

**EFFECTS OF SOFTWARE ENGINEERS' WORK
ETHICS ON THEIR WORK PERFORMANCE AND JOB
SATISFACTION: ROLE OF EMOTIONAL
INTELLIGENCE**

BY

SHAFIA KHATUN

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ABSTRACT

In the present Information and Communication Technology (ICT) based society, software engineers hold significant roles. Every sector of society uses software, be it education, healthcare, security, transportation, and so on. As software engineers are affecting society greatly, if they do not behave ethically in their work, it could cause widespread damage. This has occurred in numerous incidents in the past such as the Volkswagen emissions scandal in 2017 and Facebook-Cambridge Analytica scandal in 2018. And although calls for reform are made repeatedly after these scandals, there is still a lack of effort to improve the situation in education, software industries and research. So, investigating the ethics of software engineers and the relationships it has with other variables is important for understanding what could be done to improve the situation. Software engineers work in rapidly-changing business environments that cause intense social interactions which results in them facing a lot of pressure which leads to stress. Their emotions are important for dealing with this, and can impact their ethical decision-making. Previous studies have shown that employees with higher Emotional Intelligence (EQ) were able to manage their emotions better leading to less stress and performed better at work. Also, job satisfaction has been found to be important for better work performance, better organizations, lower workplace deviant behavior etc. Therefore, in this quantitative study, the researcher aims to investigate the moderation effect of EQ between work ethics of software engineers and their work performance, and job satisfaction. Also, the correlation between work ethics, and work performance and job satisfaction will be investigated. 170 software engineers responded to the questionnaires measuring the four variables: work ethics, EQ, work performance and job satisfaction, which were sent to them via LinkedIn. Data collection was carried out over 4 months. Data analysis was run in SPSS version 22. For the moderation analysis, hierarchical multiple regression was used; for the correlation analysis, Pearson's product-moment correlation (r) was used. The results for the moderation analysis are as follows: EQ significantly moderates the relationship between work ethics and work performance; EQ does not significantly moderate the relationship between work ethics and job satisfaction. The results for the correlation analysis are as follows: there is a strong significant positive correlation between work ethics and work performance; there is a moderate significant positive correlation between work ethics and job satisfaction. These findings have important implications for education, software industries and research. More effort needs to be done to teach and train both work ethics and EQ in education and software industries since work ethics positively correlates with both work performance and job satisfaction, and EQ strengthens the relationship between work ethics and work performance of software engineers. Also, further research should be done on the work ethics of software engineers and its relationships with other variables such as team climate, team flexibility and so on. All of this will help in improving the ethical behaviour of software engineers in the future which will then reduce unethical incidents, and instead, increase beneficial contributions to society.

خلاصة البحث

في المجتمع المعاصر القائم على تكنولوجيا المعلومات والاتصالات (ICT)، يلعب مهندسو البرمجيات أدوارًا مهمة. يستخدم كل قطاع في المجتمع البرامج، سواء كان ذلك التعليم أو الرعاية الصحية أو الأمن أو النقل وما إلى ذلك. نظرًا لأن مهندسي البرمجيات يؤثرون على المجتمع بشكل كبير، إذا لم يتصرفوا بشكل أخلاقي في عملهم، فقد يتسبب ذلك في أضرار واسعة النطاق. حدث هذا في العديد من الحوادث في الماضي مثل فضيحة انبعاثات فوكسواغن في عام 2017م وفضيحة Facebook-Cambridge Analytica في عام 2018م. وعلى الرغم من تكرار دعوات الإصلاح بعد هذه الفضائح، لا يزال هناك نقص في الجهود المبذولة لتحسين الوضع في التعليم وصناعات البرمجيات والبحث. لذا، فإن التحقيق في أخلاقيات مهندسي البرمجيات والعلاقات التي تربطها بالمتغيرات الأخرى أمر مهم لفهم ما يمكن فعله لتحسين الوضع. يعمل مهندسو البرمجيات في بيئات عمل سريعة التغير التي تؤدي إلى تفاعلات اجتماعية مكثفة تؤدي إلى مواجهة الكثير من الضغط الذي يؤدي إلى الإجهاد. عواطفهم مهمة للتعامل مع هذا، ويمكن أن تؤثر على اتخاذ القرار الأخلاقي. أظهرت الدراسات السابقة أن الموظفين الذين يتمتعون بذكاء عاطفي أعلى (EQ) كانوا قادرين على إدارة عواطفهم بشكل أفضل مما أدى إلى تقليل التوتر وأدائهم بشكل أفضل في العمل. أيضًا، تم العثور على أن الرضا الوظيفي مهم لتحسين أداء العمل، وتحسين التنظيم، وانخفاض السلوك المنحرف في مكان العمل وما إلى ذلك. بدت، في هذه الدراسة التحقيقية، هدف الباحه إلى اسحقق في تأثير الاعتدال و EQ بين أخلاقيات العمل لمهندسي البرمجيات وأداء عملهم والرضا الوظيفي. كما سيتم التحقيق في العلاقة بين أخلاقيات العمل وأداء العمل والرضا الوظيفي. أجاب 170 مهندس البرمجيات على استبيانات قياس المتغيرات الأربعة: أخلاقيات العمل و EQ. وأداء العمل، والرضا الوظيفي، والتي تم إرسالها إليهم عبر LinkedIn. تم جمع البيانات على مدى 4 أشهر. تم إجراء تحليل البيانات في الإصدار 22 من SPSS. لتحليل الاعتدال، تم استخدام الانحدار المتعدد افرمي. لتحليل الارتباط، تم استخدام ارتباط بيرسون لحظة المنتج (r). نتائج تحليل الاعتدال كما يلي: EQ يعدل بشكل كبير العلاقة بين أخلاقيات العمل وأداء العمل؛ لا يُعدّل الذكاء العاطفي بشكل كبير العلاقة بين أخلاقيات العمل والرضا الوظيفي. وكانت نتائج تحليل الارتباط كالتالي: توجد علاقة ارتباط موجبة قوية بين أخلاقيات العمل وأداء العمل؛ توجد علاقة ارتباط موجبة معتدلة بين أخلاقيات العمل والرضا الوظيفي. هذه النتائج لها آثار مهمة على التعليم وصناعات البرمجيات والبحث. يجب بذل المزيد من الجهد لتدريس وتدريب كل من أخلاقيات العمل و EQ في التعليم وصناعات البرمجيات لأن أخلاقيات العمل ترتبط بشكل إيجابي بكل من أداء العمل والرضا الوظيفي. و EQ ينموي العلاقة بين أخلاقيات العمل وأداء عمل مهندسي البرمجيات. أيضًا، يجب إجراء مزيد من البحث حول أخلاقيات عمل لمهندسي البرمجيات وعلاقتها مع المتغيرات الأخرى مثل ظروف العمل الجماعية والمهنة الجماعية وما إلى ذلك. كل هذا سيساعد في تحسين السلوك الأخلاقي لمهندسي البرمجيات في المستقبل والذي سيؤدي بعد ذلك إلى تقليل الحوادث غير الأخلاقية، وبدلاً من ذلك، تزيد المساهمات المفيدة للمجتمع.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion, it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Computer Science



.....
Norsaremah Salleh
Supervisor

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a thesis for the degree of Master of Computer Science

.....
Ali A. Alwan
Internal Examiner

.....
Koh Tieng Wei
External Examiner

This thesis was submitted to the Department of Computer Science and is accepted as a fulfillment of the requirement for the degree of Master of Computer Science

.....
Raini Hassan
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Science

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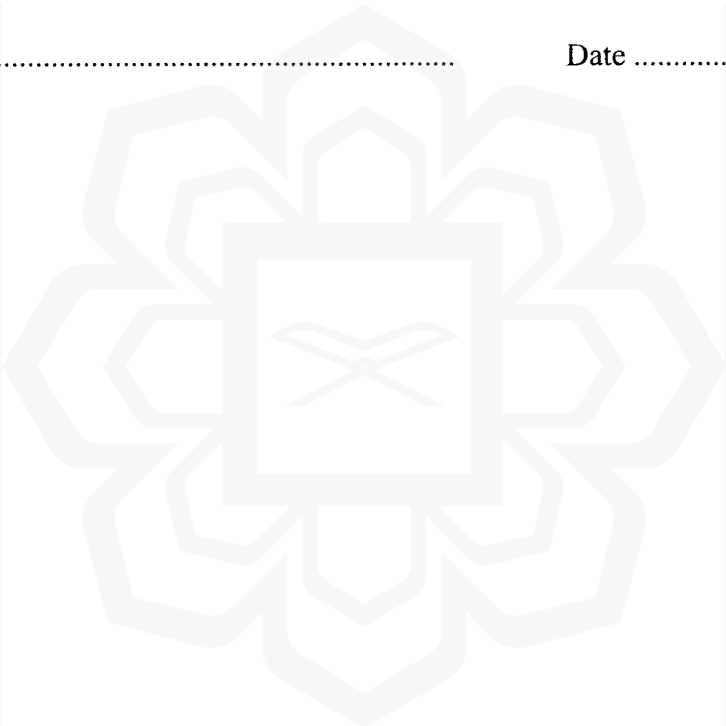
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DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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TABLE OF CONTENTS

Abstract	ii
Abstract in Arabic	iii
Approval Page	iv
Declaration	v
Copyright Page	vi
Acknowledgements	vii
List of Tables	x
List of Figures	xi
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the Study	1
1.2 Variables of the Study	4
1.2 .1 Work Ethics and Emotional Intelligence (EQ)	4
1.2 .2 Work Performance and Job Satisfaction	9
1.3 Problem Statement	10
1.4 Research Purpose	11
1.5 Research Questions	11
1.6 Research Objectives	12
1.7 Operational Definitions and Measurements	13
1.8 Research Hypotheses	15
1.9 Significance of the Study	15
1.10 Limitations of the Study	16
1.11 Chapter Summary	16
CHAPTER TWO: LITERATURE REVIEW	17
2.1 Introduction	17
2.2 Studies related to Ethics	17
2.3 Studies related to Emotional Intelligence (EQ)	32
2.4 Chapter Summary	38
CHAPTER THREE: RESEARCH METHODOLOGY	39
3.1 Introduction	39
3.2 Research Objectives	39
3.3 Research Hypotheses	39
3.4 Research Design	40
3.5 Instruments	42
3.6 Sample, Population and Data Collection	42
3.7 Data Analysis	43
3.8 Chapter Summary	43
CHAPTER FOUR: DATA ANALYSIS AND PRESENTATION OF RESULTS	44
4.1 Introduction	44
4.2 Demographics of the Respondents	44
4.3 Data Analysis for Research Objectives 1 and 2	44

4.3.1 Results from the Data Analysis (Research Objectives 1 and 2)	51
4.4 Data Analysis for Research Objective 3	53
4.4.1 Results from the Data Analysis (Research Objective 3)	65
4.5 Data Analysis for Research Objective 4.....	67
4.5.1 Results from the Data Analysis (Research Objective 4)	79
4.6 Chapter Summary	81
CHAPTER FIVE: DISCUSSION AND CONCLUSION.....	82
5.1 Introduction	82
5.2 The Relationship between Work Ethics and Work Performance (O1) ..	82
5.3 The Relationship between Work Ethics and Job Satisfaction (O2).....	85
5.4 The Moderating Effect of EQ between Work Ethics and Work Performance (O3)	87
5.5 The Moderating Effect of EQ between Work Ethics and Job Satisfaction (O4).....	90
5.6 Conclusion	92
5.7 Future Work Recommendations	93
REFERENCES.....	95
APPENDIX A: THE QUESTIONNAIRE OF THIS RESEARCH.....	105

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
4.1	Correlation of Work Ethics (IV) with Work Performance (DV)	52
4.2	Correlation of Work Ethics (IV) with Job Satisfaction (DV)	53
4.3	Model Summary for Work Performance (DV)	55
4.4	Pearson Correlation Results	59
4.5	Coefficients	60
4.6	The first 10 rows of the SDR_1 column	61
4.7	The first 10 rows of the LEV_1 column	62
4.8	The first 10 rows of the COO_1 column	63
4.9	Variables included in Model 1 and Model 2	66
4.10	Model Summary for EQ between Work Ethics and Work Performance	66
4.11	Model Summary for Job Satisfaction (DV)	68
4.12	Pearson Correlation Results	72
4.13	Coefficients	73
4.14	Casewise Diagnostics for Job Satisfaction (DV)	74
4.15	Case 35	75
4.16	The first 10 rows of the LEV_2 column	76
4.17	The first 10 rows of the COO_2 column	76
4.18	Variables included in Model 1 and Model 2	79
4.19	Model Summary for EQ between Work Ethics and Job Satisfaction	80

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1.1	Research Objective 1	12
1.2	Research Objective 2	12
1.3	Research Objectives 3 and 4	13
3.1	Research Objective 1	41
3.2	Research Objective 2	41
3.3	Research Objectives 3 and 4	41
4.1	Scatterplot of Work Ethics with Work Performance	46
4.2	Scatterplot of Work Ethics with Job Satisfaction	46
4.3	Histogram of Work Ethics	47
4.4	Normal Q-Q Plot of Work Ethics	48
4.5	Histogram of Work Performance	49
4.6	Normal Q-Q Plot of Work Performance	49
4.7	Histogram of Job Satisfaction	50
4.8	Normal Q-Q Plot of Job Satisfaction	51
4.9	SRE_1 vs PRE_1 for Work Performance (DV)	55
4.10	Partial Regression Plot for Work Ethics	56
4.11	Partial Regression Plot for EQ	57
4.12	Partial Regression Plot for WorkEthicsXEQ	57
4.13	SRE_1 vs PRE_1 for Work Performance (DV)	58
4.14	Histogram for Work Performance (DV)	64
4.15	Normal P-P Plot for Work Performance (DV)	65
4.16	SRE_2 vs PRE_2 for Job Satisfaction (DV)	68
4.17	Partial Regression Plot for Work Ethics	69

4.18	Partial Regression Plot for EQ	70
4.19	Partial Regression Plot for WorkEthicsXEQ	70
4.20	SRE_2 vs PRE_2 for Job Satisfaction (DV)	71
4.21	Histogram for Job Satisfaction (DV)	77
4.22	Normal P-P Plot for Job Satisfaction (DV)	78



CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Development of software has become a core element in today's ICT (Information and Communication Technology) based society (Aydemir & Dalpiaz, 2017; Jia & Xin, 2018). Governments, educational institutions, healthcare organizations, national security, transportation, and many other sectors are using systems that involve software. Without the software, these systems would not function. Most of these systems are necessary and are benefiting society greatly. Therefore, it can be said that the software engineers behind the development of these software are impacting society greatly (Aydemir & Dalpiaz, 2017; Rogerson, Miller, Winter & Larson, 2017; Jia & Xin, 2018). As they have the power to change society, they also have a duty to exercise that power responsibly and ethically or it could cause widespread damage. There are many instances in the past where this has happened.

In March 2018, news all over the world exploded with the Facebook-Cambridge Analytica scandal. Cambridge Analytica, a data analytics (involving software), political, advertising and consulting company based in the UK, was found to have harvested the personal data of millions of people's Facebook profiles without their consent and used it to influence a variety of political campaigns (they managed to completely change the tide of elections with their activities). It resulted in a huge public outcry, a massive fall in Facebook's stock price, Mark Zuckerberg (the founder of Facebook) had to testify in front of the United States' congress, and there were calls for tighter regulations on software companies' use of data (Facebook-Cambridge Analytica data scandal, 2018).

The year before, in 2017, the Volkswagen emissions scandal occurred. Volkswagen was found to have used a defeat device to cheat on emissions tests mandated by the Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) to sell approximately 590,000 diesel vehicles in the US. Misinformation was purposely being generated by software that was developed and implemented by professionals who were knowingly part of this unethical and illegal act (Rogerson et al., 2017).

Another example of software misuse is ransomware. According to Lord (2018), more than 7,600 ransomware attacks were reported to the Internet Crime Complaint Centre (IC3) between 2005 and March of 2017. In 2015 alone, the IC3 received 2,453 ransomware complaints that cost victims over \$1.6 million. And according to Lord (2018), these figures only represent the attacks reported to the IC3; the actual number of ransomware attacks and costs is much higher. Ransomware is a form of malicious software from cryptovirology that threatens to publish the victim's data or perpetually block access to it unless a ransom is paid (Ransomware, 2018). This means that people who are able to develop software are intentionally using their skills for unethical purposes. This illegal extortion of money is already a great crime. But when it puts people's lives at risk, the crime becomes even worse. In May 2017, a ransomware attack in the UK caused the closure of many of the emergency units in hospitals in the UK, endangering patients (Rogerson et al., 2017).

These examples are only a few of the many incidences where software is developed and used for illegal or unethical reasons. Rogerson et al. (2017) said that the consideration of ethics in the Information Technology (IT) industry is often neglected until events like these occur. In the aftermath of these incidences, members of the public reignite the discussion on the ethical standards of IT companies. They

call for tighter regulations on them. However, even with them voicing these demands time and time again, not enough is being done. In a keynote speech at ICSE 2015, Grady Booch put forward the notion that “every line of code has a moral and ethical implication.” Ferrario et al. (2017) said that “anything digital is inevitably affected by values: the organizational values of the project sponsor, the values of the research partners, and the values of each developer and designer” (p. 1). Thomson and Schmoldt (2001) mentioned that, from an ethical perspective, technology improvement should protect human values while improving computer software. However, as said before, the presence of human values in software engineering (SE) is usually neglected or invisible until the widespread consequences of breaching them are felt (Ferrario et al., 2017; Rogerson et al., 2017). In education and research as well, ethics are not given enough emphasis. Logan and Clarkson, in 2005, did a review of programs offered by universities in information security and found that there was a pattern of “strong technical content and the absence of an ethics and computer law course” (pp. 157-161). In 2017, Rogerson et al. said that in reviewing topics covered by several international and national information systems conferences and textbooks, the topic of ethics is totally missing or minimally represented. This is very surprising as, in the IT world, ethics is a very crucial issue. It can be observed that not much has improved between 2005 and 2017. From these findings, it can be seen that there is an urgent need to increase action taken regarding the ethical dimension of IT/SE in education, industries and research.

One way of taking action in research is to investigate the relationship between the ethics of software engineers and other variables, especially interpersonal variables of software engineers. Günsel and Açıkgoz (2013) said that in the context of organizational behavior (OB), “software development remains a poorly understood

process” (p. 14). Based on what previous studies have mentioned and what the researcher has reviewed in past literature, research on the interpersonal characteristics and competencies of software engineers are scant (Kosti, Feldt, & Angelis, 2014; Rezvani & Khosravi, 2019), especially in relation to their ethics. With the recurring incidents of unethical behaviour in the IT/SE industry, educators, practitioners and researchers are becoming more aware that more effort and attention should be given to understanding the software engineers developing the software (Kosti, Feldt, & Angelis, 2014). If the relationships between the ethics of software engineers and their interpersonal characteristics are investigated, this will help in understanding the dynamics surrounding the ethics of software engineers and what can be done to improve the situation.

In this study, three interpersonal characteristics of software engineers were chosen to be investigated in relation to their work ethics: work performance, emotional intelligence (EQ), and job satisfaction. Therefore, including work ethics of software engineers, there are four variables in this study altogether. The next section will describe the rationale behind choosing these variables.

1.2 VARIABLES OF THE STUDY

This study will have four variables: Work Ethics, Emotional Intelligence (EQ), Work Performance and Job Satisfaction. The following sections describe why they were chosen for investigation in this study.

1.2.1 Work Ethics and Emotional Intelligence (EQ)

As this study intends to investigate the relationship between ethics of software engineers at the workplace and other variables, Work Ethics of software engineers

will be one of the variables. Ethics can be simply defined as “a system of moral principles” (Belyh, 2016, p. 1). They influence “how people lead their lives, for life is an unbroken stream of decision-making and ethics are concerned with what is the right moral choice, for individuals and for society” (Belyh, 2016, p. 1). Within an organization, staff behaving ethically would mean that they complete their work responsibly with integrity and honesty, that their work is beneficial and not harmful, and “adhere to policies and rules while working to meet the aims” of the organization (Belyh, 2016, p. 1).

Another variable that will be studied is Emotional Intelligence (EQ) which is described below.

There is a clear linkage between an employee’s individual characteristics, such as his/her ethical beliefs, and deviant/unethical behaviour at the workplace (Robbins & Judge, 2013; Yadav, Dubey, & Ali, 2015). However, there may also be situational characteristics that can cause an employee to behave unethically (Yadav et al., 2015). Affective Events Theory (AET) which was developed by organizational psychologists, Weiss and Cropanzano (1996), explains that emotions experienced by workers at the workplace have an influence on work performance and job satisfaction; the emotions of workers are important for handling workplace situations which can be positive or negative. Upon inspection of the workplace that software engineers work in, it can be observed that software engineers work in rapidly-changing business environments (Lee & Xia, 2005) that are demanding and competitive (Günsel & Açıkgöz, 2013) which results in them facing a lot of pressure which leads to stress (Rezvani & Khosravi, 2019). Rezvani and Khosravi (2019) say that increasing levels of stress affects a software engineer’s “ability to self-regulate their feelings and understanding” (p. 139). As humans, and according to AET, software engineers not

only bring their personalities, ethical beliefs, knowledge and skills to their work, they also bring their emotions (Kelly & Barsade, 2001). Emotional intelligence (EQ) was first described formally by Salovey and Mayer (1990). They defined it as “the ability to monitor one’s own and others’ feelings and emotions, to discriminate among them and to use this information to guide one’s thinking and actions” (p. 189). Later on, researchers came up with more detailed definitions such as “the set of abilities that enable a person to generate, recognize, express, understand, and evaluate their own, and others’ emotions in order to guide thinking and action that successfully cope with emotional demands and pressures” (Van Rooy & Viswesvaran, 2004 , p. 72). As described earlier, the complex nature of a software engineer’s job calls for intense social interactions, and such interactions cause stress (Rezvani & Khosravi, 2019) and produce many emotions (Reus & Liu, 2004), and this can affect their ethical decision-making (Goleman, 1995; Haidt, 2003; Angelidis & Ibrahim, 2011; Deshpande, 2009; Fu, 2014). A software engineer with a higher EQ is more likely to manage their emotions better, leading to lower levels of stress (Gohm, 2003; Rezvani & Khosravi, 2019), and more likely to have better ethical decision-making (Fu, 2014). Also, previous studies have found that employees with higher EQs had positive correlations with work performance (Goleman, 1995; Goleman et al., 2002; Dulewicz et al., 2005; Brackett et al., 2011; Rezvani & Khosravi, 2019), team performance (Druskat & Wolff, 2001; Jordan & Troth, 2004; Günsel & Açikgöz, 2013), job satisfaction (Sy et al., 2006), and successful software projects (Nicholson & Sahay, 2004; Hoegl & Parboteeah, 2007; Günsel & Açikgöz, 2013). In fact, studies have shown that skills associated with EQ are twice as important for career success as intelligence (IQ) or technical skills (Law et al., 2004; Cote & Miners, 2006). Holt and Jones (2005) highlighted the economic value of EQ: “In the age of information and highly

specialized work teams, emotional intelligence is becoming a vital skill as people must accomplish their work by collaborating with each other, and their ability to communicate effectively becomes as critical, if not more critical, as technical skills and capabilities” (p.15).

Conservation of Resources (COR) theory (Hobfoll, 2001), as explained by Rezvani and Khosravi (2019), describes that “people aim to keep, safeguard, and construct resources. Resources are defined as objects, conditions, personal abilities, and attributes or energies in which the individual places value (Hobfoll, 2001). These can either be valued in themselves or facilitate the achievement of specified objectives (Hobfoll, 2001). A setting that drives an individual to anticipate a possible or actual loss of resources, or the application of resources without the potential to acquire further resources, can therefore generate stress (Hobfoll, 1989, 2001)” (p. 140). Adding to what was described earlier, software engineers experience many difficulties in their efforts to successfully complete their projects, especially in complex and broad projects (Gupta, George, & Xia, 2019), and this increases levels of stress. However, the development of personal competencies such as EQ can serve as a buffer to any loss of resources in such situations (Hobfoll & Shirom, 2001; Holmgreen, Tirone, Gerhart, & Hobfoll, 2017). EQ can be an “interpersonal support resource” (Rezvani & Khosravi, 2019, p. 140) that can be used to reduce the negative influence of stress on software engineers, especially on their ethical decision-making. Self-report EQ measures that are based on Salovey and Mayer’s (1990) definition of EQ, such as Schutte et al. (1998) and Wong and Law (2002), assert that “emotional capabilities are acquired skills that can be nurtured and enhanced” (Rezvani & Khosravi, 2019, p. 140). Researchers have found that EQ is a skill that can be trained and have conducted studies where they trained students and professionals alike and

found the results to be positive; their EQ did increase (Grant, 2007; Herrera et al., 2019). Therefore, as EQ is a skill that can be nurtured and enhanced, and according to COR theory, EQ may be an important resource for software engineers to acquire that can assist them in dealing with the various positive and negative situations that occur in their work, especially with regards to ethical decision-making.

Additionally, in relation to ethics, researchers have pointed out that just having a high EQ is not sufficient for employees. Gibbs et al. (1995) said that “without a moral compass to guide people in how to employ their gifts, emotional intelligence can be used for good or evil” (p. 67). Also, Maak and Pless (2006) argued that “responsible leaders need both emotional and ethical qualities to guide their action and behaviour in interaction” (p. 105). Segon and Booth (2014) reviewed several emotional competency inventory frameworks that are popular in business leadership and management development and found that, in terms of their definitional constructs, it is possible for a manager/leader to display high EQ but still be an unethical individual; they demonstrated this through analyzing several high-profile cases of business leaders who were praised by the public but were later found to have behaved unethically. They said that the frameworks did not include an ethical dimension in them. They concluded that ethics competencies must be included in the frameworks to guide EQ. And although studies exploring the relationships between ethics and EQ are scant, the few that are available have shown that the ethics of an employee were most effective when the employee had high EQ and vice versa (Deshpande, 2009, Angelidis & Ibrahim, 2011; Fu, 2014; Chowdhury, 2015; Ashrat, Hosseinnia, & Domskey, 2017).

In the introduction, the researcher described that many unethical incidents have occurred in the IT SE industry and keep occurring, and that investigating the

ethics of software engineers and the relationships it has with other variables are of significant importance in understanding what could be done to improve the situation. As discussed earlier, software engineers experience a lot of pressure in their jobs which can lead to high levels of stress. Based on AET (Weiss & Cropanzano, 1996) and COR theory (Hobfoll, 2001), their emotions are important in dealing with this, and can impact their ethical decision-making (Goleman, 1995; Haidt, 2003; Angelidis & Ibrahim, 2011; Deshpande, 2009; Fu, 2014). Therefore, EQ is one of the variables that will be investigated in relation to the work ethics of software engineers. Studies investigating this relationship among software engineers are scant. And previous researchers of other areas have also recommended this investigation. Holian (2006) recommended that future research investigate whether ethical decisions are affected by skills associated with EQ. Also, Mulki et al. (2009) proposed that future research address the impact of EQ on an individual's ethical judgment. Bay and McKeage (2006) said that "it may eventually be shown that emotional intelligence is one of the variables that may explain the current gap between ethical understanding and ethical behaviour" (p. 441).

1.2.2 Work Performance and Job Satisfaction

The third variable that will be investigated in this study is Work Performance. The performance of employees is crucial to the success of a company (Leonard, 2019), and unethical behavior of employees will negatively impact this (Rogerson et al., 2017). Therefore, the relationships between Work Ethics of software engineers and Work Performance will also be investigated. Earlier, it was stated that EQ was found to have positive correlations with Work Performance (Goleman, 1995; Goleman et al., 2002; Dulewicz et al., 2005; Brackett et al., 2011; Rezvani &

Khosravi, 2019). Therefore, the moderating role of EQ between Work Ethics and Work Performance will also be investigated.

The fourth and final variable that will be investigated is Job Satisfaction. It has been found by Robbins and Judge (2013), authors of the textbook, *Organizational Behavior*, that employees who were satisfied with their jobs were more likely to have better work performance, have higher organizational citizenship behavior (OCB), bring higher customer satisfaction, have less absenteeism, have lower turnover rates, and lower workplace deviant behavior/less unethical behavior. Previous research has found that ethical conduct can improve Job Satisfaction (Ali & Al-Owaidan, 2008; Khan, Abbas, Gul & Raja, 2013) among employees. Therefore, it would be worthwhile to investigate whether Work Ethics of software engineers has an effect on their Job Satisfaction as well. Also, earlier, it was stated that EQ was found to have positive correlations with Job Satisfaction (Sy et al., 2006). Therefore, the moderating role of EQ between Work Ethics and Job Satisfaction will also be investigated among software engineers.

1.3 PROBLEM STATEMENT

Many unethical incidences have occurred and keep occurring in the IT/SE industry. Yet, not enough action is being taken regarding the ethical dimension of IT/SE in education, industries and research. One way of taking action in research is to investigate the relationships between the ethics of software engineers and other variables. This will increase our understanding of the dynamics that surround the ethics of software engineers and what can be done to improve the situation. Software engineers work in rapidly-changing business environments that cause intense social interactions which results in them facing a lot of pressure which leads to stress. Based

on AET and COR theory, their emotions are important for dealing with this, and can impact their ethical decision-making. Previous studies have shown that employees with higher Emotional Intelligence (EQ) were able to manage their emotions better leading to less stress and performed better at work, and are more likely to have better ethical decision-making. Also, job satisfaction has been found to be important for better work performance, better organizations, less unethical behavior etc. Therefore, in this quantitative study, the researcher aims to empirically investigate the effects of Work Ethics (independent variable) of software engineers on their Work Performance (dependent variable) and Job Satisfaction (dependent variable), and whether EQ (moderating variable) moderates the relationships between them. The findings will give insights on the relationships among these four variables and are expected to give valuable information on the need of both Work Ethics and Emotional Intelligence (EQ) in software engineers for improving their ethical behavior at the workplace.

1.4 RESEARCH PURPOSE

The purpose of this research is to empirically investigate the relationships between software engineers' Work Ethics and their Work Performance and Job Satisfaction, and the moderation effect of EQ between them.

1.5 RESEARCH QUESTIONS

- 1) How does the work ethics of software engineers relate to their work performance?
(Q1)
- 2) How does the work ethics of software engineers relate to their job satisfaction?
(Q2)

- 3) How does EQ moderate the relationship between the work ethics of software engineers and their work performance? (Q3)
- 4) How does EQ moderate the relationship between the work ethics of software engineers and their job satisfaction? (Q4)

1.6 RESEARCH OBJECTIVES

- 1) To empirically investigate the relationship between work ethics of software engineers and their work performance (O1).
- 2) To empirically investigate the relationship between work ethics of software engineers and their job satisfaction (O2).
- 3) To empirically investigate how EQ moderates the relationship between work ethics of software engineers and their work performance (O3).
- 4) To empirically investigate how EQ moderates the relationship between work ethics of software engineers and their job satisfaction (O4).

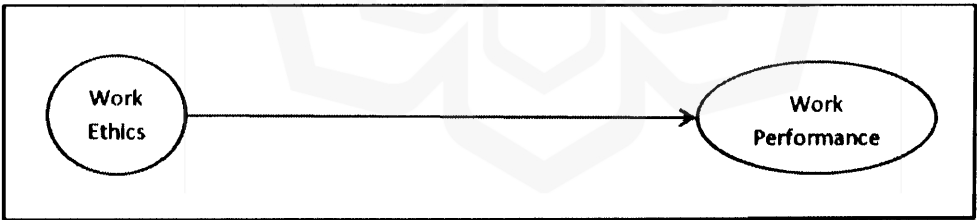


Figure 1.1 Research Objective 1

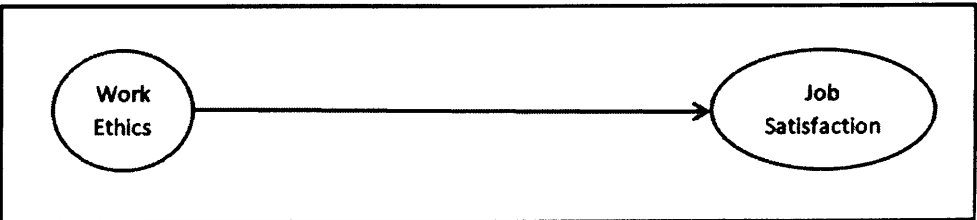


Figure 1.2 Research Objective 2