Information Sharing and Creativity in a Virtual Team: Roles of Authentic Leadership, Sharing Team Climate and Psychological Empowerment

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Abstract

Creativity is crucial in an ever-changing e-business environment. The creation of new value is essential for companies to gain the competitive edge and to pioneer new markets in e-business. Hence, many companies in e-business operate virtual teams as they are suitable to generate creativity. Even so, virtual teams possess the inherent weakness of a lack of cohesiveness. Hence, for a virtual team to be creative, team members should help each other and share information. This study emphasizes the importance of information sharing that is supposed to improve creativity and explains how to increase them for virtual teams. To explain these relationships, three dimensions are routinely examined in organizational behavior studies: leaders, teams, and members. As a consequence, and through empirical analysis, authentic leadership, sharing team climate, and psychological empowerment enhances information sharing and creativity through their respective roles, in addition to information sharing directly increasing creativity. To improve creativity and information sharing of virtual team members in e-business, this article has highlighted the importance of the three roles stated prior. Such factors can increase information sharing and creativity, and will help virtual teams and organizations to be more successful in e-business.

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1. Introduction

Today, most organizations are faced with intense competition and drastic environmental change such as technological and international relations in e-business. In this situation, organizations need to find solutions to help them adapt to the changing environment [1]. The creativity of firms is one of the most crucial factors in this fluid setting as creativity is involved with developing various new technologies. It should go without saying that creative people can develop more valuable technologies and contribute to the development of organizations. Thus, the creation of new values provides an opportunity to gain a competitive advantage in a dynamic environment.

One of many strategies to secure creativity is to organize and utilize virtual teams. As technology develops, corporations utilize their technological strengths such as the use of mobile applications for organizational management [2]. These information technologies support "business operations benefits of convenience, efficiency, flexibility, accuracy, productivity, and innovation" [3; p.5420]. Accordingly, such new technologies have led to new types of groups such as the virtual team. As the utilization of the Internet, mobiles, and information has become fundamental in these virtual groups, information related management capacity, technology, behavior, and values have been shown to influence organizational performance [4].

For sake of clarity, it is important to note that a virtual team refers to a group of members with specific and unique skills, located in separate places, who have to collaborate using technology across time and space to achieve crucial organizational tasks [5]. Since a virtual team allows members to join and leave the team quickly when environmental demands change, the team can maintain and collect a diverse range of team members [1]. Still, it is equally important to note that a virtual team has innate disadvantages. Members of a virtual team do not come into direct face to face contact. As a result, when compared with traditional groups, it is more difficult to form deep and close relationships among virtual team members. This shallower relationship if you will between members can certainly reduce team identification and cohesiveness and as a consequence, information sharing within a virtual team may become more difficult. Logic dictates that the process of innovation and performance increasingly depend on how team members utilize social technologies to share information [6, 7]. Accordingly, this study seeks to explain how to increase creativity, which is the core value of a virtual team, via information sharing.

To begin, in order to increase information sharing in a virtual team, this study suggests three-broad factors; leadership, team and member dimensions from organizational behavior studies. A leader for starters, motivates and influences members so that they can naturally improve their information sharing. This article as sought to explain how to improve information sharing through such authentic leadership. Authentic leadership for the purposes of this article can best be understood as to enhance the information sharing by certain characteristics such as optimism, hope, and resilience [8]. With regards to team dimension, this will largely involve the relationship among co-workers and their supervisors. When a certain positive team climate is formed, the communication between members improves, and thus will cooperate more with each other. Hence, a specific type of team climate should increase information sharing [9]. Lastly, this article will go on to describe the psychological empowerment that members need in order to share information. Psychological empowerment

will be understood as the ability to ensure autonomy and self-determination [10], so that members can share information more often and more freely.

Put simply, this research maintains the need for a virtual team to encourage creativity in contemporary e-business situations. The article demonstrates the importance of information sharing as a necessary factor to improve creativity in the virtual team. It also discusses the roles of specific leadership, the team climate, and individual characteristics needed to increase information sharing. By way of such factors, this article makes the case for virtual teams as they will be able to improve a firm's creativity; an important value in this hyper competitive age. For these reasons, any performance improvement of the virtual team should increase the probability of success in e-business.

2. Literature Review

2.1 Virtual Team

The term virtual is related to "concepts such as the virtual knowledge network, the virtual organization, the virtual team, the virtual community of practice, and the virtual workplace" [11; pp.20-21]. The development of IT and communication technologies in e-business has led to new opportunities for companies to create and utilize virtual teams [5]. A virtual team refers to a new format of a team, in which workers are geographically scattered, and do not have or have few face-to-face meetings. Additionally, these employees also have a shared goal like traditional team members, and because the term 'team' inherently involves a united purpose of some sort [11]. Even with geographical distance, separated members individually bring their own important skills in a virtual team and as such, are forced to cooperate in order to fully utilize the technologies to achieve the team's goals. By its very existence, and under the proper conditions of course, a virtual team can emphasize problem-solving, creativity, cross-function, in addition to overcoming space and time limitations [5].

2.2 Information Sharing

Information is an essential element of success in an e-business environment. Information, particularly related to concepts such as business intelligence allows enterprises to gain competitive advantages or new opportunities in business areas [12]. Extremely large amounts of data can make it hard for companies to use existing database management tools and facilities [13]. To have a successful information system, a specific business analysis approach, or information sharing is needed [14]. In an organization, an information system becomes a key factor for innovation. Information technology also allows organizational transformation [15].

Information sharing for the purposes of this article refers to a crucial process where team members collectively use their accessible information resources [16]. Information sharing means that members exchange or provide information to each other, thus personal level information becomes information resources at a group or organizational level. Moreover, information sharing is a voluntary action undertaken by team members. This behavior is not mandatory, nor specified in the job description. In order to share information, team members should have a willingness to share their own information with their coworkers [16].

Correspondingly, information sharing also includes members' learning, so it has a positive relationship with their performance. Furthermore, information sharing allows members to acquire new information. Information, which is shared by members includes job-related content, new technologies, individuals' experiences, know-how, and organizational policy. It

is through this sort of data distribution that members make better decisions through new information. Moreover, when members of a team get a variety of new information, they are able to run new work processes [17]. As a result, information sharing allows team members to create new values and is thus a necessary factor in e-business that requires creativity, leading to improved performance and productivity.

2.3 Authentic Leadership and Information Sharing

Authentic leaders have conspicuously open minds and are frank in sharing their ideas, life stories, emotions, successes, failures, achievements, and personal endeavors [18]. Authentic leaders should focus on the positive influences of honesty, integrity and high ethical standards in a leader-member relationship [19].

Relational transparency, which is one dimension of authentic leadership is directly related to the sharing of information that is appropriate to the situation, or the presentation of the authentic and true self through open and honest communication with members [19]. Hence, an authentic leader does not hide information and intentionally avoids not informing members of any necessary information. Such a leader freely discloses one's information and knowledge to team members, who can also share more information with the leader. Leaders who emphasize transparency make it possible for followers to share information with each other. It can be seen that the transparency of an authentic leader will play a direct role in improving information sharing among members of the team. Other dimensions of authentic leadership such as balanced processing and internalized moral perspective are also related to information sharing [20]. Balanced processing is defined as the volition or tendency to objectively analyze proper information and seek the opinions of others before making a decision [21]. An authentic leader will need to share ideas, opinions, and information with followers. This type of leader does not hesitate to ask or share ideas with a group member. Also, workers who are influenced by authentic leadership are not reluctant to exchange ideas. Lastly, the internalized moral perspective refers to a specific form of self-regulation whereby individuals are guided by internal moral standards rather than external pressures to take action [19]. Leaders who have moral standards act morally and ethically. Thus, the frequency of the leaders' altruistic and pro-social behaviors are also increased. Accordingly, followers who are influenced by authentic leadership will have a tendency to share their information and knowledge with colleagues for overall team achievement. In short, authentic leadership, which emphasizes the openness of information, will facilitate the sharing of information among members of the team. Drawing from such empirical results, this paper proposes the following hypothesis.

H1. Authentic leadership will have a positive relationship with information sharing.

2.4 Team Climate and Information Sharing

Sharing is a social exchange behavior among people in communities. An individual who is relatively close to other people will be exposed to both mutual and social influences [9]. Such social influences occur in teams, as team members are willing to identify closely with their coworkers as well as the team. Furthermore, team members are likely to comply or accept a teams' policies or norms [21].

Because the prevailing climate of a team can affect the attitudes or behaviors of members, a particular team climate can affect team members' specific behaviors such as information sharing. Therefore, a specific team climate, which supports information sharing, can shape a specific team environment, which encourages sharing information or knowledge among

members [9]. Hence, members of the team will share more information when they believe that the members should share information for team performance, when the team has an atmosphere to freely share information, or when there is an atmosphere encouraging knowledge sharing. In addition, cohesion can also influence information sharing. Cohesiveness refers to individual members' being attracted to the team, or the tendency of a team to remain unified. It is a psychological force, which closely bands team members together [21]. Cohesiveness tends to increase peoples' volition to help or support their coworkers. As a result, employees in a highly cohesive team are willing to share information or knowledge with coworkers [9]. Thus, the following hypothesis is offered to be tested.

   H2. A sharing team climate will have a positive relationship with information sharing.

2.5 Psychological Empowerment and Information Sharing

Empowerment means the sharing of power and is the motivational concept of self-efficacy for subordinates [22]. Furthermore, empowerment can facilitate increased intrinsic motivation of tasks [23]. Psychological empowerment has diverse aspects, including meaning, competence, self-determination, and impact [10]. Meaning refers to the value of a team's goal or a shared purpose and is associated with an individual's ideals or standards. Competence is similar to self-efficacy and refers to a person's belief in their capability or ability to achieve tasks. Self-determination means a person's sense of having the rights or opportunities to choose to regulate and to initiate actions. Impact refers to the degree to which a person can influence various work outcomes. Psychological empowerment involves sharing information in organizations, and information availability is directly related to empowerment within organizations. Hence, inclusive of sharing behaviors, psychological empowerment brings more positive outcomes in organizational situations [10, 22, 23].

   Information which is associated with an organization's mission and performance is crucial for empowerment [17]. Knowledge and information sharing in teams do not always occur automatically, thus, we need specific stimuli [24]. Psychological empowerment involves autonomy [10]. When employees have autonomy, their intrinsic motivation levels also increase [23]. Intrinsically motivated workers have a tendency to help others by, for example undertaking organizational citizenship behavior, which is a voluntary and pro-social behavior for organizations or teams [25]. Team members who have psychological empowerment will more frequently undertake activities that help their peers, such as information sharing. Also, intrinsic motivation directly increases information or knowledge sharing intentions [23, 24, 25]. An additional element of psychological empowerment is impact. A team member with impact acts in a variety of ways to influence task outcomes. For instance, the member exchanges information with other colleagues or suggests their own opinions for better work results. When one's opinions or ideas are adopted, the worker will share more information. Hence, impact also has an influence that increases the information sharing of members. Accordingly, team members are likely to receive fair recognition by an empowering leader for their contribution of ideas and information, which motivates them to again share their unique knowledge with one another. Similarly, participative decision-making and coaching behaviors of an empowering leader will also encourage knowledge sharing in teams [24]. Moreover, in the relationship between empowerment and information sharing, empowering leadership plays a valuable role. Empowering leadership encourages members to participate in decision making, thereby allowing them to share ideas. When a leader encourages workers to suggest ideas and gives them an opportunity to voice their opinions, they believe that they can influence team decision making, and further, they will

find their knowledge sharing actually relevant [24]. Therefore, the following hypothesis is offered to be tested.

H3. Psychological empowerment will have a positive relationship with information sharing.

2.6 Creativity and Information Sharing

Creativity refers to the ability or capability to produce novel and useful ideas and thoughts by an individual or a team of individuals working together [26]. These perspectives explain creativity by focusing on the individual or individuals who produce creative outcomes. "Creativity is the generation of new and useful ideas by individual employees, whereas innovation involves the successful implementation of creative ideas by the organization. Thus, employees' creativity is often the starting point for innovation" [27; p. 683]. Creativity is a necessary competency for an organization's survival in today's e-business world where innovation is constantly needed. Moreover, creativity is a strategic resource that is flexible, valuable, and substitutable or incompletely initiable. Creativity is also the foundation of new technologies of the enterprise and a driving force for developing various products and services. This driving force affects the technological development of society and the competitive advantage of companies [26, 28].

Information sharing plays a key role in supporting expertise, creative thinking skills and motivation, which are core constituents of creativity. Also information sharing enhance creativity by allowing individuals to acquire new information and learning, to ensure diversity and new perspectives, and to increase self-efficacy. When employees work together more often, they can exchange more ideas and information, and further, individual members will be exposed to more knowledge. Through this dynamism, they will have more creative thoughts [26]. Hence, when team members each have different knowledge and share this information, they will be more diversified and creativity will increase. These workers may ultimately get new perspectives, learn more, and have more diverse ideas, which in turn stimulates their creativity [29]. From another perspective though, any negative relationship between members may reduce imagination. Some members do not share information with each other, for various reasons such as personality clashes, and negatively engage in political activities or gossip. Such negative behavior reduces intrinsic motivation and creativity [26]. In light of this theoretical background, it can be seen that information sharing plays a critical role in enhancing creativity by itself. When members share information with each other, they learn new things and have more diverse thinking. Thus, workers will have new perspectives and can make various and new attempts. Hence, when members share various information, creativity will increase. Depending on this logical relationship, we set the following hypothesis.

H4. Information sharing will have a positive relationship with a workers' creativity.

2.7 Creativity and the Mediating Effects of Information Sharing

Authentic leadership promotes team members helping each other and sharing information in a transparent manner. Authentic leadership is characterized by sharing one's own ideas and thoughts [18]. This sharing behavior will also affect the sharing of information among members. Thus, authentic leaders will make their members share information and have different perspectives that will increase their creativity. Authentic leaders also emphasize transparent and open relationships [19]. In this atmosphere, it is difficult for members to hide their information. Thus, the relational transparency of authentic leadership will facilitate information sharing among followers. Also, members who are influenced by the authentic

leaders act more ethically and help each other [19, 20]. These actions will include sharing information that is necessary for each other and through this information sharing, members will be able to have more diverse perspectives, learn new things, assist each other, make new attempts, and eventually increase their creativeness. Based on these logical relationships, we set the following hypothesis.

H5. Information sharing will mediate between authentic leadership and creativity.

Also, a sharing team climate creates an atmosphere in which members are open to their ideas and information throughout the team. Climate affects behavior, and a sharing climate increases the degree of information sharing [9]. Behavior, thoughts, and emotions can all be shared [5, 6]. Among them, sharing information has the most critical role in enhancing creativity. Information is closely related to the learning and thinking of the members. Thus, when workers approach jobs with new minds, their creativity will increase. When members share information, learn together and think new, creativity will increase throughout the team. In the shared climate, the members will share more information, so that members can pursue new things with various perspectives. In this climate, creativity will improve through information sharing. Based on this relationship, we set the following hypothesis.

H6. Information sharing will mediate between sharing climate and creativity.

Psychological empowerment ensures autonomy for members. Thus, they can freely express opinions and ideas in the team. They also have the belief that their opinions and shared information are well adapted to their co-workers. Hence they can trust that their opinions and information are helpful to each other, so they can share more information [11, 23, 24, 25]. Moreover, psychological empowerment enhances intrinsic motivation [10, 23]. Intrinsically motivated members achieve higher performance and satisfaction, which in turn affects the increase in behavior that they are more favorable to their colleagues on the team [24, 25]. Hence, psychologically empowered members will be able to share information more freely and easily share the information they need for their peers. In addition, when empowering leadership influences members and their members become aware of psychological empowerment, they focus more on team performance and help each other or share information to solve team problems [25, 26]. Psychological empowerment has a positive impact on information sharing in a variety of ways. Members' sharing information by psychological empowerment can have self-efficacy in solving team problems [23]. Thus, information sharing enhances self-efficacy and this process will increase creativity. Drawing from such empirical results, this article proposes the following hypothesis.

H7. Information sharing will mediate between psychological empowerment and creativity.

Fig. 1 indicates the research model. The relationship between authentic leadership and information sharing is H1, and the other independent variables(sharing team climate and psychological empowerment) and information sharing are represented by H2 and H3. The relationship between information sharing and creativity is H4. In addition, the mediating effects of information sharing in the relationship between independent variables and creativity are shown as H5, H6, and H7, respectively.
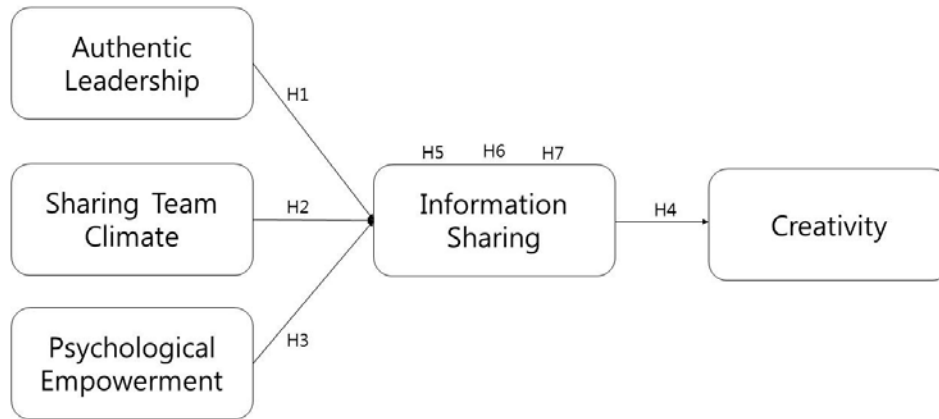
Fig. 1. Research Model

3. Participants and Measurement

3.1 Participants

Data were collected from 138 employees who are members of 42 virtual teams in 16 IT companies. The teams associated in this data collection are created temporarily and disband when the project is over. Most of these virtual teams are task forced teams - hence, workers do not work continuously on one team. The survey collected data for about a month from December 2016 to January 2017. Data collection methods are based on online such as email (around 50 employees) and google survey systems (around 90 employees).

Background information on these employees is as follows: 95 (68.8%) of the employees were male, and 43 (31.2 %) were female; 13 (9.4%) were in their twenties, 91 (65.9%) were in their thirties, 30 (21.7%) were in their forties, and 4 (2.9%) were fifty or over; 8 (5.8%) had completed high school only, 87 (63.0%) held a bachelor degree, 43 (31.2%) held a masters or doctoral degree; 16 people (11.6%) had worked for less than one year at their current company, 45 (32.6%) had worked for between 1 and 5 years, 54 (39.1%) had worked from 5 to 10 years, 23 (16.7%) had worked for longer than 10 years.

3.2 Measurement

All items were rated on a Likert-type scale ranging from 1 (totally disagree) to 7 (totally agree).

Authentic leadership was measured by 12 items [30], including, "My leader solicits feedback for improving his/her dealings with others (self-awareness)", "My leader carefully listens to alternative perspectives before reaching a conclusion (balanced processing)", "My leader expresses his/her ideas and thoughts clearly to others (relational transparency)", "My leader resists pressures on him/her to do things contrary to his/her beliefs (internalized moral perspective)".

Sharing team climate was measured by 6 items [16], including, "Team members are assigned to tasks commensurate with their task-relevant knowledge and skill", "People in our team share their special knowledge and expertise with one another", "There is virtually no exchange of information, knowledge, or sharing of skills among members ".

Psychological empowerment was measured by 12 items [10], including, "The work I do is meaningful to me (meaning)", "I am confident about my ability to do my job (competence)", "I can decide on my own how to go about doing my work (self-determination)", "My impact on what happens in my department is large (impact)".

Information sharing was measured by 8 items [17], including, "I actively use IT sources available in the company to share my knowledge and information", "I share with others useful work experience and know-how", "After learning new knowledge or information useful for work, I promote it to let more people learn about it". "In daily work, I take the initiative to share my work-related knowledge to my colleagues", "In the workplace I take out my knowledge to share with more people", "So long as the other colleagues need it, I always tell whatever I know without any hoarding", "I keep my work experience and never share it out with others easily (reverse)", "I never tell others my work expertise unless it is required in the company (reverse)".

Creativity was measured by 9 items [27], including, "I suggest new ways to achieve goals or objectives", "I search out new technologies, processes, techniques, and/or product ideas", "I develop adequate plans and schedules for the implementation of new ideas".

4. Analysis

For the empirical analysis of this study, we used exploratory factor analysis (EFA), Cronbach's α for reliability, descriptive statistics, linear regression and the Sobel test [31]. Factor analysis is a statistical and systematic approach for identifying and understanding unobservable variables presumed to underlie a set of connected measurements. For factor analysis, we used EFA, which is the traditional method used for investigating data using the common factor model. For EFA we used initial solution statistics, the principal components method, and varimax rotation. As a result, we found six components. Psychological empowerment could be divided into two components (meaning and competence were one, and self-determination and impact were another). In EFA, factor loading should be suggested of 0.4 or more among the same factors, but less than 0.4 with other factors. In this study, all components have significant commonality. Also, each component has an eigenvalue above 1.0. Eigen value should be greater than 1.0, which refers to the number of factors one component can explain. In addition, KMO above 0.7 means middle significance value [32]. As a result of exploratory factor analysis, each factor has significant validity. For instance, factor loading of sharing team climate: .622-.769 (3.948), authentic leadership: .557-.809 (6.581), meaning and competence of psychological empowerment: .609-.769 (4.142), self-determination and impact of psychological empowerment: .698-.770 (4.982), information sharing: .605-.809 (5.070), creativity: .651-.831 (6.217). The parentheses indicate the Eigen Value, and KMO was .749 (sig=.000).

Table 1 indicates results of reliability and they have enough values (when Cronbach's α is higher than .8), the results of descriptive statistics (mean and standard deviation) [33], and the results of the correlation. All variables have significant and positive correlations with the others [31]. Particularly, information sharing and creativity have a higher correlation (.529,

$p<.001$), and contrary to this sharing team climate and creativity have a lower correlation (.206, $p <0.1$). Thus, hypothesis 4 was accepted.

Table 1. Results of reliability, descriptive statistics, and correlation

	Cronbach's α	Mean	Std. Deviation	SC	AL	PE	IS	CR
SC	.860	5.416	.857	-				
AL	.915	4.687	.887	.257***	-			
PE	.925	5.231	.721	.477***	.325***	-		
IS	.903	5.621	.867	.278***	.242***	.286***	-	
CR	.933	4.871	.952	.206**	.334***	.376***	.529***	-

***$=p<.001$ **$= p <.01$ *$= p <.05$ †$= p <.1$

SC=sharing team climate, AL=authentic leadership, PE=psychological empowerment, IS=information sharing, CR=creativity

   Table 2, 3, 4 are about the mediating effect of information sharing between three independent factors (authentic leadership, sharing team climate and psychological empowerment) and the dependant factor (creativity) In step 1, each table shows the effect of the independent factor on the dependant factor (creativity). Then in step 2, we put the mediating factor (information sharing). In step 2, the mediating factor needs to significantly influence the dependent effect, and the effect of the independent on the dependant factor should be decreased. In this case, the effect of independence factors on dependent factors can be reduced at a significant level (partial mediating effect), or at a level that is not significant (perfect mediating effect) [31, 34].

Table 2. The mediating effects of information sharing between authentic leadership and creativity

	dependant : creativity						
	step 1			step 2			
	β	t	sig	β	t	sig	VIF
authentic leadership	.334	4.130	.000	.219	3.000	.003	1.062
information sharing				.476	6.523	.000	1.062
R^2 (Adjusted R^2)	.111 (.105)			.324 (.314)			Sobel test: 2.713 (sig=.006)
ΔR^2	-			.213 (.209)			
F	17.061 (sig=.000)			32.412 (sig=.000)			

   Table 2 indicates the results of the linear regression analysis and the Sobel test, which can prove mediating effects of information sharing between authentic leadership (independent) and creativity (dependent) [31, 34]. As **Table 2** shows, authentic leadership has a significant influence on creativity in step 1. In contrast, in step 2, which inputs a mediating variable (information sharing), when information sharing has a significant effect on creativity, influence of authentic leadership on creativity was reduced (β=.334, sig=.000 → β =.219, sig=.003). Also, R^2 and Adjusted R^2 were increased. These results demonstrated a partial mediating effect of information sharing between authentic leadership and creativity.

Also, the Sobel test supports the same significant mediating effect of information sharing [31, 34]. Hence, hypothesis 1 and 5 were accepted.

Table 3. The mediating effects of information sharing between sharing team climate and creativity

	dependant : creativity						
	step 1			step 2			
	β	t	sig	β	t	sig	VIF
sharing team climate	.206	2.453	.015	.064	.841	.402	1.084
information sharing				.511	6.734	.000	1.084
R^2 (Adjusted R^2)	.042 (.035)			.283 (.273)			Sobel test: 3.068 (sig=.002)
ΔR^2	-			.241 (.238)			
F	6.016 (sig=.015)			26.659 (sig=.000)			

Table 3 suggests the mediating effects of information sharing between sharing team climate and creativity. Sharing team climate has a significant effect on creativity in step 1. Although information sharing has a significant effect on creativity, but sharing team climate does not have significant influence in step 2 (β=.206, sig=.015 → β =.064, sig=.402). Changing from step 1 to step 2, the R^2 and Adjusted R^2 values increased by .241 and .238. In addition, the result of the Sobel test suggests a significant mediating effect of information sharing. These results support the perfect mediating effect of information sharing between sharing team climate and creativity [31, 34].Thus, hypothesis 2 and 6 were accepted.

Table 4. The mediating effects of information sharing between psychological empowerment and creativity

	dependant : creativity						
	step 1			step 2			
	β	t	sig	β	t	sig	VIF
psychological empowerment	.376	4.726	.000	.244	3.336	.001	1.089
information sharing				.459	6.259	.000	1.089
R^2 (Adjusted R^2)	.141 (.135)			.334 (.324)			Sobel test: 3.133 (sig=.002)
ΔR^2	-			.193 (.189)			
F	22.338 (sig=.000)			33.891 (sig=.000)			

Table 4 displays the mediating effect of information sharing between psychological empowerment and creativity. Information sharing has a significant effect on creativity in step 1. Further, when information sharing has a significant effect on creativity, the effect of psychological empowerment on creativity was reduced in step 2 (β=.376, sig=.000 → β =.244, sig=.001). Moreover, changing from step 1 to step 2, the R^2 and Adjusted R^2 values increased by .193 and .189. In addition, the result of the Sobel test supports the significant mediating effect of information sharing. These results support a partial mediating effect of

information sharing between psychological empowerment and creativity [31, 34]. Therefore, hypothesis 3 and 7 were accepted.

5. Conclusion

5.1 Results and Implications

According to the results of the statistical analysis, as in the conclusions of previous studies [11, 16, 29], it has been found that information sharing and creativity are closely related [6] in virtual teams. Moreover, authentic leadership, sharing team climate and psychological empowerment can improve information sharing. Similarly, research has shown that these variables increase creativity through the mediating effect of information sharing. The relevance of these variables includes several academic implications.

First, they explain what concepts are needed to enhance creativity. In particular, in the case of the virtual team, information sharing is a prerequisite for diversity and creativity.

Second, this paper explains the role of specific leadership, team climate, and the psychological state of members as ways to increase information sharing among team members. Authentic leadership influences members to share information and act transparently. Thus, members tend to be willing to share their information. Furthermore, sharing team climate encourages members to help and share with each other. Hence, the members of a team with sharing team climate are familiar with sharing their information. Moreover, psychological empowerment promotes the intrinsic motivation levels and autonomy of the team members. Psychologically empowered members become more satisfied with team activities, thus they work for the team, typically to help each other or to share information. Also, these workers feel that their information and opinions are respected, thus they increase the frequency of information sharing behaviors. These explanations indicate how the individual variables are theoretically related.

Third, we explain the mediating effects of information sharing on leadership. There is a mediating effect of information sharing in the process of enhancing creativity in authentic leadership, sharing team climate and psychological empowerment. These results suggest the theoretical processes of how authentic leadership, sharing team climate and psychological empowerment improve creativity. Hence, we assert that information sharing is essential for creativity in the virtual team.

Fourth, it can be argued that authentic leadership, sharing team climate, psychological empowerment, and information sharing have important roles in virtual teams as well as traditional or off-line teams.

In addition, the results of the study also include practical implications.

In today's e-business situation, virtual teams have the advantages of creativity, new value creation, diversity, and fast problem-solving. We suggest necessary factors to maximize the positive effects of virtual teams. The leader of a virtual team has to be genuine, encourage the personal growth of their members, and support them to be creative.

Furthermore, the leader should strive to create a climate for team members to help each other and share information. Members need to understand that helping each other, sharing information, and creating new value increases both the team's and their own performance.

Finally, the leader should instinctively motivate and stimulate the psychological empowerment of their members, and members should be keen to achieve higher levels of performance. When the leader has enough influence and the team has a positive climate,

psychologically empowered members will help each other, share information, and display creativity and improve the performance of the virtual team. The results of these virtual teams will contribute to the success of companies in e-business.

5.2 Limitations and Potential Areas of Future Study

We explain some limitations of this study and propose suggestions for future studies.

First, this study explains the role of leadership, team climate, and member's psychological state to increase information sharing and creativity at the individual level. Hence, it will be necessary to study other types of leadership or the psychological dimension of individuals. However, since information sharing takes place at the group level, we believe that group level research should be done. Therefore, we suggest that future research should demonstrate the relationship between factors (i.e. team efficacy) to increase information sharing and creativity at the group level.

Second, there are various perspectives in measuring creativity. Although this study measures the creativity of individual members, there are other more accurate measurement methods. For example, a supervisor or co-worker can check the creativity of a particular member. It is also possible to measure the number of new ideas presented by an individual worker. Therefore, in future research, we should measure actual behavior to fit the practical situation in creativity measurement.

Third, there are contingency factors that can influence the relationship between the factors we set in the study. In particular, individuals' creative personalities, needs, values, and relationships with their leaders will affect leadership and creativity. Therefore, it is necessary to study the differences according to various situations and the control effect of specific factors.

Fourth, the distinction between information sharing and knowledge sharing is ambiguous. In previous studies, knowledge sharing is sometimes described as including information sharing. However, because this study is about virtual teams, we focus on the information itself in the IT context. Hence, we emphasized the importance of information sharing. In the academic field, information sharing and knowledge sharing need to be more clearly distinguished for the future.

Finally, sharing team climate is directly related to information sharing. However, virtual teams will find it more difficult than traditional teams to create and utilize sharing team climate. Therefore, future research should be conducted on how to improve the sharing team climate in virtual teams where people do not work and meet each other directly.

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