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Collaboration Orientation, Peer Support and the Mediating Effect of Use of E-collaboration on Research Performance and Satisfaction*

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This study investigates the potential components for academic research collaboration, and the factors that make it possible to achieve higher academic productivity. The components include collaboration factors and a collaboration model. We use two major collaboration factors to develop a framework for understanding the mechanisms that influence academic research collaborations: motivational factors and mediating factors. Motivational factors include self-motivation and trust whereas mediating factors are collaboration orientation and peer support.

We analyze the effect for use of e-collaboration with research performance, reward, and satisfaction with e-research output. A survey of academicians was conducted, and by using the factor analysis and the structural equation model with SPSS 20 AMOS, we illustrate the possible influence of these factors on research performance and satisfaction. We discovered that both motivational and mediating factors play important roles on the success of academic research.

This study offers several implications for academicians. We develop a parsimonious research model, which is related to e-collaboration in academic research. This unique model offers academicians to achieve good publication output from the research team. The motivational factor, self-motivation and trust, are important factors which has received positive impact of mediating factor collaboration orientation and peer support.

Our research sheds light on the crucial factors for use of e-collaboration which offer the ultimate effect on performance and satisfaction with e-research output. Satisfaction motivates people to work more and more on the field of their interest, thereby influencing the performance of academicians. Rewards should be distributed according to performance of the individual, which will motivate the person to become more enthusiastic for his work of interest.

Our evidence suggests that in understating the collaborative process, one must account for the context in which the collaboration occurs, the motivation of the collaborators, the scope and nature of the project, the roles and activities undertaken, and interpersonal processes such as trust. Researchers' motivations for engaging in collaboration were both instrumental and intrinsic.

Keywords : IS Usage, Collaboration, Motivational Factors, Mediating Factors, Research Performance, Satisfaction with E-research Output

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Ⅰ. Introduction

During and after the Second World War, the term collaboration originally meant working with the opponent. Since then, it has been used in a more positive sense, referring to working in association with others for some form of mutual benefit. Research collaboration may be defined as two or more researchers working together in order to achieve a common goal of producing new knowledge. It occurs when researchers determine the need to collaborate and identify possible gains. Access to information, the availability of technical facilities or personnel, and professional interaction are some of these needs, whereas increased prominence in the field, new knowledge, and the establishment of networks are some of its possible benefits.

Katz and Martin [1997] define research collaboration as a necessary factor to distinguish between true collaborators and others who were not directly involved in the research. According to them, collaborators include those who are responsible for one or more of the main elements of the research (experimental design, construction of research equipment, execution of the experiment, analysis and interpretation of the data, and writing up the results in a paper). Next, collaborators include those who work together on the research project throughout its duration or who make frequent or substantial contributions. They suggest that collaborators will generally exclude those not seen as, or treated as, 'true' researchers; for example technicians, research assistants, and also those who make only an occasional or a relatively minor contribution to a piece of research. However, the majority of research collaboration could be defined as a group of researchers working together in order to achieve a common goal of producing new knowledge.

Today, it is widely believed that collaboration in research is worthy because it supports researchers to produce high-quality outcomes. In addition, it helps to increase the productivity of research. However, it is assumed that when researchers are attempting to collaborate on specific projects, they might not have a clear idea about the precise nature of collaboration. In other words, they should have a clear concept as to what they are doing through collaboration. For example, each researcher in a collaborative group prepares works as part of the research without involving others. Collaboration is a fundamental and common feature in academic research. It adopts various forms, ranging from the sharing of ideas among researchers to corporate partnerships. Collaboration arises at different levels within the research scheme: individuals (micro-level), departments (middle-level), and institutional sectors (macro-level). Collaboration is encouraged by institutions, funding bodies, and policymakers due to the number of positive factors, which were discussed in the literature [Katz and Martin, 1997; Luukkonen *et al.*, 1992; Sonnenwald, 2007]. There are both scientific and extra-scientific advantages of collaboration, which are frequently organized by the scientists themselves. Theoretical investigation, experimental analysis, and compelling and elegant writing are assignments which require different skills, but which are rarely enjoyed by the same scholar. Collaboration allows coping better with specialization in science, with multidisciplinary approaches, and

with the complexity of scientific instruments. Researchers can derive scientific advantages by sharing knowledge, expertise and techniques, jointly controlling the accuracy and significance of the results, limiting isolation and giving substance to the cross fertilization of ideas.

Currently, being involved in interactions via e-mail is a common occurrence in both people's professional and personal lives. E-mail is essential for the work of employees such that it has become a habitat, or the central place from which work is received, managed, and delegated in organizations. In research settings, most e-mail messages involve collaborative tasks. These tasks involve interactions with colleagues both within and across the organization in order to coordinate collaborative work. Since team members spend a significant amount of time communicating through email, collaborators are starting to recognize the importance of email in research development. The overall goal of the collaboration process is the improvement, management, and control of essential research progressions. E-mail contains interactions that are an important part of the research process.

Furthermore, collaboration increases the potential visibility of work. Using the network of contacts, collaborators can publish their findings, either formally (e.g., through conference presentations) or through informal discussions. Collaborators are likely to compete at a more informed decision as to the best journal in which to publish the results. The published paper may be accessed in library searches by scanning for work produced by any of the collaborating authors, multiplying the chance that it will be located and used by others. It is therefore likely to be cited more frequently and to have a greater impact. Additionally, collaboration has the effect of spreading the network of contacts within an academic community. An individual researcher may have a good network with a number of other researchers in his or her field around the world, with whom he or she can contact for information or advice. By collaborating with others at another institution or country, the individual can greatly extend that network. This study attempted to clarify the nature of e-research collaboration and to make it more understandable.

Ⅱ. Problem Statement

Researchers and scholars in the academic field are likely to produce new knowledge as a result of combining existing knowledge. There is a need for an organized structure to help research members to share knowledge and collaborate effectively. The formal instrument to realize the exchange and reuse the knowledge of researchers are the campus wide knowledge that acquires, organizes, and distributes newly created knowledge for collaboration. A few studies describe the institutional repositories regarding collaboration; however, they do not provide information as to the online collaboration activities of researchers in academic institutions. Collaboration activities will create more opportunities for members to exchange their ideas and engage in cooperative activities. Therefore, these activities will maximize the efficiency of members' performance in contributing to the success of their goals. This study investigates and identifies the unique characteristics of the major factors that influence the achievement of higher research productivity of academic insti-

tution. It also examines the ways in which those factors are interrelated.

The main purpose of this study is to investigate how the mediating effect of collaboration orientation and peer support influences both the impact and the quality contributions of the academic field. More precisely, our investigation is shaped by the following research questions:

- What are the most vital factors for successful e-collaboration among researchers?
- How are those factors different from the ones identified as crucial factors in academic sectors?
- Are there any relationships or implications among the factors in the relational and structural dimensions of successful academic research and e-collaboration?
- What is the role and usefulness of available technology in an academic e-collaboration?

Ⅲ. Literature Review on Academic Collaboration

Sargent and Waters [2004] reports the two-stage process background in order to understand the mechanisms that influence academic research collaborations. First, they discuss the process background, which highlights the relevant factors for each phase (from initiation to completion of research), such as collaborator motivations, nature and scope of the assignment, roles and activities, as well as project outcomes. Second, two sets of factors are affecting the phases of collaboration: (1) collaborative context (resources, support, and climate) and (2) interpersonal collaborative processes (communication, trust, and attraction). Rijnsover and Hessels [2011] discuss the understanding and optimal conditions for interdisciplinary research. They investigated about what characteristics of researchers are associated with disciplinary and interdisciplinary research collaborations and what collaborations are most rewarding in scientific disciplines. They found that in both types of disciplines, disciplinary collaborations contribute more to career development as well as to the quality of the work.

Therefore, further work is required to investigate the nature of collaboration across all stages of the career. Other researchers focused on the collaboration within academic contexts, specifically on international [Peterson, 2001; Stead and Harrington, 2000], cross-cultural [Easterby-Smith and Malina, 1999], and cross-profession collaborations. Most of the literatures focused on why these types of collaborations are useful. Hinings and Greenwood [1996] accounted for two types of collaboration outcomes; first, there needs to be academic outcomes, or publications, that not only make some minimal impact on the field, but an impact stronger than anything we could do individually. Second, there should be personal outcomes, or enjoyments, in working together. Thus, they defined that success in collaborations have three dimensions: (1) objective outcomes (publications, reports, and presentations), (2) subjective outcomes (satisfaction with collaborative experience, enhanced self-efficacy, and self-confidence) and (3) learning from other collaborators. Learning may include the expansion of one's content knowledge and knowledge about the process of research through the learning of specific skills, such as report writing and new data analysis techniques.

Ⅳ. Research Model, Variable Explanation, and Measurement Items

4.1 Research Model

We develop research model which is based on motivational factors (self-motivation for research and trust), and mediating factors (collaboration orientation and peer support) which influence academician to involve in e-collaboration in an academic research. The use of e-collaboration is a mediator between mediating factor and three outcome variables (research performance, satisfaction with e-research output and reward). All to gather, this proposed model makes possible to achieve higher academic productivity for the academician and ultimately have direct effect on receiving reward. Figure 1 is a research model for e-collaboration in an academic research.

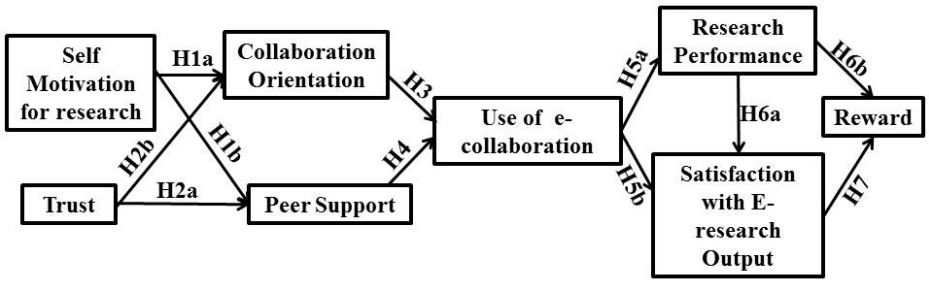
4.2 Motivational Factor

4.2.1 Self-motivation for Research

Self-motivation is a group of phenomena that affects the nature of an individual's behavior, the strength of the behavior, and the persistence of the behavior. There are many approaches to self-motivation for research: physiological, behavioral, cognitive, and social. Self-motivation for research is driven by an interest or enjoyment in the research task itself, and exists with the individual rather than relying on any external pressure. It is a crucial element in setting and attaining a goal.

Kankanhallii *et al*. [2005] explained that self-efficacy relates to the perception of people about what they can do with the skills they have. When people share expertise with the organization, they gain confidence in terms of what they can do and this brings the benefit of increased self-efficacy. Knowledge self-efficacy is typically presented in the form of people believing that their knowledge can help solve job-related problems, improve work efficiency, or make a difference to their organization. Wasko and Faraj [2005] explained how individual motivation of knowledge contribution in an electronic network of practice mainly occurs when individuals are motivated to access the network. In order to contribute knowledge, individuals must think that their contribution to others will be worthwhile and that some added value will be created, with expectations of receiving some of that value for themselves. Thus, the expectation of personal benefits can motivate individuals to contribute knowledge to others in the absence of personal acquaintance, similarity, or the likelihood of direct reciprocity.

Self-motivation for research is the ability to satisfy a desire or a goal in the best interests of research without the influence from other people or situation. It is typically shown in the form of people believing that their knowledge can help solve research-related problems, improve work efficiency, or make a difference to their research group. It has a direct impact on work performance. When motivation is low, both high- and low-ability people demonstrate low levels of performance. However, when motivation is high, performance variability due to the individual difference in ability will be more evident. They pay more attention to job stability, work challenges, and future growth within



<Figure 1> Research Model for E-collaboration in an Academic Research

the organization. It makes people play a subjective initiative by dint of the outside force, which is different from the motivation effected by the directly external stimulation.

4.2.2 Trust

Trust typically refers to a condition characterized by the following aspects: the trustor (one party) is willing to rely on the action of the trustee (another party). In addition, the trustor abandons control over the action performed by the trustee. McKnight *et al*. [2002; 1998] defined initial trust as trust in an unfamiliar party. When the trustor has no prior interaction with a trustee, he/she cannot develop trust based on direct experience with or first-hand knowledge of the trustee. Instead, the trustor will depend on other sources, such as second-hand information, contextual factors, or personal intuition, in order to make trust inferences. Trust is both an emotional and a logical act. Emotionally, it is where you expose your vulnerabilities to people, but believing that they will not take advantage of your openness. Emotions associated with trust include companionship, friendship, agreement, relaxation, and comfort.

Kanawattanachai and Yoo [2007] discussed the important managerial implications for organizations using virtual teams for critical tasks. They suggested that organizations need to highlight early and frequent task-oriented communications when they make a new virtual team. Once the team develops, they may be misdirecting their effort if managers continue to emphasize frequent task-oriented communication. Instead, managers should focus on supporting and coordinating the specialized knowledge of team members in the domain of the task requirements.

Most Information Systems (IS) trust research has focused on web vendor or virtual team members and thus, the trustee has been human, or an organization of humans. Recent IS research has discussed trust in technology as where the trustee is a technological artifact, such as a recommendation agent or an information system [Corritore *et al*., 2003]. Models of trust and technology acceptance have been applied to the relationship between humans and technology in the context of recommendation agents [Wang and Benbasat, 2005]. The empirical results support the nomological validity of applying such models to technology, with significant loadings for the three dimensions of trusting

beliefs (benevolence, competence, and integrity) and replications of the significant relationships among trusting beliefs and technology acceptance constructs [Wang and Benbasat, 2005].

Based on the above theoretical concept for motivational factor, we proposed following hypothesis for our research.

H1a: The greater the self-motivation for research the greater the positive effect on the collaboration orientation.

H1b: The greater the self-motivation for research the greater the positive effect on peer support.

H2a: The greater the trust on collaborators the greater the positive effect on peer support.

H2b: The greater the trust on collaborators the greater the positive effect on collaboration orientation.

4.3 The Mediating Factor

4.3.1 Collaboration Orientation

Collaboration orientation is a personal and organizational readiness of collaboration, the means by which research skills will improve due to online collaboration and interaction with other research members. It includes not only an individual's preference on collaboration with other researchers in an academic field, but also the organizational concern on research collaboration. The impact of collaboration in the organization as a whole has been studied at length.

Bozeman and Corley [2004] discussed how the scientific and technical human capital (S&T human capital) is the totality of scientific, technical, and social knowledge, as well as the skills and resources embodied in a particular individual. It includes (1) human capital grants, such as formal education and training, social relations and (2) network ties that bind scientists and science users together for knowledge value collectively. S&T human capital is a unique set of resources which the individual brings to his or her own work and to the collaborative efforts. They proposed a scientific collaboration model in which collaboration takes on mentoring characteristics, where a more experienced scientist collaborates with a junior scientist, post-doctoral researcher, or graduate students. In those cases, the junior partner can develop a wide variety of S&T human capital assets. They not only enhanced S&T knowledge, but craft skills, know-hows, and the ability to structure and research plans. They also increase contacts and connections with other scientists, industry, and funding agents.

4.3.2 Peer Support

Peer support occurs when people provide knowledge, experience, emotional and social or practical help to each other. It commonly refers to a creativity consisting of trained supporters, and can take a number of forms, such as peer mentoring, listening, or counseling. Peer support is also used to refer to creativity where colleagues, members of self-help organizations, and others meet as equals in order to give each other support on a reciprocal basis. According to Vygotsky [1978], students are capable of per-

forming at higher intellectual levels when asked to work in collaborative situations than when asked to work individually. Group diversity in terms of knowledge and experience contributes positively to the learning process. Bruner [1985] contends that cooperative learning methods improve problem solving strategies because students are confronted with different interpretations of the given situation. Peer support makes it possible for the learner to internalize both external knowledge and critical thinking skills and to convert them into tools for intellectual functioning.

Sykes *et al*. [2009] presented the social network perspective, which is a valuable tool employed by information system (IS) researchers to understand various phenomena. They proposed a model of acceptance with peer support (MAPS) that integrates prior individual-level research with social networks constructs. They argue that a person's embeddedness in the social network of the organizational unit executing a new information system can enhance one's understanding of technology use. An individual member could be the main source of help in overcoming knowledge barriers constraining the use of a complex system, and further, interactions with others member can determine one's ability to influence the eventual system configuration and features.

The collaborative learning medium provides researchers with opportunities to analyze, synthesize, and evaluate ideas cooperatively. The informal setting facilitates discussion and interaction. This group interaction helps researchers to learn from each other's knowledge, skills, and experiences. The reinforcement and support may include a peer's appreciation, encouragement, expectation, and patience to the individual's efforts in transferring learned knowledge and skills to his or her job.

Based on above explanation and discussion, we proposed following hypothesis for the mediating factor.

H3: The greater the collaboration orientation the greater the positive effect on use of e-collaboration.

H4: The greater the peer support the greater the positive effect on use of e-collaboration.

4.4 The Mediation Effect of Use of E-collaboration on Research Performance, Satisfaction with E-research Output and Reward.

4.4.1 Use of E-collaboration

E-collaboration has been seen as a new way of performing research and a strategic weapon, which could fundamentally change the traditional researcher relationships. There is an assortment in both academic and practical areas of what e-collaboration implies and how it differs from traditional collaboration in the academic field. Both e-research and e-learning are often associated with some form of collaboration (also referred to as e-collaboration). Borgman [2006] suggests that e-research can facilitate collaboration through distributed access to content, tools, and services. Kock [2007] defines e-collaboration as "collaboration using electronic technologies among different individuals whose goal is to accomplish a common task". Kock presented six key conceptual elements of e-collaboration: collaborative task; e-collaboration tech-

nology; individuals involved in the collaborative task; mental schemas possessed by the individuals; physical environment surrounding the individuals; and the social environment surrounding the individuals.

Riemer [2009] explained that e-collaboration systems have become the backbone infrastructure to support virtual work in and across organizations. Recent technology trends on the market offers plenty of systems that often support a wide range of communication and collaboration features. High speed internet, wireless connection, and web-based collaboration tools, such as blogs and wikis, has such created "mass collaboration." People from all over the world are efficiently able to communicate and share ideas through the internet, or even conferences, without any geographical barriers. Hence, use of e-collaboration plays key role for academician to extemporize their academic work.

4.4.2 Research Performance

Every human individual wants to distinguish themselves by particular competencies, attitudes, and interests, generally translating into outstanding levels of performance. Allison and Stewart [Allison and Stwart, 1974] discussed about the scientist performance dependent upon accumulative advantage (feedback through recognition and resource); highly productive scientists maintain or increase their performance but produce very little, and produce even less in the future. Therefore, top universities are able to attract top scientists, top students, and public and private financing with notable socio-economic benefits in their region [Abramo *et al*., 2012; Hancock *et al*., 1992].

Researcher performance depends upon several factors, such as research interest, ability to find important problems and their solutions, technical ability and persistence, creative thinking, good analytical skills, peer support, and an enjoyable working environment [Avital and Collopy, 2005; Jones and Preusz, 1993]. Performance of individuals and teams are measured through a set of metrics that pertain to a task and contextual performance. Similarly in academia, scholars and scientists are evaluated based on their academic performance (e.g., research productivity, teaching evaluations, governance capabilities) [Avital and Collopy, 2005]. Such evaluation of scholars is not only needed for faculty recruitment and promotion schemes, but also for governmental funding allocation as well as for achieving a high reputation within the research community. The reputation of research organizations indirectly affects the society's welfare, since high reputation attracts foreign purchases, foreign investments, and highly qualified students from around the world [Abbasi *et al*., 2010].

Research performance has a direct effect on the quality of publication, research fund generation, personal career development, and the creation of an identity in the research community [Bazeley, 2010; Goldstein, 2011]. Our research is tremendously valuable in establishing the basic phenomena in order to understand the relationship between those motivational factors and research performance, and we will further suggest adding another aspect that can help explain what and how the sources of contributions will be helpful for researchers in developing their own work performance.

4.4.3 Satisfaction with E-research Output

Research output is estimated and monitored at different levels and for different purposes [Henrekson and Waldenström, 2011]. At the macro-level, governments have selected the increasing project funding for research, usually allocated on a competitive basis, in determinant to institutional funding. To access this funding, researchers submit research proposals to a funding body. In the evaluation process, evidence provide proof that past publications have an important effect during the evaluation process for the expected level of grant funding [Arora *et al*., 1998]. At the micro-level, universities and research centers use publication and citation counts to monitor their researchers and give raises and promotions. Publications are also important channels of communication with the industry. Companies use publications to identify the expertise within the universities, ensued by hiring of faculty and graduates as consultants or employees.

He *et al*. [2009] described that the relationship between research collaboration and research output is likely to be confounded by a common latent variable, such as a scientist's ability. They further added that there are at least three theoretical explanations for a positive relationship between research collaboration and research output. The first is the perspective of knowledge recombination: knowledge creation is frequently improved by the combination of different expertise and know-hows from a wide variety of sources. Second, collaboration provides the opportunity for researcher or scientists to learn techniques and skills form their partners for his/her future research activities. Third, collaboration provides the platform for scientists with social networks where they can capture valuable information on research opportunities. Further, they might expose themselves to future research collaboration, leading to future research output. A number of existing studies have documented significant heterogeneity in the pattern of publications across areas.

Nevertheless, previous work has not made a systematic effort to explore how the scientific area conditions the research output and impact. This paper explores the determinants of research output and the impact of the most productive research in e- collaboration.

4.4.4 Reward

A reward could range from monetary incentives, such as bonuses, to non-monetary awards, such as gifts certificates, to praise the public recognition that does not have a monetary equivalent value. A reward could also be intrinsic, such as the pleasure derived from performing the task itself. Common extrinsic rewards include monetary rewards, recognition, and promotion. Favorable perceptions of rewards, in turn, have been linked to positive human resource outcomes such as job satisfaction, work motivation, affective commitment, high levels of performance and organizational effectiveness [Bratton and Gold, 2007; Squires, 2001]. Rewards should be arranged in such a way that it covers from the individual to the team level or across teams/work units.

Lee and Ahn [2007] discussed about the intra-organizational reward system for knowledge sharing. They considered two forms of the reward system: (1) individual based reward, which is based on the individual contribution of valuable knowledge, and (2) group based reward, which is based on the contribution of the whole group through knowledge sharing to organ-

ization performance. They found that the individual-based reward system depends on the amount and the productivity of shared knowledge. Bartol and Shrivastava [2002] examined monetary reward in the encouragement of knowledge sharing within the organization. They proposed four mechanisms of knowledge sharing along with the reward that should be distributed. First, knowledge contribution to the database permits knowledge sharing behaviors, which is to be recorded, and as a result, a reward is allocated accordingly. Second, in knowledge sharing in a formal interaction within or across teams and work unit, the reward allocator (e.g., group leader) is able to observe or track the knowledge sharing behavior of individuals. Third, in knowledge sharing through informal interactions, the key supporting factor is trust between the individual and the organization. In this case, although the reward is indirect, the fairness in the selection and distribution of the award becomes a crucial factor in the development of trust. Lastly, they discussed the emerging role of communities of practice within the organization.

These factors explore the determinants of research output and the impact of the most productive research in e-collaboration. However, previous work has not made a logical effort to explore how use of e-collaboration will influence academician to achieve higher productivity which ultimately has effect on their research performance and satisfaction. Based on above explanation and discussion for mediation effect of use of e-collaboration on research performance, satisfaction with e-research output and reward, we proposed following hypothesis of our research.

<Table 1> Measurement Variables, Definitions, and Related Prior Researchers' Efforts

Variable	Definition	References
Self-motivation for research	Self-motivation for research is an internal and external factor that stimulates the desire in people to continually be interested in and committed to the research without influence from other people or situation.	Kankanhalli *et al.* [2005] Wasko and Faraj [2005]
Trust	Trust refers to an aspect of a relationship among the co-authors, by which a given situation is mutually understood, and the commitments are made toward the actions in favor of a desired research outcome.	Corritore *et al.* [2003] McKnight *et al.* [2002] McKnight *et al.* [1998]
Collaboration orientation	Collaboration orientation is the preference of the co-authors, where they are eager to collaborate for the improvement of their overall research performance.	Bozeman and Corley [2004]
Peer support	Peer support is helping the co-authors by providing knowledge, experience, or practical help.	Bruner [1985], Sykes *et al.* [2009] Vygotsky [1978]
Use of e-collaboration	Use of e-collaboration enables teamwork among co-authors to accomplish a common research goal using electronic technology.	Borgman [2006], Katz and Martin [1997] Kock [2007], Riemer [2009]
Research performance	Research performance, the descriptor for performing as a high-level researcher, includes expression of creativity, originality, and innovation by discovering new facts for the academy.	Abbasi *et al.* [2010] Abramo *et al.* [2012] Allison and Stwart [1974]
Satisfaction with E-research output	Satisfaction with research output is the fulfillment of the co-authors' desire and expectation from research, which is investigated systematically in order to establish a fact and reach a new conclusion.	Arora *et al.* [1998] He *et al.* [2009]
Reward	Reward is honoring the efforts of researchers and encouraging them to exert more for the sake of elevating academic research to the highest levels.	Bartol and Srivastava [2002] Lee and Ahn [2007]

H5a: The greater the use of e-collaboration the greater the positive effect on research performance.

H5b: The greater the use of e-collaboration the greater the positive effect on satisfaction with e-research output.

H6a: The greater the research performance the greater the positive effect on satisfaction with e-research output.

H6b: The greater the research performance the greater the positive effect on reward.

H7: The greater the satisfaction with e-research output the greater the positive effect on reward.

Ⅴ. Methodology and Results

We used a five-point Likert scale (from strongly disagree to strongly agree) to evaluate the responses to the questions concerning motivational factors, mediator factors, e-collaboration, performance, and satisfaction. To empirically test the proposed research model, we simultaneously conducted paper-based surveys of graduate students, researchers, and academic collaborators. Our target was graduate students, researchers, and faculty members who are currently involved in an academic research institute. Concurrently, we collected 306 responses from graduate students, researchers, and faculty members. The research model and variables presented above were tested and verified by SPSS 20. Eight multiple-items construct (motivational factors, mediator factors, e-collaboration, performance, and satisfaction) were subjected for analysis by a factor analysis using SPSS 20. The validity of the constructs was evaluated in terms of uni dimensionality, convertgent validity, internal consistency, and discriminant validity. All factor loadings were significant at $p < 0.01$.

The samples herein were collected from Chonnam National University and Chosun University, Gwangju. Paper based samples were collected from domestic as well as international students, researchers and academicians. 48.03% of respondents were from the age group of 31~40 years. Majority of respondent (45.09%) have academic qualification PhD. Most of respondents were working as a researcher and 43.45% of the respondents were involved in e-collaborative re-

<Table 2> Demographic Descriptions

	Particulates	Male Frequency (%)	Female Frequency (%)		Level	Male Frequency (%)	Female Frequency (%)
Age Group	20~30	29 (9.47)	28 (9.15)	Qualification	Undergraduate	-	-
	31~40	105 (34.31)	42 (13.72)		Masters	58 (18.95)	48 (15.68)
	41~50	32 (10.45)	20 (6.53)		PhD	107 (34.96)	31 (10.13)
	51~60	40 (13.07)	10 (3.26)		Postdoc	41 (13.39)	21 (6.86)
Profession	Student	36 (11.76)	15 (4.90)	E-collaboration activity	< 1 year	68 (22.22)	57 (18.62)
	Researcher	124 (40.52)	72 (23.52)		2~5 years	98 (32.02)	35 (11.43)
	Faculty member	46 (15.03)	13 (4.24)		> 5 years	40 (13.07)	8 (2.61)

search since 2 to 5 years. Details of demographic data were presented on <Table 2>.

In order to assess the reliability and convertgent validity of our model, we need to check Cronbach's α, squared multiple correlations (SMC), and construct reliability and AVE values which are presented on <Table 3>. Cronbach's α estimates the proportion of the variance in the test score that can be attributed to true score variance. It is used to estimate the proportion to variance that is systematic or consistent in a set of a score. The value for each construct is more than 0.800, which implies that items have a relatively high consistency [Hair *et al.*, 2005]. The Cronbach's α values for the presented constructs range from 0.908 to 0.922, which is highly consistent within the constructs All the items presented on <Table 3> were significance at 0.01 level.

All the AVE values were greater than the 0.5 cutoff point indicating satisfactory convergence validity. Discriminant validity was assessed with Chain's methods [1998]. The square root AVE for each constructs was greater than the correlation of the construct with any other constructs; thus the measurement model evidenced discriminant validity. Constructs correlation data are presented on <Table 4>. Discriminant validity indicated the extent to which a given constructs differed from other constructs, the measures of the constructs were distinct and the in-

<Table 3> Result of Measurement Model Assessment

Constructs	Items	Mean	SD	Cronbach's α	Construct reliability	SMC	AVE
Self-motivation for research	4	4.49	.396	.908	**.841**	.721	**.735**
Trust	4	4.35	.388	.916	**.828**	.630	**.728**
Collaboration orientation	4	4.41	.402	.913	**.846**	.645	**.769**
Peer support	4	4.40	.432	.917	**.837**	.639	**.734**
Use of e-collaboration	4	4.48	.391	.917	**.857**	.599	**.801**
Research performance	4	4.39	.420	.915	**.885**	.641	**.777**
Satisfaction with e-research output	4	4.53	.378	.911	**.861**	.672	**.760**
Reward	4	4.41	.563	.922	**.822**	.589	**.753**

Note) All values were significant at $p < 0.01$.

<Table 4> Constructs Correlations and Collinearity Statistics

Constructs	SMR	T	CO	PS	UEC	RP	SRO	R	Collinearity Statistics	
									Tolerance	VIF
SMR	**.857**$^{+}$								.511	1.96
T	.639	**.853**$^{+}$							.482	2.07
CO	.720	.620	**.877**$^{+}$						.411	2.43
PS	.677	.695	.537	**.857**$^{+}$					.504	1.98
UEC	.662	.441	.661	.474	**.895**$^{+}$				.490	2.04
RP	.686	.573	.647	.687	.574	**.882**$^{+}$			.371	7.70
SRO	.745	.622	.688	.578	.641	.690	**.872**$^{+}$		.393	2.55
R	.656	.612	.595	.510	.651	.482	.635	**.868**$^{+}$	--	--

SMR = Self-motivation for research, T = Trust, CO = Collaboration Orientation, PS = Peer Support, UEC = Use of e-collaboration, RP = Research Performance, SO = Satisfaction with research Output and R = Reward, $^{+}$ = $\sqrt{AVE}$ and all values were significant at $p < 0.01$.

dicators were loaded onto an appropriate constructs [Messick, 1980]. Multicollinearity is a statistical phenomenon in which two or more predictor variables in multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a non-trivial degree of accuracy. The variance inflation factor (VIF) for Multicollinearity should be less than 10 (Cut-off value) [O'Brien, 2007]. Our constructs VIF values were less than 10, so there was not any issue regarding Multicollinearity.

We conducted an exploratory factor analysis to evaluate the measurement model (Williams *et al*., 2010). <Table 5> presents the data of the rotated factor matrix. This matrix is used to compute the rotated factor matrix from the original (unrotated) factor matrix. The factor transformation matrix describes the specific rotation applied to the factor solution for the proposed model. The value of Kaiser-Meyer-Olkin Measure of Sampling Adequacy is .843, which is meritorious.

<Table 5> Rotated Factor Matrix[a]

Constructs Items	Communalities	Factor							
		1	2	3	4	5	6	7	8
R2	.508	.801	.086	.051	.155	.008	.120	.034	.031
R4	.653	.571	.077	.154	.177	.298	.121	.091	.100
R3	.790	.537	.238	.062	.124	-.091	.170	.083	.047
T1	.524	.034	.788	-.043	.160	.218	.310	.138	.073
T3	.348	.091	.580	.088	.030	.084	.333	-.124	.161
T2	.399	.486	.553	.028	.094	.143	.058	-.069	.000
SO2	.691	.138	.112	.706	.178	.092	.246	.298	.147
SO4	.550	-.124	.051	.566	.037	.122	.195	.100	-.010
SO1	.633	-.069	.141	.541	.114	-.054	.284	.166	.235
RP1	.473	.098	.096	.016	.687	-.027	.277	-.068	.139
RP4	.569	.100	.160	.066	.542	.232	.019	.120	.115
RP3	.389	.166	.079	.041	.383	-.082	.047	.164	-.010
PS3	.546	-.068	.048	-.011	.092	.672	.028	-.005	.161
PS2	.851	.120	.094	.118	.122	.385	.131	.181	.000
PS4	.589	.164	.069	.032	-.054	.334	.193	.261	.121
SM1	.618	-.005	.069	.218	-.027	.034	.621	.044	.175
SM2	.559	.181	.177	-.069	.020	.072	.623	.138	.074
SM3	.429	.138	.148	.092	.352	.087	.511	.081	-.209
EC3	.508	-.124	.039	.070	.020	.186	.160	.584	.188
EC4	.523	-.069	.041	.078	.168	.073	.079	.550	.087
EC2	.410	.298	.052	.127	.066	.141	.048	.338	-.283
CO3	.581	.100	.134	.143	.073	.292	.175	.048	.564
CO2	.404	.166	.038	.062	.124	-.091	.170	.083	.563
CO4	.400	-.068	.101	.131	.183	.038	.174	.093	.485
Total Value		**7.209**	**1.151**	**1.285**	**.799**	**.729**	**.695**	**.573**	**.507**
Variance %		**30.038**	**4.797**	**5.355**	**3.331**	**3.039**	**2.895**	**2.386**	**2.112**
Cumulative %		**30.038**	**34.835**	**40.190**	**43.521**	**46.560**	**49.455**	**51.841**	**53.953**
Survey Questions		**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Note) Extraction Method: Alpha Factoring; Rotation Method: Varimax with Kaiser Normalization.[a];
a: Rotation converged in 18 iterations. Note: R1, SM4, T4, CO1, PS1, EC1, RP2, and SO3 were deleted.

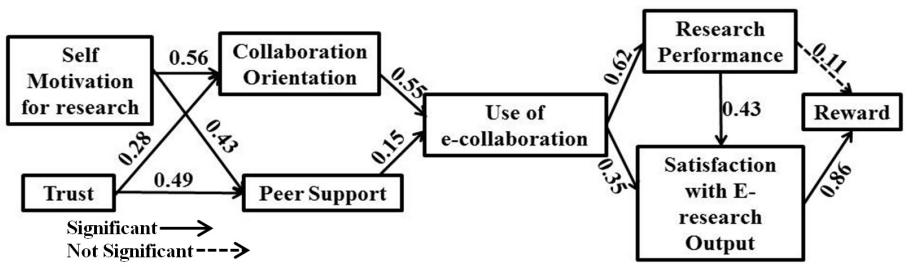
We evaluated common method variance by conducting a CFA. For this, we compared the eight-factor model with a single-factor model (or Harman's one-factor model) in which all the indicators were loaded into single factor [Podsakoff *et al*., 2003]. According to podsakoff *et al*. [2003], if common method of variance is substantial, then the single-factor model provides a better fit. The single-factor model did not provides a good fit (χ^2 = 1233, df = 248, GFI = 0.53, CFI = 0.86 and RMSEA = 0.30), indicating that common method bias was not a serious problem.

The structural model, including the research path of dependent and independent variable, was examined using AMOS. Path analysis is a statistical technique used to inspect the comparative strength of direct and indirect relationship among variables. A series of parameters are estimated by solving one or more structure equations in order to test the fit of the correlation matrix between two or more casual models, which are hypothesized by academician to fit the data. It is useful in making the rationale of conventional regression calculations unambiguous [Ducan, 1966]. <Figure 2> shows the standardized path coefficient of the research model, and <Table 6> presents the details of the path analysis with statistically significance values.

The model provides good fit of data: χ^2 = 261.59 (p value 0.000), df = 126, χ^2/df = 2.07, GFI = 0.90, AGFI = 0.89, RMR = 0.04, RMSEA = 0.07, CFI = 0.91 and NFI = 0.93. <Figure 2> demonstrates the details of the path analysis with statistically significance values [Hooper *et al*., 2008] except **H6b**. <Table 6> illustrates the result of summary of hypothesis which provide standardized path coefficient and result of the statistical tests. These results provide support for ten out of the eleven hypotheses.

Finally we verified the mediating effect of collaboration orientation and peer support on research performance and satisfaction with e-research output using a three step regression analysis method. In order for the fully mediated model to be accepted, it had to fulfill the following criteria; (l) the independent variable exerts an effect on the mediating variables, (2) the independent variable exerts effect on the dependent variable, and (3) the effect of the independent variable on the dependent variable is eliminated or reduced substantially when the effects of the mediating variables are controlled [Baron and Kenny, 1986].

According to Frazier *et al*. [2004], if the relation between independent variable and the dependent variable controlling for the mediator is zero, the data is consistent with a complete mediation model. If the relation between the in-



<Figure 2> Path Analysis Results of the Proposed Model

<Table 6> Summary of Hypothesis Testing

Hypothesis/Path	SPC	P	Results	Fit Indices
H1a: Self motivation for research → Collaboration orientation	.56	***	Supported	χ^2 = 261.59 p = .000 df = 126 GFI = .90 AGFI = .89 RMR = .04 RMSEA = .07 CFI = .91 NFI = .93
H1b: Self motivation for research → Peer support	.43	***	Supported	
H2a: Trust → Peer support	.28	***	Supported	
H2b: Trust → Collaboration orientation	.49	***	Supported	
H3: Collaboration Orientation → Use of e collaboration	.55	***	Supported	
H4: Peer support → Use of e-collaboration	.15	.001	Supported	
H5a: Use of e collaboration → Research performance	.62	***	Supported	
H5b: Use of e collaboration → Satisfaction with e-research output	.35	***	Supported	
H6a: Research performance → Satisfaction with e-research output	.43	***	Supported	
H6b: Research performance → Reward	.11	.174	Not Supported	
H7: Satisfaction with e research output → Reward	.86	***	Supported	

SPC: Standardized path coefficient, *** = significant at < 0.001.

dependent variable and the dependent variable is significantly smaller when the mediator is in the equation, when the mediator is not in the equation but still greater than zero, the data suggest partial mediation. We analyzed mediation effect using Preacher and Hayes [2008] method in SPSS 20. We summarized the result of the mediation effect of collaboration orientation and peer support on research performance and satisfaction with e-research output on <Table 6>. All the constructs have mediation effect. In this study relationship between dependent variable and Independent variable were statistically significance at $p < 0.01$.

- In this study the relationship between independent variable (CO) and mediating variable (UEC) was statistically significant (Step 1). The β value (.279) for collaboration orientation in step 3 was less than β value (.673) of CO in step 2; however it remind statically significant we concluded that the partial mediation effect of use of e-collaboration between collaboration orientation and research performance. Similarly, the relation relationship between independent variable (PS) and mediating variable (UEC) was statistically significant (Step 1). The β value (.462) for peer support in step 3 was less than β value (.499) of PS in step 2; however it remind statically significant we concluded that the partial mediation effect of use of e-collaboration between peer support and satisfaction with e-research output Finally, the relation relationship between independent variable (RP) and mediating variable (SO) was statistically significant (Step 1). The β value (.546) for research performance in step 3 was less than β value (.646) of RP in step 2; however it remind statistically significant we concluded that the partial mediation effect of satisfaction with e-research output between research performance and reward. We summarized the results of the mediation testing in <Table 7>.

<Table 7> The Result of Testing the Mediation Effect

	Step	Relationship	β	p	Adjusted R^2	F (Sig.)	Result
CO → UEC → RP	Step 1	CO → UEC	.642	0.000	.434	235.29 (0.000)	O
	Step 2	CO → RP	.673	0.000	.417	218.77 (0.000)	O
	Step 3	CO	.279	0.000	.453	127.22 (0.000)	O (Partial mediation)
		UEC → RP	.496	0.000			
PS → UEC → SO	Step 1	PS → UEC	.482	0.000	.222	87.94 (0.000)	O
	Step 2	PS → SO	.499	0.000	.323	146.79 (0.000)	O
	Step 3	PS	.462	0.000	.498	152.29 (0.000)	O (Partial mediation)
		UEC → SO	.302	0.000			
RP → SO → R	Step 1	RP → SO	.617	0.000	.468	268.86 (0.000)	O
	Step 2	RP → R	.646	0.000	.230	91.91 (0.000)	O
	Step 3	RP	.546	0.000	.399	102.42 (0.000)	O (Partial mediation)
		SO → R	.124	0.000			

CO = Collaboration Orientation, PS = Peer Support, UEC = Use of e-Collaboration, RP = Research Performance, SO = Satisfaction with e-research Output and R = Reward.

Ⅵ. Discussion and Implication

This study attempts to investigate how collaboration orientation and peer support provides a positive effect on research performance and satisfaction with e-research output. We have studied the effect of the use of e-collaboration as a mediator between mediating factor and three outcome variables. More specifically, the results indicate that use of e-collaboration facilities research performance of academicians. The Standardized path coefficient for usefulness of e-collaboration to research performance was 0.62, $p < 0.001$, suggesting that researcher can achieve better research performance through usefulness of e-collaboration. Researchers at universities and colleges tend to prefer working with other people or groups to working independently. Consequently, they like or are willing to share and exchange their materials with one another. We believe that trust is directly and indirectly related to the faith of work within the team members in order to work in a collaborative environment. The standardized path coefficients for trust to peer support and collaboration orientation were 0.49 and 0.28, $P < 0.001$, suggesting mutual understanding among collaborator is essential in order to perform their respected task. Hence, collaborators have a mutual understanding among them in order to perform their respected task in efficient way.

This research ranges from studying the alignment of specific collaboration and objectives. In general, collaboration seems to promote higher levels of organizational integration, and is also expected to result in improved academic performance. Researchers have also tried to explain the apparent collaboration by drawing attention to the differences between the research traditions of the disciplines (e.g., management, economics, and production) from which the studies are derived. We discuss the development of individual researcher performance in a collaborative manner. Along with the emergent states,

particular collaborative behaviors also shape performance outcomes.

The standardized path coefficient for self-motivation for research to collaboration orientation and collaboration orientation to usefulness of e-collaboration was 0.56 and 0.55, $p < 0.001$ respectively, which suggested that self-motivation for research and collaboration orientation plays important role in collaborative research. Path analysis data as well as testing of mediation effect <Table 7> suggested that there was partial mediating effect of collaboration orientation on research performance in the presence of mediator usefulness of e-collaboration. This result supports that e-collaboration systems have become the backbone infrastructure to support virtual work in and across research organizations [Riemer, 2009].

Mediation is a causal model that explains the process of "why" and "how" a cause-and-effect happens [Baron and Kenny, 1986; Frazier *et al.*, 2004]. Hence, a mediational analysis attempts to "identify the intermediary process that leads from the independent variable to the dependent variable" [Muller *et al.*, 2005]. In other words, in a simple mediational model, the independent variable is presumed to cause the mediator, and in turn, the mediator causes the dependent variable. We provide an easily understood example for a mediation model where collaboration orientation (i.e., independent variable) is hypothesized to affect usefulness of e-collaboration (i.e., mediator), and in turn research performance of the academicians. (i.e. dependent variable). Similarly, we explained how peer support influences on satisfaction with e-research output by use of e-collaboration tool and techniques. Testing of mediation effect data <Table 7> supports our hypothesis and model. So, academicians can implement this model to achieve better output from their research through collaborative study.

In this research we find the support given to the researcher, such as financial support for research related travels seminars and financial incentives. The sharing of rewards may play an important role in determining a group's creativity relevant processes and outcomes through its interaction with other factors, such as its task or its operating conditions. These factors include the ability of group members to identify each other's contributions. The awareness and enhancement of such reward systems will eventually strengthen researchers and scholars and allow them to develop important strategies for the future of their research. During our analysis, we get that standardized path coefficient for satisfaction with e-research output and reward (0.86 and $p < 0.001$) was the highest one. This data support that if we achieve the good outcome from our research, the probability of getting reward is higher. Favorable perceptions of rewards have been linked to positive human resource outcomes such as job satisfaction, work motivation, affective commitment [Bratton and Gold, 2007; Squires, 2001].

This study suggested that use of e-collaboration functions as a mediator between collaboration orientation and peer support with research performance and satisfaction. We empirically confirmed its mediating effect with our predictor and outcome variables. Based on the result of our empirical testing, we suggest several important implications with regard to academic e-collaboration for both practitioners and academicians. This study contributed to mount-

ing evidence that researchers can benefit by engaging in e-collaboration. We suggest that electronic collaboration is composed of electronic information sharing and electronic cooperation between researchers and collaborators, and these influences the development of academic research performance with regard to e-research output.

This study offers several implications for academicians. First of all, we develop a parsimonious research model for the first time, which is related to e-collaboration in academic research. This unique model offers academicians to achieve good publication output from the research team. The motivational factor, self-motivation for research and trust, are important factors which has received positive impact of mediating factor collaboration orientation and peer support. Prior researcher's efforts have been focused on investigated about what characteristics of researchers are associated with disciplinary and interdisciplinary research collaborations and what collaborations are most rewarding in scientific disciplines [Sargent and Waters, 2004; Rijnsoever and Hessels, 2011; Peterson, 2001; Stead and Harrington, 2000]. Basically, we discuss as to how e-collaboration helps academicians to develop their skills and knowledge in order to achieve higher academic output. How can the different people from different places work jointly to achieve the same goal or academic interests? What are the factors which bound them to work together to achieve quality academic output?

Our research sheds light on the crucial factors for e-collaboration which offer the ultimate effect on performance and satisfaction with e-research output. Satisfaction motivates people to work more and more on the field of their interest, thereby influencing the performance of academicians. Rewards should be distributed according to performance of the individual, which will motivate the person to become more enthusiastic for his work of interest.

Based on the results of our empirical testing, we suggest several important implications with regard to an academic based electronic collaboration for both practitioners and researchers. This study contributed to an increase in the evidence that researchers can benefit by engaging in collaboration. We suggest that electronic collaboration is composed of electronic information sharing and electronic cooperation. These factors differentially influence the development of research information capability with respect to a researcher's competence toward academic research.

Ⅶ. Conclusion, Limitation and Future Research

This work was carried out in the context of collaborative factors for use with academic practitioners, research scholars, and business institution sectors. The success of collaboration can help scholars, collaborators, and research groups to increase the research awareness of the important areas that contribute to successful collaboration. E-collaboration tools could advance collaborative research beyond the traditional approach and raise it to higher levels of research productivity. Therefore, researchers might need to change their patterns of collaboration and devote their time and effort to do so. Our evidence suggests that in understating the collaborative process, one must account for the context in which the collaboration occurs, the motivation of the colla-

borators, the scope and nature of the project, the roles and activities undertaken, and interpersonal processes such as trust. Researchers' motivations for engaging in collaboration were both instrumental and intrinsic.

This study also provides a basic appreciation of e-collaboration, supporting its systems and tools. By looking at different well-documented case studies, it investigates how e-collaboration alters the way of conducting research and its impact on researcher's relationships. Collaborative research has been increasingly celebrated by the science community; yet, the hypothesized positive relationship between research collaboration and research output is more assumed than rigorously tested.

There are some limitations for this study. First, in terms of the generalization of findings, the data are only collected from Gwangju, South Korea. Therefore, it is only prudent that caution be exercised in generalizing the findings. Further, the majority of researchers were new in the collaborative research and thus, they may have limited knowledge of online research collaboration. Thus, future research should generalize this study's results by considering a wider range of countries and experienced researchers. Second, in this research, reward was assumed to be affected by research performance and satisfaction with research output. But perceived reward may also be defined as an independent variable which could have influence on collaboration orientation and peer support. In the future, a recursive process, the loop which starts from motivational factors including perceived reward through mediating factors and finally leads to research performance factors, might be developed as a research model, and be empirically tested.

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〈Appendix〉 Questionnaire Items

Constructs	Items	
Self-Motivation for research	SM1	I enjoy working on the topic of my research interest.
	SM2	Developing new research ideas makes my working life enjoyable.
	SM3	Reading interesting research articles motivates me to become involved more and more in the research.
Trust	T1	Trusting my coauthors helps me to make a mutual understanding in order to achieve the goal of research.
	T2	I believe my coauthors are willing to share research information with each other.
	T3	I believe that the empirical data shared by our coauthors is accurate.
Collaboration Orientation	CO2	I am willing to improve my research skills with the help of other coauthors in order to successfully complete my work.
	CO3	I am willing to cooperate in refining an appropriate research model for our study with my coauthors.
	CO4	I prefer to cooperate in a close discussion about the selection of our research project with my coauthors.
Peer Support	PS2	My group members support creative and higher order of thinking for the progress of the research.
	PS3	My coauthors help each other to refine the research model in order to improve the quality of the research.
	PS4	My group members help each other to refine research questions in order to improve the quality of the research.
Use of e-collaboration	EC2	An e-mail is a convenient tool to interact with my coauthors.
	EC3	Messaging through messenger is very efficient to share research related issues with my coauthors.
	EC4	Collaboration with coauthors enables me to heighten my research interest and skills.
Research Performance	RP1	I achieve good research results with the efforts of our coauthors.
	RP3	I critically analyze my assigned task and perform accordingly in order to achieve good research findings.
	RP4	I achieve good publication through our research results.
Satisfaction with e-research output	SO1	I am satisfied with the research results achieved by our group.
	SO2	I am satisfied with the publication derived from our research results.
	SO4	I am satisfied with the empirical data derived from our research results.
Reward	R2	Research funds motivate me to prepare my research proposal.
	R3	My school encourages me to attend national/international conferences by supporting the expenses.
	R4	Research funds allow me to have passion for my research work.

◆ About the Authors ◆

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