

Factors Influencing the Participation of Information Security Professionals in Electronic Communities of Practice

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Abstract: The purpose of this study is to contribute to a better understanding of the current status of the participation of the information security professionals (ISPs) in the electronic communities of practice (eCoP) in the information security (IS) domain in Norway. An online survey is conducted with 56 ISPs working in Norway to investigate this issue. This study used the logistic regression as a statistical technique to formulate the results and findings. The probability of an ISP being a user of eCoP is tested with demographic data, nature of the job, and the knowledge sharing preference. Furthermore, the determinants of the knowledge sharing theories, i.e., the theory of planned behavior, the motivation theory, and perceived trust theory are used to test our statistical model. The findings of this study are useful to get the initial insight into the determinants that influence the participation of ISPs in eCoP in Norway.

1 INTRODUCTION

The ISPs working in different organizations in Norway often face many of the same problems and design similar solutions. ISPs also collect and apply the same knowledge to design their solutions. However, it is inefficient if they do it so largely on their own (Fenz et al., 2011). Therefore, proper sharing and reuse of knowledge among the ISPs can improve the quality of their work (Von Krogh, 1998). The involvement of information security practitioners and learning is an important cog in the wheel of knowledge translation. The knowledge available on the information security guidelines and journals is inadequate to solve the day-to-day problems faced by ISPs in their job. An evolving body of research suggests that communities of practice can be effective in engaging the professionals and enable the sharing of knowledge among them. The members discuss issues, and learn from others' experience to solve the challenges in their job. The nature of the learning that evolves from these communities is collaborative, i.e., the collective knowledge of the community is greater than any individual knowledge (Johnson, 2001), (Liedtka, 1999).

With the advancement in information and communication technologies, communities of practice adopted the possibility of virtual communication among the members of the community (Ho et al., 2010). Modern information technologies can extend

the boundaries and reach of these communities by providing an electronic platform to share knowledge in the community. The electronic communities of practice (eCoP) can establish collaboration across geographical locations and time zones. The adoption of eCoP is not restricted to any particular community or domain. The application of eCoP is spread across health care (Ho et al., 2010), finance sector (Ardichvili et al., 2002), banking & Information Technology (Probst and Borzillo, 2008). However, it is not explicitly evident whether eCoP is popular among the ISPs in Norway. We believe that sharing of knowledge among the ISPs improve IS in Norway. Therefore, we investigate the following research question in this study:

RQ1: What are the factors affecting the participation of information security professionals in electronic communities of practice in Norway?

This study contributes towards the understanding of the various factors that influence the participation of ISPs in eCoP in Norway. We are interested in investigating this issue because we want to establish an open electronic community of practice in IS for the ISPs. Therefore, it is imperative for us to learn the present status of participation of ISPs in eCoP as there is a lack of literature.

An online survey is conducted with the members of ISF, Norway. The participants of this survey are also the target audience (in the form of members) of

the electronic community that we are interested in establishing. We collected the responses from the ISPs to understand the nature of their job, the source they use to collect essential information for their task, and the challenges they face in obtaining such information. Furthermore, we also collected their knowledge sharing preferences in eCoP based on the factors derived from the theory of planned behavior (Ajzen, 1991), motivation theory (Frey and Osterloh, 2001), and perceived trust (Usoro et al., 2007). The findings of this study act as a starting point to get an initial insight into the popularity of eCoP among ISPs in Norway.

The rest of the paper is structured as follows: In section 2, the existing literature is used to describe the concepts and knowledge sharing in eCoP. In section 3, the research approach of the study is explained. In section 4, the findings of the study is explained with the help of survey responses. Finally, the paper ends with a discussion of the results, stating the implication of the findings, limitation of the study and expected future work, and conclusion.

2 RELATED WORK AND BACKGROUND KNOWLEDGE

This section presents an overview of the difference between traditional CoP and eCoP followed by the studies covering the knowledge sharing activities in eCoP.

2.1 Traditional vs Electronic Communities of Practice

The term 'communities of practice' (CoP) is introduced by Wenger et al. in 1998 (Wenger, 1998). The basic concept of CoP is presented by Lave & Wenger (Lave and Wenger, 1991), and by Brown & Duguid (Brown and Duguid, 1991) in 1991. According to Wenger (Wenger et al., 2002), "*Groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis*" A CoP mainly consists of three fundamental elements: a) *Domain* creates common ground and sense of common identity. A well-defined domain enables the community to understand its purpose and value to the members and stakeholders associated with the community, b) *Community* creates the bond among the members that enable the learning among them. A strong community can be developed when the members have mutual respect and trust among them. A

strong community also encourages healthy interactions and discussion, c) *Practice* is the specific knowledge the community develops, shares, and maintains. A practice can be set of ideas, tools, information that the community members share (Wenger et al., 2002).

A CoP can exist in offline (also known as traditional) or electronic or both the forms. The offline form uses face to face meeting, round table discussion, whereas the electronic form uses networked technology, mainly the Internet, to establish collaboration among the members across the world. The idea of having an electronic platform for the traditional communities of practice is supported in the studies (Mathwick et al., 2008), (Wiertz and de Ruyter, 2007). The traditional communities rely heavily on the location and have membership according to norms. The electronic communities are organized around an activity, idea or task rather than location (Johnson, 2001). The electronic nature of the community provides the opportunities to facilitate communication among the members from different geographic locations and time zones. The electronic CoPs combine both online activities and face to face meetings to enhance the interaction process.

2.2 Knowledge in Electronic Communities

According to the work of (Wasko and Faraj, 2000), there are three perspectives of knowledge on the definitions of knowledge, i.e., *Knowledge as object*, *knowledge embedded in individuals*, and *knowledge embedded in a community*. In this study, we focused on the third perspective, i.e., knowledge embedded in a community to define the knowledge sharing practice in eCoP. The community perspective of knowledge can be used to develop and support electronic communities of practice. This perspective defines knowledge as 'the social practice of knowing' (Schultze and Cox, 1998), and argues that learning, knowing and innovating are closed related forms of human activity and inevitably connected to practice. The knowledge resides in a community can be used to enable discussion, and share ideas among the members of eCoP.

Moreover, the use of information and communication technologies enables knowledge sharing through the mechanisms that allow sharing incidence based on personal experience, discussing and debating issues related to the domain of the community, posting and responding to the queries (Wasko and Faraj, 2000). In eCoP, the knowledge can be stored in the digital form and transferred to others regardless of the location of the individual who generated the knowledge and who is going to receive it. Knowledge sharing in

eCoP is a process that exploits existing knowledge by identifying, transferring, and applying to solve tasks better, faster and cheaper (Christensen, 2007). However, members are often reluctant to share knowledge others in the eCoP (Tamjidyamcholo et al., 2014).

Furthermore, Ardichvili et al. (Ardichvili et al., 2002) conducted a qualitative study to understand the motivation and barriers to participating in eCoP at Caterpillar Inc. The study identified that the members of the community are not willing to share their knowledge because of the fear of criticism or misleading the other members. It has been shown in a recent study (Agrawal and Sneekenes, 2017) that the participants (IT professionals) of the communities were not willing to participate actively in the absence of strong motivation. ISPs may not want to disclose information on eCoP that describes their organization's security status or any weakness. Therefore, it is important to anonymize the knowledge sharing process (Fenz et al., 2011). The role of trust in encouraging the ISPs to share knowledge in eCoP is studied in (Gefen et al., 2003), (Ratnasingam, 2005), (Fenz et al., 2011).

2.3 Underlying Theories

This study considers knowledge sharing behavior and participation of ISP in eCoPs as an individual's social psychological process. Thus, one's attitude, intention, motivation, trust subsequently influence the behavior of the individual. We adopted three theories in this work to analyze the factors affecting the participation of ISPs in eCoP. The theories are as follows:

2.3.1 Motivation Theory (MT)

Motivation refers to "internal factors that impel action and to external factors that can act as inducements to action" (Locke and Latham, 2004). According to Fray et al. (Osterloh and Frey, 2000), motivation to share knowledge is driven by intrinsic and extrinsic factors. Extrinsic motivations satisfy the instrumental needs of a human. For instance, money, financial reward, social rewards, increase in the status. Intrinsic motivations are perceived by the values provided directly within the work (Frey and Osterloh, 2001). For instance, altruism drives many people to do something for the enjoyment of doing the work.

2.3.2 Theory of Planned Behavior (TPB)

According to TPB theory, the human behavioral intentions are determined by three factors: attitude, subjective norms, and perceived behavioral control. Attitude refers to the degree to which one evaluates the behavior favorably or unfavorably. Subjective norm

is the perceived social pressure to perform or not perform the behavior. Perceived behavioral control is defined as the degree to which a person perceives that the decision to engage in a given behavior is under his/her control (Jeon et al., 2011).

2.3.3 Perceived Trust Theory (PTT)

The role of trust in increasing the willingness to share knowledge in an online community of practice is studied in (Usoro et al., 2007) where trust is conceptualized into *competence*, *integrity*, and *benevolence*. Competence-based trust defines the degree to which a member believes that the community is knowledgeable and competent. Integrity-based trust defines the degree to which a member believes the community to be honest and reliable (Mayer et al., 1995). The *benevolence* trust considers the self-motivation through a sense of moral obligation to become a part of a community. Therefore, the individual that receives the knowledge in the community does not play a major role in influencing benevolence-trust of the person willing to share the knowledge. However, we are more interested to understand the role of the trust that is established based on the action of the person receiving the knowledge, and not just by self-motivation.

3 RESEARCH METHOD

This study is based on the principle of *stated* preference technique (Brownstone et al., 2000) for establishing valuations. An online survey-based technique is designed to collect the response from the ISPs. The online questionnaire is distributed in one of the ISF meetings where 56 ISPs participated in answering the survey.

3.1 Questionnaire Design

An online quantitative questionnaire was created using LimeSurvey open source survey tool. The questionnaire was hosted on the project website (Agrawal, 2017). The online survey was available in both English and Norwegian. The respondents accessed the online survey on their smartphone during the ISF meeting. The survey consisted of 18 questions covering the topics on demography, working activities, and preference for eCoP. The detail of the survey is given in Appendix. The survey was conducted at Information Security Forum (ISF) Norway meeting. The questionnaire consists of three sections that are as follows:

1. *Demography* - Questions related to age, gender, job role, job location, type of organization, the size of an organization.
2. *Work activities* - Questions related to daily tasks, full-time or half-time ISP, the source used to collect information, challenges associated with information gathering.
3. *Community-based knowledge sharing* - Questions on prior experience using eCoP, the nature of eCoP, no. of members on eCoP, the domain of eCoP, and the preferences related to sharing knowledge, participation on eCoP. This part of the questionnaire is created to analyze the concepts of the above-mentioned theories (Ref. section 2.3).

3.2 Respondents

A total of 56 respondents (46 male, 9 female, 1 undisclosed) volunteered to complete the online survey. The majority of the respondents are working as a full-time ISPs in Norway. A short introduction about the research project is presented to the respondents at the beginning of the workshop. The objective of the online survey and the details of the various terms, used in the questionnaire, are also presented to the survey respondents. The survey had the option for the respondents to decline their participation at any point in time if they feel uncomfortable participating in the survey.

3.3 Data Analysis

We collected data from 56 respondents through the online survey. Since the study is restricted to the users participating in only in the online CoPs, we rejected the responses of six respondents as these respondents participated only in the offline communities of practice. Subsequently, we rejected two more observations from the sample as they did not answer many questions in the questionnaire. Therefore, our final sample size consists of 48 observations. A dichotomous data is considered as an output variable with the values, 'yes' and 'no,' which signifies whether the given user participates or does not participate in eCoP respectively. Based on the study and argument presented in the studies (Little, 1978), logistic regression fits well to this study. Ergo, logistic regression (also called as logit) is used as a statistical technique to formulate the results and findings. Hence, all predictors are considered as categorical variables whereas the participation in eCoP (Y_i) is assumed as a dichotomous or binary outcome. Furthermore, this study assumes the covariates such as age, gender, educational levels, occupational levels, the organizational size of

the respondents and number of hours spent on IS per week as independent variables. Equation 1 summarizes the main element of the logit model and Equation 2 expresses the probability of Y_i .

$$Y_i = \begin{cases} 1 & \text{if the } i^{\text{th}} \text{ subject is using eCoP} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

$$y_i = p(x'_i) = \frac{\exp(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_n x_{ni})}{1 + \exp(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_n x_{ni})} \quad (2)$$

where

- y_i can be considered as realization of output variable Y_i which takes the values 1 or 0 with probability value of p and $1 - p$ respectively.
- x'_i is i^{th} vector of the independent variables as mentioned earlier.
- $\beta_0, \beta_1, \beta_2, \dots, \beta_n$ are the coefficients of fitted regression models.

Equation 2 can be rewritten as log linear function as given below which is further used in deducing the final output.

$$\begin{aligned} \text{logit}(Y_i) &= \log \frac{p(x'_i)}{1 - p(x'_i)} \\ &= \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_n x_{ni} + \varepsilon \end{aligned} \quad (3)$$

Furthermore, we have formulated the decision rule as, the negative values of the logit of output variable will result into non user of the eCoP whereas positive logit value will represents the user of eCoP.

4 RESEARCH RESULTS

This section provides the statistical results of the logistic regression model fit which is formulated to investigate the research question RQ1 in this study.

4.1 Result I

The information about the demography of the ISPs members is presented here. Table 1 tabulates the statistics of the collected data. There are 35 ISPs with university level education, i.e., an education degree in bachelors, masters or doctorate in Information security and allied branches. The majority of the respondents are males in the age group of 30 - 60 years. 75% of the respondents work full-time in IS domain mainly affiliated to Information and communication industry, Financial and insurance, business service, health and social services sectors. Our findings also

Table 1: Summary of the demographic data of ISPs participated in the survey.

	age	sex	edu_level	ocp_level	no_emp	no_hrs
1	> 60 : 5	Female : 8	Asso. degree : 7	Unspecified : 1	5000- :13	0-10 : 6
2	21-30: 3	Male :40	B. degree :13	Administrative: 2	1000-4999:11	11-20: 6
3	31-40:14		Doc. degree : 3	CISO :13	100-499 : 7	21-30: 6
4	41-50: 9		HS diploma : 2	Other :19	0-10 : 6	31-40:17
5	51-60:17		M. degree :19	Researcher : 2	10-49 : 3	41- :13
6			Other : 2	Security Engineer :11	50-99 : 3	
7			Tech. training : 2		Other : 5	

highlight that the ISPs in our survey come from small (employee strength 1-19), medium-sized (20-99) and large (100+) companies (Iversen, 2013).

4.2 Result II

Based on the Equations 2 and 3, we have modeled our data by fitting logistic regression model using R software (R Core Team, 2013). In this model, we considered four independent variables which are *age*, *gender*, *no. of employees* and *no. of hours* spent on IS related tasks¹. Table 2 presents the coefficients and the significance of these variables. We can see that the categorical variable *no. of employees* have all positive coefficients, which indicates that the unit increment in the *no. of employees* encourage the participation in eCoP whereas the *no. of hours* spent on task related to IS has the negative coefficients. Ergo, it can be inferred that the participation of ISPs, who work for full-time or more in IS task, is low in eCoP.

To test the significance of these explanatory variables, under the null hypothesis all the coefficients will take the value equal to 0. For example, $H_0 : \beta_1 = \beta_2 \dots = 0$, and $H_a : \neq 0$

From the Table 2, p-value for levels no_emp100-499(β_p) and no_emp1000-4999(β_q) is 0.05 which is statistically significant². Hence, H_0 is rejected in the study. The p-value of no_hrs31-40(β_r), no_hrs41(β_s) is 0.03 and 0.09 which shows that levels have significant effect on the probability of participating in eCoP. Hence, the output variable can be explained in terms of the odds ratios which can be obtained by calculating the exponential of $\beta_p, \beta_q, \beta_r, \beta_s$ i.e $e^{\beta_p} = 100$, $e^{\beta_q} = 63$, $e^{\beta_r} = 0.0075$, and $e^{\beta_s} = 0.0252$. Therefore, we can write that:³

- On average, for every one unit change in the number of employees, the log odds of being a user of eCoPs (versus non-user) increases by 81.2.

¹All explanatory variables considered here are categorical variables

²We considered significance at 90% confidence level

³Analysis is made on the basis of explanatory variables which are statistically significant, non significant variables can be excluded and one can remodel the system

- For a unit increase in the number of hours spent on tasks related to the IS per week, the log odds of being the use of eCoPs increase by 0.0164.

The variables age, gender have a slightly different interpretation. For all age groups, the obtained p-value is significantly high with an average value of 0.69 hence we can not reject the H_0 . In addition to this we can see that the most of the variables are statistically non-significant.

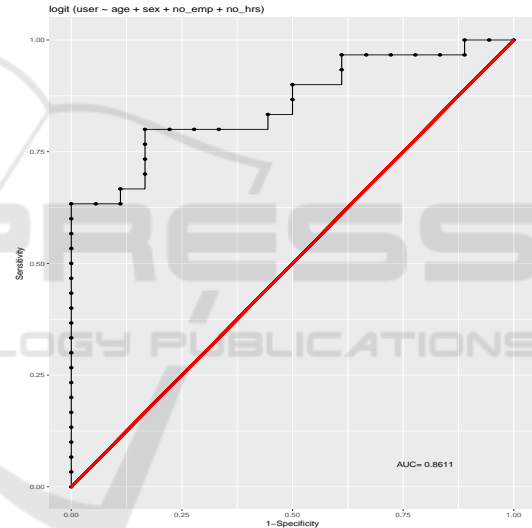


Figure 1: ROC curve for logistic regression model.

Thus, we can consider that the probability of participating in eCoP is not affected by the demography factors such as age, gender, and educational level. Further, we used Receiver Operating Curve (ROC) and area under ROC curve (AUC) to report performance of the fitted model. ROC Curves describes how well the fitted model can separate the two classes 0 and 1, and it also helps to identify the best threshold for separating them. In the case of ROC curves, the AUC plays an important role; higher the AUC better the model in classification. Figure 1 represents the ROC of the fitted logistic regression model and AUC = 0.86, which can be considered as a high performance for real life applications.

4.3 Result III

In this section, there are three factors related to work activities of ISPs analyzed to see their effect on the probability of ISPs in participating in eCoP. The factors are *source of obtaining information required to do the professional tasks, nature of the tasks, and the challenges faced in obtaining the information*. The details of the factors and their variables can be obtained from Appendix 7.

Table 2: Summary of estimated logistic regression model.

Var.	Coef	S.E.	z-val	Pr(> z)
(Int.)	0.85	3.51	0.24	0.81
age21-30	19.03	2935	0.01	0.99
age31-40	-2.90	2.62	-1.11	0.27
age41-50	0.32	2.72	0.12	0.91
age51-60	-1.35	2.52	-0.54	0.59
sexMale	2.04	1.35	1.51	0.13
no_emp10-49	0.12	2.63	0.05	0.96
no_emp100-499	4.63	2.33	1.98	0.05*
no_emp1K-4.9K	4.14	2.12	1.95	0.05*
no_emp50-99	0.91	2.01	0.45	0.65
no_emp5K-	3.11	2.06	1.51	0.13
no_empIDK	0.85	2.09	0.40	0.69
no_hrs11-20	-3.22	2.44	-1.32	0.19
no_hrs21-30	-1.69	1.95	-0.87	0.38
no_hrs31-40	-4.90	2.26	-2.17	0.03*
no_hrs41-	-3.68	2.16	-1.70	0.09*

Table 3⁴ shows that the variables [S1-S8] of 'source of information' have positive coefficient which signifies that the unit increment in the motivation will increase the participation of ISPs in eCoP. Variable S3 has statistically significant effect on the participation of ISPs in eCoP. Variable S3 signifies that respondents, who ask other professional experts on communities of practice to obtain necessary information to carry out their task, also participate in eCoP. In a case of the usual activity that ISPs perform their job tasks, the variable N7 has statistically significant (p-value less than 0.1) effect on the participation of ISPs in eCoP. The challenges, which are faced by ISPs in obtaining the information for their job, do not have statistically significant effect on eCoP participation. It also signifies that we cannot predict the probability of ISPs participating in eCoP by having any information on the challenges that they face within the category given under C1-C6.

⁴The variable corresponding to Reference modality is automatically considered as a reference by R GLM package

Table 3: Summary of variables under information source, nature of job tasks, and challenges in obtaining information.

Var.	Coef	S.E.	z-val	Pr(> z)
(Int.)	11.37	3840.09	0.00	1.00
Source of information				
S1	0.91	1.51	0.60	0.55
S2		Reference modality		
S3	4.77	2.15	2.22	0.03*
S4		Zero entry in the response database		
S5	1.11	1.69	0.66	0.51
S6	0.62	1.86	0.33	0.74
S7	2.99	9224	0.00	1.00
S8	0.12	2.01	0.06	0.95
Nature of tasks				
N1	21.73	6522.64	0.00	1.00
N2	3.38	2.17	1.55	0.12
N3		Reference modality		
N4	3.13	2.22	1.41	0.16
N5	2.49	2.41	1.03	0.30
N6	2.06	2.44	0.84	0.40
N7	5.05	2.66	1.90	0.06*
N8	20.94	6522.64	0.00	1.00
Challenges in obtaining information				
C1	-14.66	3840.08	-0.00	1.00
C2	-17.53	3840.08	-0.00	1.00
C3	3.07	5989.08	0.00	1.00
C4	-18.16	3840.08	-0.00	1.00
C5	-19.26	3840.08	-0.01	1.00
C6		Reference modality		

5 DISCUSSION

Knowledge sharing is an intentional behavior which cannot be forced by someone (Gagn, 2009). People participate in eCoP to exchange knowledge with the others. Therefore, it is useful to analyze the knowledge sharing behavior of ISPs in eCoP. The factors, affecting the participation of ISPs in eCoP activities, are investigated with the help of **MT**, **TPB**, **PTT** (refer section 2.3). We modeled our data by fitting the logistic regression model. In this model, we considered the variables of **TPB**, **MT**, and **PTT** to predict the probability of participating in eCoP. The variables are defined in the online questionnaire given in the Appendix 7.

5.1 Motivation Theory

Table 4 presents that the determinants of *motivation* have positive coefficients, which indicate that a unit increment in the motivation will increase the participation of ISPs in eCoP. We considered seven factors

under the motivation theory. SQ05 corresponds to intrinsic motivation, and SQ08, SQ10, SQ11, SQ13, SQ15, SQ20 are extrinsic motivation. Out of 7 variables, only the p-value of SQ08 is less than 0.1.

Table 4: Summary of the variables under Motivation theory.

Var.	Coef	S.E.	z-val	Pr(> z)
Motivation				
(Int.)	-1.44	0.84	-1.72	0.09
SQ05	0.17	0.77	0.22	0.83
SQ08	1.31	0.72	1.82	0.07*
SQ10	0.60	0.88	0.69	0.49
SQ11	0.41	0.74	0.55	0.58
SQ13	0.68	0.76	0.90	0.37
SQ15	0.73	0.71	1.02	0.31
SQ20	0.62	0.90	0.69	0.49

Therefore, it can be concluded that SQ08 has statistically significant effect on the participation of ISPs in eCoP. The ISPs tend to participate in eCoP more if members in the community share information relevant to them. It can be considered as one of the main incentives for the ISPs as well.

5.2 Theory of Planned Behavior

Table 5 presents the summary of the three major determinants of TPB, i.e. *attitude*, *subjective norm*, and *perceived behavioral control*. We can see that the variable SQ01, SQ06, SQ12, SQ14, and SQ22 have positive coefficients, i.e. the unit increment in these variables will signify the increment in the participation of ISPs in eCoP. The p-value of the variables SQ22 and SQ12 is less than 0.1. Hence, SQ22 and SQ12 have statistically significant effect on the participation of ISPs in Norway in eCoP. SQ22 corresponds to the statement '*my organization allows me to participate on a community-based platform to share my knowledge*' in the questionnaire.

Table 5: Summary of variables under Theory of planned behavior (TPB).

Var.	Coef	S.E.	z-val	Pr(> z)
Subjective norm				
(Int.)	0.13	0.48	0.26	0.79
SQ14	-0.09	0.78	-0.12	0.91
SQ22	2.16	0.88	2.44	0.01*
Attitude				
(Int.)	0.51	0.52	0.99	0.32
SQ01	16.26	1455.40	0.01	0.99
SQ06	0.08	0.65	0.12	0.91
SQ07	-1.20	1.33	-0.91	0.37
Perceived behavioral control				
(Intercept)	-0.37	0.43	-0.85	0.40
SQ12	1.80	0.66	2.73	0.01*

In other words, the participation of ISPs in eCoP can be decided by investigating if the organization

has any restriction on the employee to participate in eCoP. SQ07 corresponds to the negative feelings about knowledge sharing in eCoP [*I do not share anything as I am concerned about the sensitivity of my information*]. SQ07 is the only variable with the negative coefficient, which signifies that the unit increment in this variable will reduce the participation of ISPs in eCoP. It can be learned from applying TPB concepts that the variables of the subjective norm, and perceived control behavior are the important factors in influencing the participation of ISPs in eCoP.

5.3 Perceived Trust

In our study, we considered the *competence* and *integrity* aspects of trust to understand the preference of the respondents towards knowledge sharing tasks in eCoP.

Table 6: Summary of the variables under perceived trust concept.

Var.	Coef	S.E.	z-val	Pr(> z)
Perceived Trust				
(Int.)	0.044	0.49	0.09	0.93
SQ18	1.11	0.68	1.65	0.10*
SQ19	-0.08	0.62	-0.14	0.89

Table 6 presents the findings of the variable related to Trust factor. SQ18 and SQ19 have the positive coefficient and hence has the positive effect on the participation of ISPs in eCoP. Moreover, SQ18 is also statistically significant in predicting the ISPs' participation.

6 CONCLUSION

The main objective of the present study was to understand the present status of the participation of ISPs in Norway in eCoPs in IS. To achieve this goal, we analyzed various factors that help us predict the participation of ISPs in eCoP.

In this study, we observed that the number of employees in the organization, and working hours in security area are the significant factors in predicting the participation in eCoPs. Further, we observed that both extrinsic and intrinsic motivation is positively correlated with the participation in eCoP. The finding of logistic regression points out that the participation of ISPs in eCoP is statistically influenced by the factor that other members of the community share relevant information to the problems of ISPs. In other words, we can expect high participation if we can ensure that the members of the community will share information that is useful to the participants. However, the

tendency to share knowledge decreases when it is perceived that they are receiving irrelevant or not so useful information from other members.

The application of TPB also led to some important observation in this study. The probability of the participation in eCoP is significantly increased if the organization encourages the employee to participate in the knowledge sharing activities. Typically, eCoP needs information technology capabilities to establish knowledge sharing process. The presence of the necessary resources (in the form of platform, and service) also enables the ISPs to participate in eCoP.

7 RESEARCH LIMITATION AND FUTURE WORK

The response that we received from 48 participants provides an initial insight into understanding the current status of participation in electronic communities of practice by ISPs in Norway. However, the findings cannot be generalized to a large population because of the small sample size of the respondents. Hence, more studies are needed to generalize present study findings. Furthermore, we collected the data from the participants who volunteered for it. It signifies that the response is collected from the people who had enough time and interest to complete the survey. The result might have differed if we had selected the participants randomly. The future research will address this issue by targeting large respondents and selecting a random sample from it.

In our study, we mainly tried to understand the preference of the members who are going to share their knowledge. The receiver's perspective is also important in the context of knowledge sharing task. Future research will aim to address this issue by collecting the perspective of both the parties. It will help to compare their preference and design the incentive scheme along with the sharing model. The use of categorical variables in the logistic regression model can also cause some issues. Therefore, we are investigating the possibility of adopting a linear scale in the future data collection events.

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APPENDIX

The survey should only take 10-12 minutes. This survey is completely anonymous. The record of your survey responses does not contain any identifying information about you.

Demography

1. What is your age group (in years)? Choose one of the following answers
 - 21-30
 - 31-40
 - 41-50
 - 51-60
 - >60
2. Please specify your gender. Choose one of the following answers
 - Female
 - Male
 - Decline to answer
3. What is the highest level of formal education do you have? Choose one of the following answers
 - Primary school
 - High school graduate, diploma or the equivalent
 - Bachelors degree
 - Trade/technical/vocational training
 - Associate degree
 - Master's degree
 - Doctorate degree
 - Professional degree
 - Other
4. Please select the country where you are currently employed. Choose one of the following answers
 - Norway
 - Other
5. What best describes the type of organization you work? Choose one of the following answers
 - Financial and insurance
 - Mining and extraction
 - Information and communication
 - Agriculture, forestry and fishing
 - Electricity, gas, damp, and heating supply
 - Transport and storage
 - Accommodation and service
 - Health and social services
 - Production industry
 - Business service
 - Culture, entertainment and leisure
 - Other
6. Which of the following most closely matches your job role? Choose one of the following answers

- Chief Information Security Officer (CISO)
 - Data protection officer
 - Security Engineer
 - Legal (advocate)
 - IT professional (Systems administrator, programmer)
 - Journalist
 - Researcher
 - Administrative (e.g. secretary, assistant)
 - Accountant
 - Other
7. Counting all locations where your employer operates, what is the total number of persons who work there? Choose one of the following answers
- 0-10
 - 10-49
 - 50-99
 - 100-499
 - 500-999
 - 1000-4999
 - 5000-
 - I don't know

Work Activities

8. How many hours per week do you spend on information security related tasks in your job responsibilities? Choose one of the following answers
- 0-10
 - 11-20
 - 21-30
 - 31-40
 - 41-
9. Which of the following tasks do you perform daily? Check all that apply
- Develop an information security policy for the organization
 - Co-ordinate the information security activities at the organizational level
 - Share my expertise with my colleagues inside the organization
 - Share my expertise with my colleagues outside the organization
 - Perform risk and threat analysis of the information security for the organization
 - Reporting to the top management team about the information status of the organization
10. What is the most frequent activity do you perform to carry out your job tasks? Choose one of the following answers
- Look for information [N1]
 - Process information [N2]
 - Create new information [N3]
 - Solve problems [N4]
 - Make decision [N5]
 - Interact with the peers [N6]
 - Help others to do their job [N7]
 - Other [N8]
11. Which source do you mostly use to obtain the necessary information needed to carry out your tasks? Choose one of the following answers
- Personal experience [S1]
 - Government Agency (e.g. Datatilsynet) [S2]
 - Asking other professional experts on Communities of practice [S3]
 - Consultancy firm [S4]
 - Interview/meeting with your team [S5]
 - Internal document/manual of your company [S6]
 - Social media (e.g. LinkedIn) [S7]
 - Other [S8]
12. What is the most challenging part in obtaining the information required to complete your tasks? Choose one of the following answers
- The information is available in the fragmented manner [C1]
 - The information is outdated and cannot be applied to recent problems [C2]
 - The information is untrustworthy as I don't know the source [C3]
 - The information is difficult to find, time-consuming [C4]
 - The information has a low relevance to my problem [C5]
 - Other [C6]

Community-based Knowledge Sharing

13. Do you participate in a community-based knowledge sharing practice?
- Yes
 - No
14. What is the domain of the community where you are mostly an active member? [answer only if you select 'yes' in Q13]

- Information security
 - Other
15. Please select the statement that is valid for the community where you participate most. [answer only if you select 'yes' in Q13]
- The community has both online and offline activities
 - The community has only online activities
 - The community has only offline activities
16. What is the estimated number of members in the community? [answer only if you select 'yes' in Q13]
- 10-99
 - 100-499
 - 500-999
 - >1000
 - I don't know
17. Please mark the statement(s) that is(are) valid for you in terms of participating in the community-based knowledge sharing tasks. Check all that apply
- My knowledge is very personal to me. I don't like to share it with others [SQ01]
 - Sharing my knowledge improve my reputation within the community [SQ02]
 - When I share my knowledge in the community, I expect to get back knowledge whenever I need it [SQ03]
 - When I share my knowledge in the community, I believe that my questions will be answered in the future [SQ04]
 - Sharing my knowledge with others gives me pleasure [SQ05]
 - My knowledge sharing with other members is valuable to me [SQ06]
 - I do not share anything as I am concerned about the sensitivity of my information [SQ07]
 - Members on the community share information relevant to my problems [SQ08]
 - I share my knowledge only when the community has the option for the face-to-face communication [SQ09]
 - Participating in the community decreases the time needed for my job responsibilities [SQ10]
 - Participating in the community increases the effectiveness of performing job task [SQ11]
 - I have the resources necessary to share knowledge in the community [SQ12]
 - I participate in the community to establish new connection with the members [SQ13]
 - People who are important to me expect that I should participate in the knowledge sharing task in the community [SQ14]
 - By sharing knowledge within community, I find better solution for my problem [SQ15]
 - I share the work reports and official documents obtained from inside the organization with other members [SQ16]
 - I share my expertise from my education, training, experience with other members [SQ17]
 - I trust the information that I receive from other members in the community [SQ18]
 - I trust the information only if I know the identity of the member whom I am sharing my knowledge with [SQ19]
 - I get the latest (up-to-date) information/answers for my question in the community [SQ20]
 - I do not share my knowledge on a community because I may lose my competitive edge [SQ21]
 - My organization allows me to participate on a community-based platform to share my knowledge [SQ22]
 - My job profile allows me to participate on a community-based platform to share my knowledge [SQ23]
 - I have everything that I need to carry out my job tasks effectively. Therefore, I do not need to participate [SQ24]
 - I am willing to participate if the community is available as an online platform [SQ25]
- Final**
18. Any other comments? Please write your answer here: _____