems because IT is regarded as a process as well as technology. Also, social factors as Csikszentmihalyi describes are social systems.

Although research from Bostrom and Heinen, Orlikowski, and Csikszentmihalyi is valuable, this kind of research does not incorporate measurable IT constructs and testable hypothesis in the quantitative sense. Hence, The author develop our hypothesis from models of IT enabling organizational performance. The author then can come up with a measurable model representing IT enabling individual and organizational creativity.

IS researchers have developed models representing IT enhancing organizational performance. For example, Goodhue and Thompson (Goodhue & Thompson, 1995) argue that the performance of employees is dependent on the proper mix of task and technology. If task and technology are matched, the likelihood that employees will use the technology increases. The author determine the fit between technology and task by using task and technology characteristics (Goodhue & Thompson, 1995). Organizational performance results from the utilization of technology and the fit between the task and technology. The fit also makes employees utilize the technology. The fit between the task and technology

stems from the characteristics of tasks and technology (Goodhue & Thompson, 1995). Goodhue and Thompson's model is a foundation of IS research. One might say that their model is a model of socio-technical systems because it represents social and technological components.

Besides Goodhue and Thompson, DeLone and McLean developed an IS conceptual framework to represent the interaction between IT and organizational performance. DeLone and McLean (DeLone & McLean, 1992, 2003) propose the idea that information technology can benefit both individuals and subsequently organizations. The success of information technology is to interact with user satisfaction with both the use and satisfaction being determined by three constructs: system quality, information quality, and service quality (DeLone & McLean, 1992, 2003). DeLone and McLean's model suggests that the three constructs determine the use and intention to use technology and user satisfaction. IS usage and intention to use and user satisfaction are recursive and contribute to net benefits of both individual and organization. Then users evaluate the net benefit as feedback loops (DeLone & McLean, 1992, 2003).

Tiwana and McLean (Tiwana & McLean, 2005) develop a more precise model explaining creativity. They explain team creativity, which is explained by expertise integration. Expertise integration is then explained via relational capital and abortive capital (Tiwana & McLean, 2005). However, although this model is useful in understanding creativity, it does not include IT as a construct in the model.

The most recent model in IS research explaining organizational performance is the model of Petter, DeLone, and McLean (Petter, DeLone, & McLean, 2013). They show the idea that uses task characteristics, project, and organizational characteristics, and user and

social characteristics to explain information system success (Petter et al., 2013). They combine DeLone and McLean's Information Systems Success Model and Goodhue and Thompson's Task-Technology Fit Model. They propose the idea that information system success is due to project and organization characteristics, task characteristics, and user and social characteristics (Petter et al., 2013).

IT is believed as a tool for creativity and innovation (Hevner & Chatterjee, 2010). Shneiderman et al. (2006) propose the idea of creativity supporting tools (CSTs) as a form of IT. The idea behind Shneiderman et al. (2006) is predicated on Csikszentmihalyi's domain, field, and individual. Shneiderman et al.'s (2006) definition of creativity supporting tools can be viewed either an individual piece of software or the entire organizational information system. However, in this research, we define creativity supporting tools as the overall organizational information systems that support creativity based the characteristics of Shneiderman et al. (2006). Based on our literature review, The author then can develop theoretical statements like the following hypothesis.

2.2 Hypothesis 1 and 2

Individual creativity and team creativity positively lead to organizational innovation. Team creativity and individual creativity are not the same as the organizational innovation because they are different in definitions and meanings. Individual creativity represents characteristics of one person who is creative while team creativity represents working processes that bring out creativity from the team. Researchers (Bharadwaj & Menon, 2000) have found that individual creativity and organizational creativity are responsible for organizational innovation; organizational creativity is more important than

individual creativity. Organizational innovation may be partly influenced by extraneous factors such as policies, management, and so on. However, The author cannot ignore the fact that product developments require both team and individual creativity to provide the outcome of an organization as innovation. Hypothesis 1 and 2 are based on Gundry, Kickul, and Prather (1994). Creative behaviors in organizations, such as actions and outcome, lead to changes of methodology and relationships in organizations, which in turn leads to novel results such as innovation (Gundry et al., 1994). Woodman, Sawyer, and Griffin (1993) suggest that individual, group (or team), and organizational characteristics will result in creative behavior (Woodman et al., 1993). Therefore, team creativity and organizational creativity will determine the overall organizational innovation.

The author cannot expect organizations to simply hire smart people and then demand their creativity. The author need to develop both organization and individual creativity (Bharadwaj & Menon, 2000).

2.3 Hypothesis 3

Creativity is constructed by society; creativity occurs in a person's mind communicated to other people's minds. Creativity is never only a result of an individual. It is called information of culture (Csikszentmihalyi, 2014b, 2014a). It can help with a small group of people and even a bigger group like an organization. Team creativity and individual creativity contribute to each other. Creation requires a team of people. Creativity is a result of being responsible to other people. Creative people care about their team members and others. The responsibility makes them do something like a scientific discovery that helps people for whom they care (Hooker, Nakamura, & Csikszentmihalyi,

2014). Research using multiple regression shows that the average team member creativity can help to predict team creativity with a statistical significance (Pirola-Merlo & Mann, 2004). Individual creativity is based on the learning of the team. The learning of the team and the members influences individual creativity (Hirst, van Knippenberg, & Zhou, 2009). Therefore, it makes sense that The author could expect that team creativity positively affects individual creativity.

2.4 Hypothesis 4 and 5

Creativity supporting tools (CSTs) positively influence both individual creativity and team creativity. CSTs is a construct that represents the capability of IT as a tool to enhance creativity--both individual and team creativity. CSTs are characteristics defined by Shneiderman et al. (2006). They define CSTs as having the following principles: "support exploration", "Low threshold, high ceiling, and wide walls", "support many paths and many styles", "support collaboration", "support open interchange", "make it as simple as possible", "choose black boxes carefully", "invent things that you should want to use yourself", "balance user suggestions with observation and participatory processes", "iterate", "design for designers", and "evaluate your tools" (p.70). CSTs are developed to help employees, teams, and organizations become more creative. For individual, creative supporting tools could help individual users to search, visualize, relate, and think about their work (Shneiderman, 2002). Besides, DeLone and McLean (2003) posit that information systems can make changes to individuals and organizations. The definition of CSTs includes aspects of collaboration and interaction among team members (Shneiderman et al., 2006). CSTs could be used to enhance searching ideas and knowledge, collaborating

with members and teams, and expediting finding and development processes (Shneiderman, Fischer, Czerwinski, Myers, & Resnick, 2005). Goodhue and Thompson (Goodhue & Thompson, 1995) show the effect of the technology characteristics of both team and individual creativity. Therefore, The author believe that CSTs could support individual creativity and team creativity.

2.5 Hypothesis 6 and 7

Creative task characteristics positively lead to individual and team creativity. Goodhue and Thompson (1995)and Petter et al. (2013) provide a theoretical notion that task characteristics determine the use of information systems. The use of information system makes an impact on individuals and organizations (DeLone & McLean, 1992, 2003). In this context, people use creativity-supporting tools because they do creative work. For example, engineers might use CAD to design a bridge. Artists might use Photoshop to do artwork. Many possible ICT can enhance users' creativity. However, this technology should help users accomplish their jobs, such as visualization, analysis, simulation, design, editing, product development, and collaboration (Shneiderman, 2007; Shneiderman et al., 2005). Therefore, if users are creative people, they then use creativity supporting tools because of their task characteristics. The author summarizes the hypothesizes in table 2.1 and present the conceptual framework in figure 2.1.

Table 2.1: The Summary of Hypothesizes

Hypothesis	Description
1	Team creativity (TC) positively influences organization innovation (OI).
2	Individual creativity (IC) positively influences organization innovation (OI).
3	Team creativity (TC) positively influences individual creativity (IC).
4	Creativity supporting tools (CSTs) positively influences team creativity (TC).
5	Creativity supporting tools (CSTs) characteristics positively influence individual creativity (IC).
6	Creative task characteristics (CTCs) positively influence team creativity (TC).
7	Creative task characteristics (CTCs) positively influence individual creativity (IC).

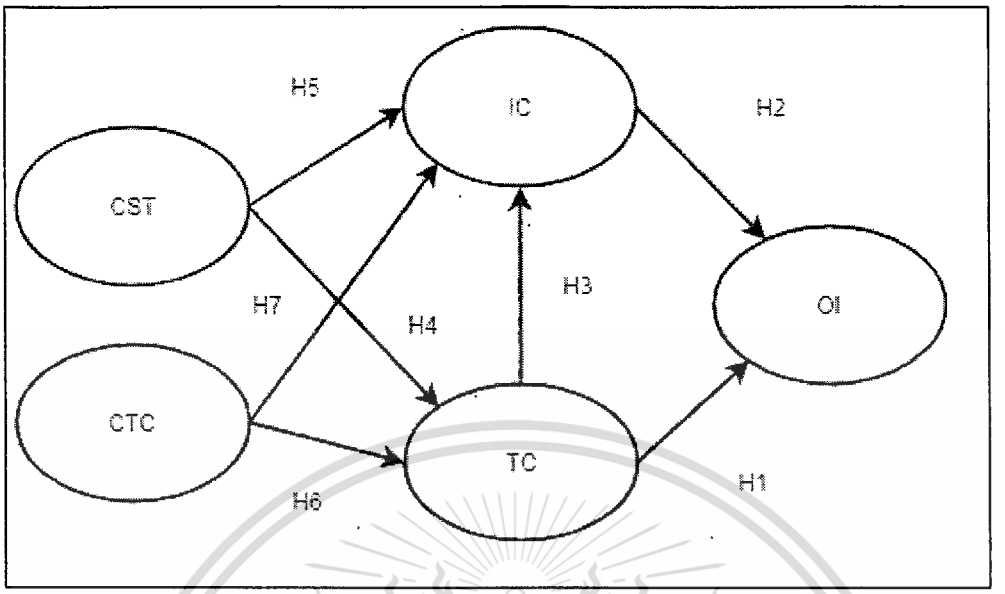


Figure 2.1: The Conceptual Framework

CHAPTER 3

METHODOLOGY

3.1 Descriptive Statistics

Based on the literature review, the descriptive statistics used to find out detailed description of diffusion of electronic payment systems. The descriptive statistics inform about mean, frequency, percentage, standard deviation (S.D). The researchers use exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) during the process of instrumental development. Structural equation modeling (SEM) is used for hypothesis testing.

3.2 Structural Equation Modeling

The use of structural equation modeling was used to inform the structure behind a connection among theories in IS and psychology to explain creativity in organization, which is based on the interaction among information technology and social systems. There are two types of structural equation modeling: co-variance based and variance based (PLS). However, in this research, co-variance based structural equation modeling was used. The advantage of co-variance based structural equation modeling is that it allows researchers to evaluate how the model fits with the empirical data. In addition, it also allows researchers to modify the model.

3.3 Measurement Items

All items were items on self-reported questionnaire. Adoption readiness is the construct that must be assess validity and reliability. For the constructs based on UTAUT2, items were measured based on the items listed on Fishbein & Ajzen (2010), Venkatesh et al. (2003), and Venkatesh et al.(2012). The items were designed to be seven point-Likert scales ranging from disagree (1) to strongly agree (7).

3.4 Instrumental Development

For instrumental development, The author follow the guideline of Moore and Benbasat (1991). The author first need to find existing instruments. The author also need to go through the instrument development process because the author change the language from English to Thai since previous literature for the instrumental development is written in English. The author creates new items when there is no existing instrument or when The author think that items obtained from the existing literature are not suitable for the context. Table 3.1 shows the literature that could be used in the process of item development and that could support the definition.

Table 3.1: The Sources and References of Construct Development

Construct	Operational definition	Sources
Organization innovation	The degree to which a person believes that his or her organization is innovative	(Bharadwaj & Menon, 2000; Pirola-Merlo & Mann, 2004)
Individual creativity	The degree to which a person believes that he or she is creative	(Açıkgöz & Günsel, 2016; Moulang, 2015)
Team creativity	The degree to which a person believes that his or her team is creative	(Tiwana & McLean, 2005)
CST characteristics	The degree to which a person believes that his or her information system support creativity	(Goodhue & Thompson, 1995; Petter et al., 2013; Shneiderman et al., 2006)
Creative task characteristics	The degree to which a person believes that his or her task requires creativity	(Goodhue & Thompson, 1995; Petter et al., 2013)

According to Moore and Benbasat (1991), the process of instrument development consists of three steps: 1) creating items, 2) developing scales, and 3) testing the instrument. Moore and Benbasat (1991) provide good guidance to ensure construct validity, reliability, content validity, and convergent validity, and discriminant validity. However, statistical analysis that is going to be used be different since there is an advancement of statistics. To determine content reliability, construct validity, convergent validity, and discriminant validity, The author use exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) as statistic techniques. EFA can show how items are

grouped, representing groups of items as factors. CFA can be used to determine content reliability, convergent validity and discriminant validity (Hair, Black, Babin, & Anderson, 2010).

3.5 Model Estimation

For the model estimation, we use SEM because it provides us with at least three advantages. First, SEM provides model fit indices. Unlike PLS, SEM provides model fit indices that give us insight as to how well our model fits with the data. Second, SEM can be used to estimate latent variables (Hair et al., 2010). Third, SEM can be used to estimate a recursive model. Latent variables are constructs that represent the unobservable concept underpinning critical realist's philosophical assumption (Kelloway, 1998), which is an emerging and important philosophy of information systems and social science (Mingers, Mutch, & Willcocks, 2013). The use of SEM requires several assumptions: multi-normality, linearity relationship, adequate sample size, and an identified or over-identified model (Hair et al., 2010; Prasith-rathsint, Sookasame, Pongsaree, & Prasithimet, 2008). The author need to satisfy these assumptions so that SEM can be used.

3.6 Reliability and Construct Validity

In this research, the author measured the reliability via Cronbach' Alpha. Both are used to measure reliability of attitudinal constructs including perceived trust. However, the composite reliability was re-evaluated for the latent variable.

In terms of validity, face validity is achieved because the items were taken from the theories. Since, there is only latent variable – discriminant validity is ignored. For

Cronbach's Alpha, the value accepted in this research is greater than 0.70 (Hair, Black, Babin, & Anderson, 2010). For construct validity, the standardized factor loading is than 0.50 as the minimum requirement while the average variance extracted (AVE) is more than 0.50 (Hair, Black, Babin, & Anderson, 2010).

3.7 The Estimation

The estimation of variables is the maximum likelihood. The author used the maximum likelihood estimation because it allows the researcher to use variables with different measurement scales when assumptions of normality and adequate sample size are achieved. It is the most widely used estimation (Hair, Black, Babin, & Anderson, 2010).

3.8 Computer Software

The author used IBM's SPSS and AMOS 21.0 to estimate the structural model.

CHAPTER 4

RESEARCH RESULTS

The respondents consist of 411 people. The average age is 32.48 years old. Table 4.1 shows the characteristics of the respondents. The majority is female respondents who account for 63 %. The respondents are well educated. The majority respondents have master's degrees. Most respondents work for private companies accounting for 51.6 percent.

Table 4.1: Characteristics of Respondents

	Frequency	Percent
Gender		
male	152	37.0
female	259	63.0
Education		
Below bachelor	18	4.4
bachelor	39	9.5
Master	293	71.3
Ph.D.	58	14.1
Post-doctoral study	2	0.7

Table 4.1 (Continued)

	Frequency	Percent
Organization type		
Government	44	10.7
State-owned enterprise	112	27.3
Private company	212	51.6
Non-profit organization	15	3.6
Other	28	6.8
Occupation		
Engineer	52	12.7
IT	48	11.7
Architect	12	2.9
Artist	28	6.8
Scientist	29	7.1
Business and accountant	125	30.4
Others	117	28.5

4.1 Validity and reliability

The author used construct validity, factorial validity, convergent validity, and discriminant validity to determine the construct validity. Factorial validity informs that the measuring items belong their constructs they intend to represent. Average variance extracted (AVEs) prove convergent validity. Convergent validity solidifies that each item is a representative of each construct. Discriminant validity ensures that each construct is

different from one another. Additionally, Cronbach's Alpha can measure reliability. Exploratory Factor Analysis (EFA) with principal axial factoring depicts factorial validity. We use the Varimax rotation as the rotation method. Table 4.3 depicts that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity is statistically significant.

Table 4.2: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.944
Bartlett's Test of Sphericity	Approx. Chi-Square	10373.960
	df	276
	Sig.	.000

Figure 4.1 shows the Scree Plot. The Scree Plot is used to show where to stop factor analysis.

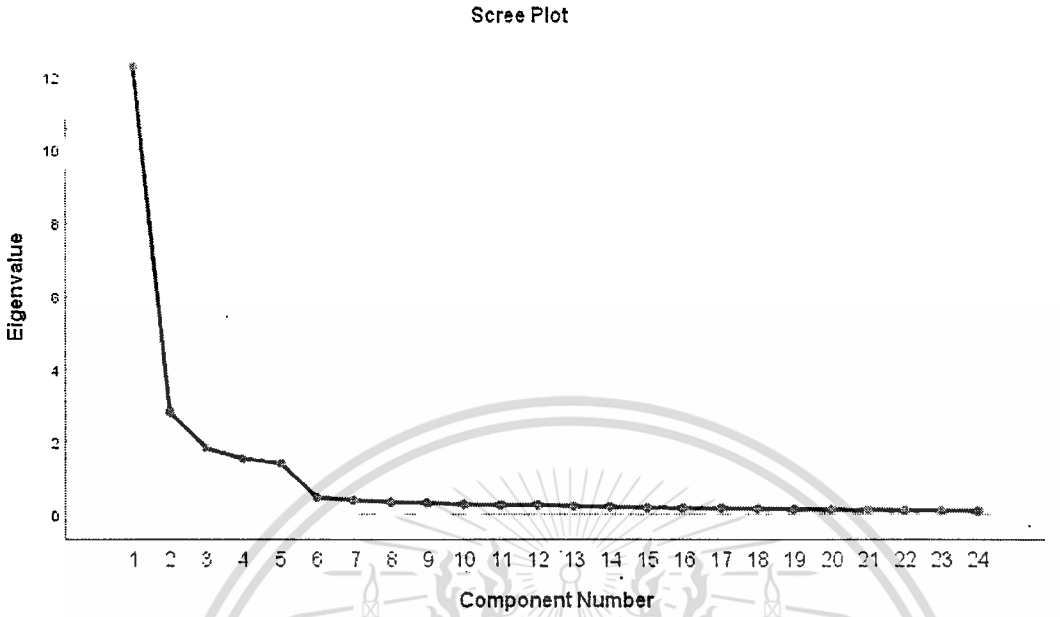


Figure 4.1: Scree Plot

Table 4.3 shows the results of exploratory factor analysis. Factorial validity is met because the items were grouped according to their designed constructs.

Table 4.3: Exploratory Factor Analysis

	CST	OI	IC	TC	CTC
OI2		.747			
OI3		.830			
OI4		.879			
OI5		.858			
OI7		.843			
IC1			.827		
IC3			.827		
IC4			.842		
IC5			.855		
IC8			.707		
TC1				.758	
TC2				.826	
TC3				.755	
TC5				.787	

Table 4.3 (Continued)

	CST	OI	IC	TC	CTC
TC6				.737	
CST1	.820				
CST3	.822				
CST5	.831				
CST6	.824				
CST8	.831				
CTC1					.837
CTC2					.858
CTC3					.800
CTC4					.811

Table 4.4 shows the range, minimum, maximum, mean, and standard deviation of each item.

Table 4.4: Descriptive Statistics of Each Item

	N	Range	Minimum	Maximum	Mean	Std. Deviation
OI2	411	6	1	7	4.82	1.305
OI3	411	6	1	7	4.56	1.386
OI4	411	6	1	7	4.48	1.387
OI5	411	6	1	7	4.55	1.398
OI7	411	6	1	7	4.55	1.376
IC1	411	6	1	7	4.79	1.126
IC3	411	6	1	7	4.70	1.159
IC4	411	5	2	7	4.73	1.149
IC5	411	6	1	7	4.77	1.143
IC8	411	6	1	7	4.55	1.297
TC1	411	6	1	7	4.76	1.218
TC2	411	5	2	7	4.83	1.226
TC3	411	5	2	7	4.87	1.232

Table 4.4 (Continued)

	N	Range	Minimum	Maximum	Mean	Std. Deviation
TC5	411	6	1	7	4.79	1.282
TC6	411	6	1	7	4.72	1.313
CST1	411	6	1	7	4.80	1.310
CST3	411	6	1	7	4.69	1.333
CST5	411	6	1	7	4.80	1.308
CST6	411	6	1	7	4.74	1.396
CST8	411	6	1	7	4.78	1.366
CTC1	411	6	1	7	4.45	1.416
CTC2	411	6	1	7	4.46	1.455
CTC3	411	6	1	7	4.55	1.404
CTC4	411	6	1	7	4.61	1.450

Table 4.5 shows the reliability test. All constructs consist of more than .9 reliability.

Table 4.5: Reliability Test

	Cronbach's Alpha	Number of Items
OT	0.942	5
IC	0.927	5
TC	0.944	5
CST	0.950	5
CTC	0.956	4

Figure 4.2 shows the results of confirmatory factor analysis. These results are used to construct table 4.7.

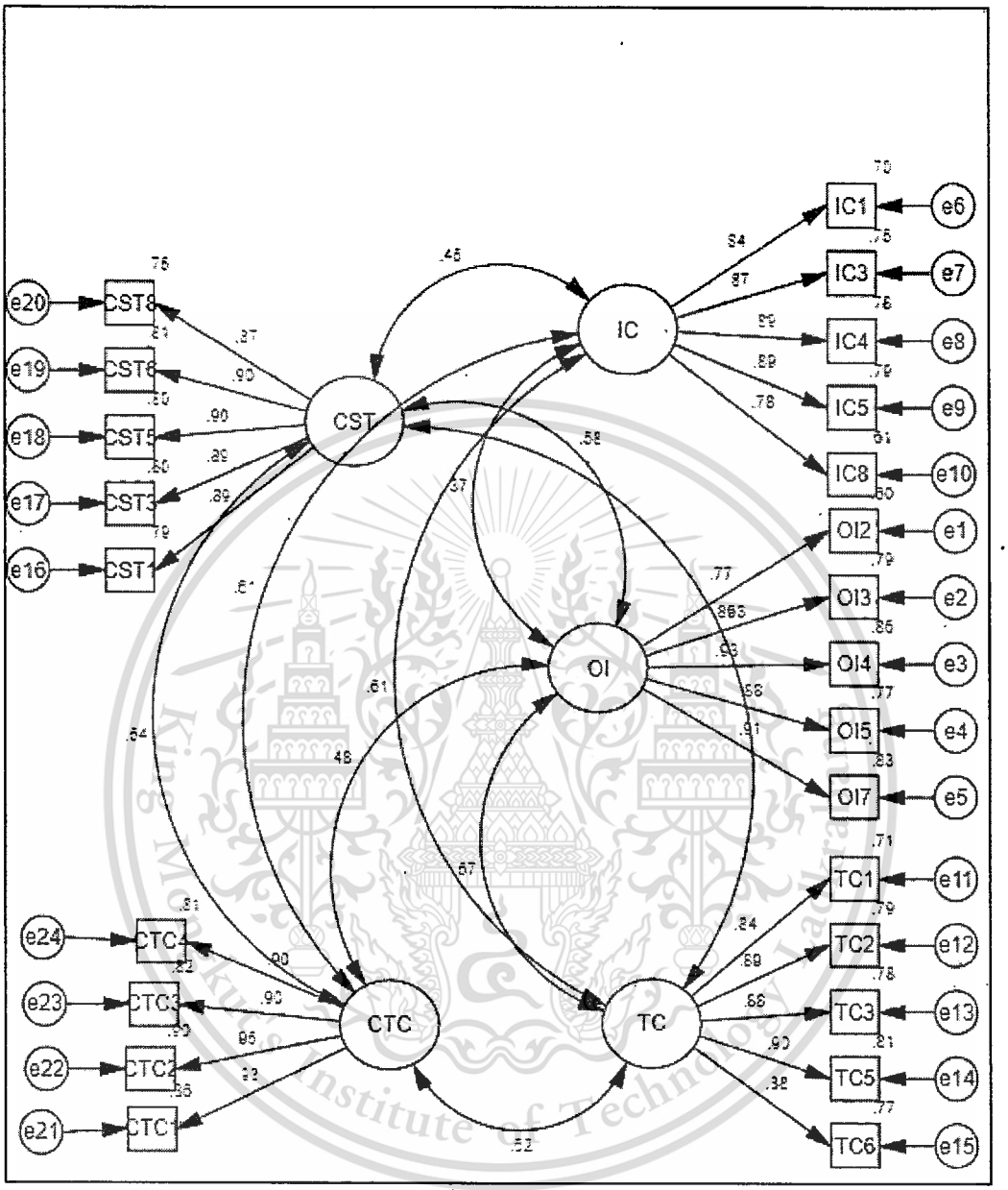


Figure 4.2: The Confirmatory Factor Analysis

Table 4.6 represents that AVEs are all above 0.5 (0.85 - 0.92). The values of the AVEs are more than 0.5. Therefore, convergence validity is acceptable. Additionally, all

the values of AVEs are more than the values of the squared correlations; this suggests that discriminant validity is met (Hair et al., 2010).

Table 4.6 Squared correlations and AVEs.

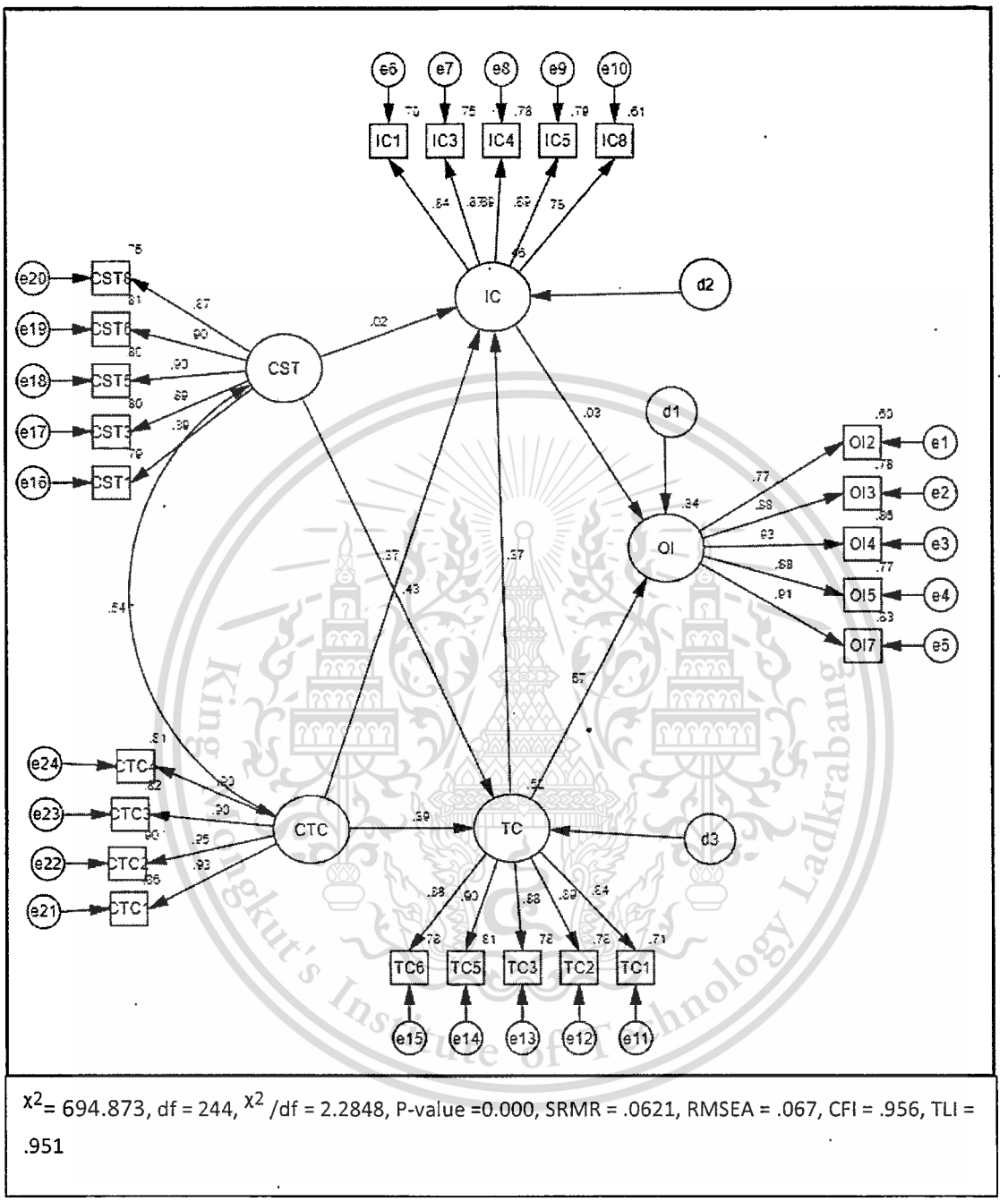
	OI	IC	TC	CST	CTC
OI	**.87**				
IC	.14	**.85**			
TC	.33	.37	**.88**		
CST	.33	.20	.40	**.89**	
CTC	.23	.37	.38	.29	**.92**

Note: Diagonal values are AVEs, and off-diagonal values are squared correlations

Cronbach's alpha shows the reliability of items representing a construct. All Cronbach's alpha values are shown above .7 recommended by (Hair et al., 2010).

4.2 Structural Equation Modelling

The author tests the conceptual framework by using SEM. Figure 4.2 shows the results of structural equation modeling



x^2= 694.873, df = 244, x^2 /df = 2.2848, P-value =0.000, SRMR = .0621, RMSEA = .067, CFI = .956, TLI = .951

Figure 4.3: The Results of Structural Equation Modeling

Table 4.7: Path Analysis of the Theoretical Model

Path	S.E.	C.R.	P	Sig.
TC <-- CTC	0.305	0.037	8.243	***
TC <-- CST	0.38	0.042	8.937	***
IC <-- CST	0.017	0.045	0.376	0.707
IC <-- CTC	0.265	0.04	6.65	***
IC <-- TC	0.339	0.058	5.854	***
OI <-- IC	0.028	0.061	0.457	0.648
OI <-- TC	0.562	0.063	8.984	***

Table 4.7 suggests that team creativity (TC) positively affects organizational creativity at the significance level 0.05 ($p < 0.001$) while individual creativity (IC) does not affect organizational innovation (OI). Team creativity (TC) also positivity affects individual creativity (IC) at the significance level 0.05 ($p < 0.001$). Besides, creative task characteristics (CTC) positively affect individual creativity (IC) and team creativity (TC) at the significance level 0.05 ($p < 0.001$). Creativity is supporting tools (CST) positively affect team creativity (TC) at the significance level 0.05 ($p < 0.001$) while Creativity supporting tools (CST) do not positively affect individual creativity. Table 4.9 shows the model fit indices and how this model matches with the ideal model.

CHAPTER 5

DISCUSSIONS AND CONCLUSION

This chapter is dedicated for discussions and conclusion. The discussion part is divided into each research question.

5.1 Discussions

Team creativity positively influences organization innovation. Team creativity and individual creativity are not the same since they are different in definitions and meanings. As we show in EFA, team creativity and individual creativity are different constructs. The author does not accept that individual creativity contributes to organizational innovation. However, The author partially confirmed researchers (Bharadwaj & Menon, 2000) that team creativity is responsible for organizational innovation; team creativity is more important than individual creativity. The author confirm that creative behaviors in organizations lead to changes in organizations, such as innovation (Gundry et al., 1994). Similar to Woodman, Sawyer, and Griffin (1993), teamwork results in creative behavior (Woodman et al., 1993). Hence, hypothesis 1 is accepted, while hypothesis 2 is rejected.

Our research confirmed that team creativity positively influences individual creativity. Creativity has resulted from society; creativity occurs in a human's mind communicated to others. Creativity is never only a result of an individual but culture (Csikszentmihalyi, 2014b, 2014a). Creativity is a result of being responsible to other people. Creative people care about their team members and others. The responsibility

makes them do creative tasks that help people for whom they care about (Hooker et al., 2014). The author do not confirm scholars (Pirola-Merlo & Mann, 2004) that individual member creativity can predict team creativity with a statistical significance [29] (Pirola-Merlo & Mann, 2004) while Individual creativity is largely based on the learning of the team. The learning of the team and the members influences individual creativity (Hirst et al., 2009). Hence, hypothesis 3 is accepted.

Creative supporting tools positively influence team creativity. Creative supporting tools represent the capability of IT as a tool to enhance creativity at team creativity. The author has no evidence suggesting that CSTs can help supporting individual creativity. More samples should be included in this research. CSTs are developed to help employees, teams, and organizations become more creative. For individual, creative supporting tools could help individual users to search, visualize, relate, and think about their work (Shneiderman, 2002). CSTs enhance new ideas, share knowledge, and help to collaborate with members and teams (Shneiderman et al., 2005). The author confirm Goodhue, Thompson (1995) that the technology characteristics affect both teams, and individual creativity. Hence, hypothesis 5 is accepted, but hypothesis 6 is rejected.

As suggested by the literature, Creative task characteristics positively influence both team creativity and individual creativity. The author confirm Goodhue and Thompson (1995) and Petter et al. (2013) that task characteristics determine the use of information systems. In this context, people use creativity-supporting tools because they do creative work. Hence, the author accepted hypothesis 7 and 8.

This research bridges the gap in the literature of IT and organizational innovation. The author provides our research contribution to operate in several ways. First, the author provides instrumental development. The author develops a Thai instrument to collect data in Thailand. Most of the literature that the author has reviewed is written in English. In survey research, when the author changes items and instruments significantly (e.g., changing languages), The author need to develop as if The author have no prior instrument. Second, The author also re-design two new constructs: CST characteristics and creative task characteristics, which are the combined ideas of Goodhue and Thompson (1995), Petter et al. (2013), and Shneiderman et al. (2007; 2005). Third, if the propositions are proven and confirmed, The author then can use this model as a kernel or reference theory in designing science research (DSR) because DSR researchers can use this model as a guideline of designing IT supporting tools and systems (Gregor & Hevner, 2013; Hevner & Chatterjee, 2010; Hevner et al., 2004; Walls, Widmeyer, & El Sawy, 1992). Finally, the author proves the flow of causations explaining creativity and innovation in organizations: how much the CST characteristics contribute to organizational innovation together with the other factors. However, causations are difficult to establish in research dealing with people, culture, and society (Basole et al., 2015). Causality requires co-variation, time order, and elimination of alternative explanation (T. D. Cook & Campbell, 1979). Therefore, the author cannot establish causality in this survey research. However, The author may propose the causations for the experimentalists to conduct randomized control trial (RCT) to establish causations (T. D. Cook & Campbell, 1979; Robson, 2011).

5.2 Conclusion

Innovation and creativity are important to all organizations. Researchers and practitioners want to understand creativity and innovation in organizations and how to enhance creativity and innovation in organizations. IT is believed to support employees to have creativity and subsequently assist organizations in becoming innovative. However, IS research does not show the connection between IT and organizational innovation. Hence, this research aims to propose theoretical relationships explaining IT enhancing organization innovation. Our sole research question is what drives organization creativity and innovation. The author develops our understanding of the phenomenon based on socio-technical and psychological theories. However, this paper attempts to prove the conceptual model before the author can do experimental research. The author apply Moore and Benbasat (1991)'s framework of instrumental development. To determine, content reliability, construct validity, convergent validity, and discriminant validity, the author use EFA and CFA. EFA can show how items are grouped, representing groups of items as factors. CFA can be used to determine content reliability, convergent validity and discriminant validity (Hair et al., 2010). SEM is used for hypothesis testing. The results show that team creativity positively influences organization innovation, but individual creativity does not influence organization innovation. Also, team creativity positively influences individual creativity. Creative supporting tools positively influence team creativity, but there is no evidence supporting that creative supporting tools positively influence individual creativity. Moreover, the results show that creative task characteristics positively influences both team creativity and individual creativity.

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BIOGRAPHY

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ผู้ร่วมโครงการ

1. ปัจจัยที่มีผลต่อความสำเร็จในการพัฒนาทรัพยากรมนุษย์ของธุรกิจเกษตรอินทรีย์เพื่อสร้างให้เป็นองค์การแห่งการเรียนรู้โดยรับการจากสาขาวิชาบริหารธุรกิจและพัฒนาการเกษตร ปีงบประมาณ 2552

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ประวัติส่วนตัว

ชื่อ-สกุล นายวทัญญู สุขเสงี่ยม

ประวัติการศึกษา

ชื่อย่อปริญญา	สาขา	สถาบันที่จบ	ปีที่จบ
วศ.บ.	วิศวกรรมศาสตรบัณฑิต	สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง	2544
บธ.ม.	บริหารธุรกิจ	สถาบันบัณฑิตพัฒนบริหารศาสตร์ (นิด้า)	2546

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