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**DEVELOPMENT OF A MODEL FOR VIRTUAL LEADERSHIP
BEHAVIOR ON KNOWLEDGE SHARING IN ONLINE
PROGRAMMING COMMUNITIES**

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Abstrak

Komuniti pengaturcaraan atas talian menjadi saluran yang popular untuk perkongsian pengetahuan. Walau bagaimanapun, hanya segelintir yang berjaya menggalakkan sumbangan yang aktif di kalangan ahli. Kajian terkini lebih tertumpu kepada faktor tahap individu dalam menggalakkan perkongsian pengetahuan di kalangan ahli. Namun, kajian yang menekankan faktor kontekstual seperti peranan kepimpinan adalah sangat terhad. Bagi menangani permasalahan ini, kajian ini bertujuan membangunkan sebuah model untuk mengkaji peranan kepimpinan ke arah perkongsian pengetahuan dalam komuniti pengaturcaraan atas talian. Untuk mencapai objektif tersebut, kajian tingkah laku kepimpinan maya sebagai moderator ke atas faktor kognitif individu ahli terhadap perkongsian pengetahuan telah dijalankan. *Social Cognitive Theory* (SCT) dan *Path Goal Theory* (PGT) digunakan sebagai asas bagi model yang dicadangkan. Model ini diuji secara empirikal menggunakan data yang dikumpul daripada dua puluh komuniti pengaturcaraan atas talian. Hasil kajian menunjukkan bahawa tingkah laku kepimpinan yang berbeza bertindak sebagai moderator yang signifikan dalam mempengaruhi hubungan factor individu iaitu keupayaan sendiri dan jangkaan dapatan terhadap perkongsian pengetahuan. Dapatan kajian menunjukkan walaupun komuniti pengaturcaraan atas talian lebih bersifat tidak formal, tingkah laku kepimpinan yang sesuai dapat meningkatkan keupayaan sendiri dan jangkaan dapatan ahli untuk melibatkan diri dalam perkongsian pengetahuan. Idealnya, dengan tahap autonomi yang bersesuaian dan pengiktirafan sumbangan ahli dapat mendorong perkongsian pengetahuan secara berterusan dan mempromosikan kelestarian platform ini. Kajian ini memberikan pemahaman kepada pereka bentuk sistem untuk memasukkan beberapa ciri bagi menyokong tingkah laku kepimpinan dalam komuniti pengaturcaraan atas talian. Bagi menggalakkan tingkah laku kepimpinan serta sama, pengundian atas talian perlu disesuaikan untuk menyokong keputusan inklusif daripada ahli. Di samping itu, kebolehan penerangan dan reputasi dapat memudahkan kepimpinan berorientasikan pencapaian dalam meningkatkan perkongsian pengetahuan di kalangan ahli komuniti pengaturcaraan atas talian.

Kata Kunci: Perkongsian pengetahuan, Kepimpinan maya, Komuniti pengaturcaraan atas talian, *Path Goal Theory*, *Social Cognitive Theory*.

Abstract

Despite the significant increase in the number of emerging online programming communities, very few succeed in inspiring members to share their knowledge. Recent studies have focused on personal level factors in encouraging members' knowledge sharing. However, limited studies emphasis on the role of leader. In addressing this gap, this study aims to develop a model to examine the role of virtual leadership towards knowledge sharing in online programming communities. Then in carrying out the objective, the examination of virtual leadership behaviour moderating members' personal cognitive factors toward knowledge sharing was conducted. Social Cognitive Theory and Path Goal Theory are used as the basis for the proposed model. The proposed model is tested empirically using data collected from 20 online programming communities. The result suggests that different leadership behaviors significantly moderate the effect of self-efficacy and outcome expectancy on members' knowledge sharing. This finding implies that although online communities are informal in nature, the appropriate type of leadership can boost members' efficacy and outcome expectancy to participate in knowledge sharing. Ideally, with the appropriate level of autonomy and recognition of members contributions can motivate members to continuously contribute to online programming communities and promote the sustainability of this platform. The implication of this study will provide meaningful insights for system designers to include several features to facilitate leadership behaviors in online programming communities. In supporting participative-leadership behavior, online poll and online voting need to be accommodated to allow inclusive decisions by members. Additionally, ranking and reputation features can further facilitate the achievement-oriented leadership and increase knowledge sharing among online programming community members.

Keywords: Knowledge sharing, Virtual leadership, Online programming communities, *Path-goal theory, Social cognitive theory.*

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List of Abbreviations

AOB	Achievement Oriented Behavior
AVE	Average Variance Extracted
CB-SEM	Covariance Based Structural Equation Modeling
DB	Directive behavior
F ²	Effect Size
IM	Information Management
KS	Knowledge Sharing
KSB	Knowledge Sharing Behavior
KM	Knowledge Management
OC	Online Community
OPC	Online Programming Community
PB	Participative behavior
PGT	Path-Goal Theory
PLS-SEM	Partial Least Square- Structural Equation Modeling
SB	Supportive Behavior
R ²	Coefficient of Determination
R ² included	R ² when all the exogenous variables are existed
R ² excluded	R ² when a particular exogenous variable is omitted from the model
SCT	Social Cognitive Theory
SOC	School of Computing
SPSS	Statistical Package for Social Science
TIOBE	The Importance of Being Ernest- a programming community index
UUM	Universiti Utara Malaysia
VIF	Variance Inflation Factor

CHAPTER 1 :

INTRODUCTION

1.1 Background

Online communities are groups of web users with regular interest, concerns, and activities that interact and share great amounts of resources with each other via the Internet (Preece, 2000; Schwartz & Timbolschi-Preoteasa, 2015). The communities assemble thousands of people from different nationalities, time zone, and geographical boundaries. Online communities are getting bigger each day and contribute greatly to the consumptions and generations of online content (Thackeray, Neiger, Smith, & Van Wagenen, 2012). In addition, the Web 2.0 advancement in recent years has promoted the rise of online communities. These communities rely on contributions from online volunteers to build knowledge and software artifacts (Qin, Salter-Townshend, & Cunningham, 2014). Furthermore, there are communities that focus on creating and maintaining a relationship (such as Twitter, Facebook and Snapchat), while some focus on integrating knowledge (such as Wikipedia, Citizendium and About.com). There are also online communities for creating creative work (such as YouTube and Pexels), for software and web development (such as Github, Stack Overflow, Java community and Linux community), and answering queries (such Quora.com and Stackexchange). There is a massive information load created and shared by members of these online communities. This produces millions of data and information in the form of ideas, opinions, and beliefs by these big audiences that make up the Internet.

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Appendix A

Web Survey Questionnaire

Section A

Dear Respondents,

My name is Abdul Razak Faiek, a postgraduate student at Universiti Utara Malaysia. I am conducting a study on a research titled "Examining Virtual Leadership Behavior towards Knowledge Sharing in Online Programming Communities". This survey has two sections. Section A and section B. It will take approximately 5 - 10 minutes to complete the survey.

Before answering the survey, please go through our definition of "influential member", "knowledge sharing" and "online programming community".

Influential Members: A person whose ideas, opinions, knowledge, skills or characteristics that trigger you to participate and strongly influence your existence in this Online Programming Communities. These members also are willing to guide you towards a common goal and belief to realize the vision.

Knowledge Sharing: Members' action of posting what they know using the online community platform. Knowledge sharing/contribution in the community can be in the form of:

1. Posting new project/articles/coding/threads.
2. Posting answers (e.g.: solution, feedback, opinion).

Online Programming Community is an online community platform for programmers and open source software enthusiast that provide a place to connect, build and share knowledge and learning to develop websites, apps, programs, and games.

All responses are **treated anonymous and will be strictly confidential**. Your cooperation and willingness to participate in this survey is highly appreciated. If you have any inquiries regarding the study, you can contact me at 0135007022 or email me at qazakian@gmail.com

Please provide information about your background for our study by answering the following questions. This information is important to allow us to study the effects of differences among individuals on their perceptions of their Online Programming Communities. (Tick where necessary).

1. [Lucky Draw Prize]

Please insert your email address to reach you for delivering the prize

Email [**Optional**]:

2. Have you participated in any Online Programming Communities?

- Yes
- No

3. Which Online Programming Community do you most actively participate in?

- JavaScript Programming Community
- SQL Programming Community
- Java Programming Community
- C# Programming Community
- Python Programming Community
- PHP Programming Community
- C++ Programming Community
- C Programming Community
- TypeScript Programming Community
- Ruby Programming Community
- Swift Programming Community
- Objective-C Programming Community
- VB.NET Programming Community
- Assembly Programming Community
- R Programming Community
- Perl Programming Community
- CSS Programming Community
- Matlab Programming Community
- Visual Basic Programming Community
- Go Programming Community
- Other (please specify)

4. How long have you been in this online programming community?

- Less than 1 year
- 1 to 3 years
- 3 to 5 years
- 5 to 7 years
- More than 7 years

5. Please name the most influential members of the online programming community answered in Q3?

[**Optional**]

For example (Jon Skeet, An Wang, Zaidoun Karadsheh, Anubhava)

6. How frequently do you visit this Online Programming Community?

- Everyday
- More than once a week
- More than once a month
- More than once a year
- Less than once a year
- Rarely
- Never

7. In average, how often do you post in this Online Programming Community?

- Everyday
- More than once a week
- More than once a month
- More than once a year
- Once a year or less
- Rarely
- Never

8. What is your Role in this Online Programming Community?

- Beginner
- Intermediate
- Advanced
- Expert
- Moderator/Administrator/Community Manager

9. What is your gender?

- Male
- Female

10. What is your age?

- 13-20 years
- 21-30 years
- 31-40 years
- 41-50 years
- 51-60 years
- Over 61 years

11. What is the highest level of education that you have completed?

- Primary School
- Secondary School
- Diploma
- Bachelor's Degree
- Master's Degree
- Doctor of Philosophy (PhD)



Section B : Items

(Scale : Strongly Disagree (1) – Strongly Agree (5))

Self-Efficacy: Please indicate your level of agreement with each statement below that best reflects what you think about sharing knowledge in the community, on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree).

1. I am confident in responding to other members' post in this Online Programming Community.
2. The knowledge I share with members of this Online Programming Community should be useful to them.
3. I am confident in giving guidance to questions asked by members of this Online Programming Community.
4. I am confident that my knowledge sharing would help this Online Programming Community to achieve its goals.
5. I am confident in providing my opinion to others by engaging in dialogue with other members in this Online Programming Community.

Outcome expectancy: This section asks you about your expected outcomes from community activities. Please indicate your level of expectations, on a scale from 1 (No impact) to 5 (Great deal).

1. My knowledge sharing will strengthen the tie between me and other members in this Online Programming Community.
2. Sharing my knowledge can enhance my reputation in this Online Programming Community.
3. Gaining useful information from this Online Programming Community will help me spend less time on routine job tasks.
4. Sharing my knowledge will give me a sense of accomplishment.
5. If I share my knowledge with other Online Programming Community members, I will get better cooperation and benefits in return.
6. Sharing my knowledge will help me meet other people with similar interests in this Online Programming Community.
7. Using knowledge from this Online Programming Community will enable me to accomplish my tasks more efficiently.

The Supportive Leadership behavior:

This section asks you about the most influential members' supportive leadership behavior in online programming community. Please indicate your level of agreement with each statement below.

1. The most influential members help me find meaning of my existences in this Online Programming Community.
2. The most influential members keen to satisfy my inquiries posted in this Online Programming Community.
3. The most influential members give positive feedback when I contribute to this Online Programming Community.
4. The most influential members of this Online Programming Community encourage me when I needed support.
5. The most influential members provide a clear vision of my existence in this Online Programming Community.

Directive Leadership Behavior :

This section asks you about the most influential members' directive leadership behavior in online programming community. Please indicate your level of agreement with each statement below.

1. The most influential members let me know what is expected from me in this Online Programming Community.
2. The most influential members inform me the standard rules and regulations that I have to follow in online programming community.
3. The most influential members explain what and how I can contribute to this Online Programming Community.

Participative Leadership Behavior :

This section asks you about the most influential members' participative leadership behavior in online programming community. Please indicate your level of agreement with each statement below.

1. The most influential members listen receptively to my ideas and suggestions.
2. The most influential members consult me when I share my ideas in this Online Programming Community.
3. The most influential members always ask for my suggestions concerning on how to enhance community contribution in this Online Programming Community.
4. The most influential members will let me participate in making decisions on enhancing this online community.

Achievement-oriented Leadership Behavior:

This section asks you about the most influential members' Achievement-oriented leadership behavior in online programming community. Please indicate your level of agreement with each statement below.

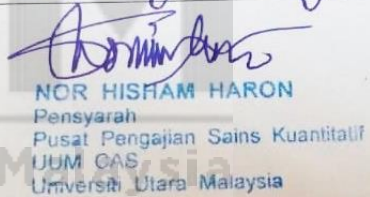
1. The most influential members made me aware that participation in this Online Programming Community is beneficial and rewarding.
2. The most influential members set challenging goals for my contribution in this Online Programming Community.
3. The most influential members encourage my continual contribution in this Online Programming Community.

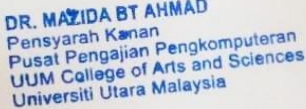


Knowledge Sharing Behaviors: This section asks you about your knowledge sharing behaviors in the online programming community. Please indicate your level of agreement with each statement below.

1. I share my knowledge with members of this Online Programming Community.
2. I make valuable information available to all other members in this Online Programming Community.
3. I often ask for advice and information in this Online Programming Community that can help me solve problems in my work.
4. I try to stay updated by exploring all the information available in this Online Programming Community.
5. I contribute my ideas by participating in one or more discussion in this Online Programming Community.
6. I help other members find solutions to their problems in this Online Programming Community.

Appendix B

List of Experts Involved in This Study

Expert Information	Evidences
<p>Expert 1. FACE VALIDITY Name: Nor Hisham Haron Department: Pusat Pengajian Sains Kuantitatif, UUM. Position: Senior Lecturer/ Statistical consultant Expertise: Sampling & Regression</p>	<p>Expert Information: Name of Reviewer: <u>NOR HISHAM HARON.</u> Expertise Area: <u>Sampling & Regression.</u> Official Stamp: </p>
<p>Expert 2. CONTENT VALIDITY Name: Assoc. Prof. Dr. Azizah Hj. Ahmad Department: School of Computing, UUM. Position: Senior Lecturer Expertise: Information Management</p>	<p>Expert Information: Name of Reviewer: <u>ASSOC. PROF. DR. AZIZAH HJ. AHMAD</u> Director Institute for Advanced and Smart Digital Opportunities School of Computing Universiti Utara Malaysia Expertise Area: <u>Information Management / Business Intelligence</u> Official Stamp:</p>

<p>Expert 3. CONTENT VALIDITY Name: Dr. Mazida Ahmad Department: School of Computing, UUM. Position: Senior Lecturer Expertise: Knowledge Management</p>	<p>Expert Information: Name of Reviewer: <u>Mazida Ahmad</u> Expertise Area: <u>Knowledge Management</u> Official Stamp: </p>
<p>Expert 4. CONTENT VALIDITY Name: Dr Alawiyah Abdul Wahab Department: School of Computing, UUM. Position: Senior Lecturer Expertise: E-Learning, E-commerce & Internet Application</p>	<p>Expert Information: Name of Reviewer: <u>Alawiyah Abd Wahab</u> Expertise Area: <u>E-learning, E-commerce & Internet Applications</u> Official Stamp: </p>
<p>Expert 5. CONTENT VALIDITY Name: Dr. Ishola D. Muraina Department: School of Computing, UUM. Position: Visiting Senior Lecturer Expertise: Information technology & Digital Information</p>	<p>Expert Information: Name of Reviewer: <u>Dr. Ishola D. Muraina</u> Expertise Area: <u>Information Technology & Digital Information</u> Official Stamp: </p>