Faculty of Information Technology and Communication

AGILE DECISION MAKING APPROACH TO ENHANCE INFORMATION MANAGEMENT FOR FLOOD IMPACT

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AGILE DECISION MAKING APPROACH TO ENHANCE INFORMATION MANAGEMENT FOR FLOOD IMPACT

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A thesis submitted in fulfilment of the requirement for the degree in Master of Computer Science (Software Engineering and Intelligent)

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DECLARATION

I declare that this thesis entitled "Agile Decision Making Approach To Enhance Information Management For Flood Impact" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature   : …………………………….

Name   : …………………………….

Date   : …………………………….

APPROVAL

I hereby declare that I have read this dissertation/report and in my opinion this dissertation/report is sufficient in terms of scope and quality as a partial fulfillment of Master of Computer Science (Software Engineering and Intelligent)

Signature   :……………………………………………………

Supervisor Name :…………………………………………………...

Date   :……………………………………………………

DEDICATION

To my beloved wife, daughters and son.

ABSTRACT

Natural disasters are natural forces that cannot be avoid. There are various natural disasters that have been recorded since human civilization which are earthquakes, storms, floods and so on. Malaysia is not spared from experiencing a natural disaster. Although Malaysia is fortunate because did not receive a lot of natural disasters like other countries in the world, but the impact of natural disasters that befell onto Malaysia is still large and can cause devastating losses such as loss of life. Flash flood is a natural disaster that affecting Malaysia the most. Malaysia's position in the middle of wind flowing from north to south and vice versa yielding monsoon wind. The wind was carrying the next heavy rain caused flooding in Malaysia. Melaka as one of the existing state in Malaysia is no exception from this natural disaster. Low areas are prone to flash floods during the annual monsoon season. When natural disasters occur, the situation will become very chaotic and uncertain. There are various studies and findings has been conducted to investigate this situation to further understand how people can react in accordance with the chaos. Studies has produced a framework to confront the natural environment crisis. Within this framework there are five proposed measures to confront the crisis situations To ensure that each of these steps can be carried out successfully, good communication is required. Communication is one important element in times of crisis. With communication, situation can be controlled, news and information can be conveyed to the rescue team and rescue and recovery process can be carried out. To ensure that the message of can be arranged in the order of precedence of the more important and less important in the future, a mechanism should be introduced. This is to ensure that the composition of the news can be arranged according to the importance so decisions can be made quickly and can easily be change with the times of crisis. In this study, Agile Decision Making (ADM) was introduced to help those involved in the rescue and recovery of flood victims making a decision using Agile Decision Making. Agile Decision Making will be developed in this study. After Agile Decision Making has been developed, research will be done to get feedback from related agencies of effectiveness of using Agile Decision Making during the process of flash flood rescue and recovery Result from feedback will be used to improve Agile Decision Making in the future. This research will also try to understand parameters that can contribute in the process of rescue and recovery in flash flood situations. This parameter can help related agencies make decision on dangerousness of situation during rescue and recovery of flood victims. At the end of this study are expected to be better understood by flash floods and the system can be developed. The system is expected it can help improve the process of rescuing the victims of flash floods in the future.

ABSTRAK

Kejadian bencana alam ialah kuasa semula jadi yang tidak dapat kita hindari. Terdapat berbagai-bagai kejadian bencana alam yang telah direkodkan semenjak manusia mempunyai peradaban antaranya gempa bumi, ribut, banjir dan sebagainya. Malaysia tidak terkecuali dari mengalami bencana alam semulajadi. Walaupun Malaysia agak beruntung kerana tidak menerima banyak bencana alam seperti negara-negara lain di dunia, tetapi kesan dari bencana alam yang menimpa Malaysia masih lagi besar dan boleh menyebabkan kerugian yang dahsyat seperti kehilangan nyawa.Banjir adalah bencana alam yang amat memberi kesan kepada Malaysia. Kedudukan Malaysia yang menjadi laluan angin bergerak dari utara ke selatan dan sebaliknya menhasilkan tiupan angin monsun. Tiupan angin ini telah membawa hujan yang lebat seterusnya menyebabkan banjir di Malaysia. Melaka sebagai salah satu dari negeri yang ada di Malaysia tidak terkecuali dari mengalami bencana alam ini. Kawasan-kawasan rendah sering dilanda banjir kilat setiap kali musim angin monsun bertiup. Semasa kejadian bencana alam berlaku, keadaan akan mejadi sangat kucar kacir dan tak menentu. Terdapat berbagai-bagai kajian dan dapatan terlah dijalankan untuk mengkaji keadaan ini seterusnya memahami bagaimana manusia dapat bertindak balas sesuai dengan keadaan kucar kacir tersebut. Dari kajian telah terhasil sebuah kerangka kerja untuk mendepani suasana krisis semulajadi. Di dalam kerangka ini terdapat lima langkah diusulkan untuk mendepani situasi krisis semulajadi tersebut.Untuk memastikan setiap langkah-langkah tersebut dapat dilaksanakan dengan berjaya,komunikasi yang baik amatlah diperlukan. Komunikasi adalah salah satu element yang penting semasa krisis berlaku. Dengan komunikasi, keadan kucar-kacir dapat dikawal, berita dan maklumat dapat di sampaikan agar proses menyelamat dapat dijalankan. Untuk memastikan berita yang disampaikan dapat disusun mengikut susunan yang lebih penting didahulukan dan yang kurang penting di kemudian, satu mekanisme perlu diperkenalkan. Ini untuk memastikan susunan berita dapat di susun mengikut kepentingan yang betul seterusnya keputusan dapat dibuat secara pantas dan mudah pula untuk disesuaikan mengikut keadaan semasa krisis. Dalam kajian ini, Agile Decision Making (ADM) diperkenal untuk membantu pihak yang terlibat dengan proses menyelamat mangsa banjir kilat dapat membuat keputusan dengan tepat mengunakan Agile Decision Making. Agile Decision Making akan dibangunkan di dalam kajian ini. Setelah Agile Decision Making dibangunkan, kajian ini akan mendapatkan maklum balas dari pihak yang terlibat dengan proses menyelamatkan mangsa banjir tentang keberkesan Agile Decision Making di dalam proses menyelamat mangsa banjir kilat.Dapatan dari maklum balas tersebut akan digunakan untuk menambah baik Agile Decision Making di masa akan datang Selain itu, kajian ini juga akan mendapatkan maklumat berkenaan apakah parameter yang dapat menyumbang dalam proses menyelamat dalam situasi banjir. Parameter ini dapat membantu pihak yang terlibat dengan proses menyelamat mangsa banjir kilatmenentukan keadaan manakah yang lebih serius semasa bajir kilat seterusnya membuat keputusan semasa menyelamatkan mangsa banjir kilat. Di akhirnya dari kajian ini diharapkan agar banjir kilat dapat lebih difahami dan satu system dapat dibangunkan. Dengan system

tersebut diharapkan ia dapat membantu meningkatkan proses menyelamat mangsa banjir kilat di kemudian hari.

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ADM   -   Agile Decision Making

CHAPTER 1

INTRODUCTION

1.1. Introduction

The definition of crisis if referred it to the dictionary is time of intense difficulty, trouble or danger. Crisis can be defined as event or occurrence which affects negatively to the victims, properties and daily activities. By the definition itself we can imagine how intense the situation would be if we are on that situation. Crisis can also be explained as an unexpected events that triggered a major disruption in society and will create fear and threat among people involve in it. There are a lot of crisis type. Below is listed type of crisis it definition and it example of each crisis:-

Natural Crisis - This crisis happen in nature. Disturbances in the environments lead to natural crisis. This occasions are normally beyond human control. Normally human being is not involve in triggered this event as it is a natural process. Wild Fire, Earthquakes, Hurricanes, Tsunamis, Flood, Drought are some sample of natural disaster.

Technological Crisis - Technological crisis happened as a consequence from failure in technology. Problems related to systems in the machine are the main issue that will lead to technological crisis. This problem are normally cause by human being and involve machine. Corrupted software, failure of machine and cases similar like that give rise to technological crisis.

Confrontation Crisis - This type of crisis normally happen in organization. Confrontation crises happen when employees fight with each other's. Individuals that is not agree among them will lead to non-productive action of employees like strikes for a long periods, boycotts

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and cases similar like that. In this type of crisis, employees refuse to comply superiors command and force superiors to accept their demands. Internal disputes, ineffective communication and lack of coordination can lead to this kind of crisis.

Crisis of Malevolence - This type of crisis happen in Organization. Crisis of malevolence happened when some dishonourable employees use a criminal actions and dangerous steps to fulfil their demands. Sample of this act are like kidnapping company's officials, false rumours all lead to crisis of malevolence.

Crisis of Organizational Misdeeds - This type of crisis is happen in organization or company. Crises of organizational misdeeds happen when management has to make a resolutions even though they know the risky consequences they will share towards the stakeholders and external parties. Normally, superiors pay no attention to the after effects of result they take for quick results. Crisis of organizational misdeeds can be divided into three types:

     i.   Crisis of Skewed Management Values - Crisis of Skewed Management Values happen when management choose to get short term development and ignores much larger issues.

    ii.   Crisis of Deception – Happen when management purposely alters data and information. Management makes fake promises and wrong obligations to the customers. Other reason are when management shared wrong information about the organization.

   iii.   Crisis of Management Misconduct – This type of crisis happen in organizations when management involve in acts of illegality like accepting bribes, passing on confidential information and so on. Management can be charges according to laws and regulation of the company or nation.

Crisis due to Workplace Violence - This crisis happen in organization. This type of crisis happen when employees are involve in violent acts such as beating employees, superiors in the office premises itself.

Crisis Due to Rumours - This crisis normally happen in organization. Someone spreading false rumours about the organization and brand thus creating a crisis. This will taint the image of their organization.

Bankruptcy - This crisis normally happen in organization. A crisis also happen when organizations fail to pay its creditors and other parties. This happen because organization is lack of fund thus leads to crisis. This can happen to individual too.

Smoldering Crisis - This crisis happen in organization. When management neglecting small issues in the beginning, it can lead to smoldering crisis later. Management often can predict a crisis. If they ignore it and wait for somebody else to charge and take responsibility, it can lead to this crisis.

Sudden Crisis - This can happen to any entity. A situations happen all of a sudden, on an extremely short warning and happen beyond control. If in organization, managers do not get warning signals and this situation is in most cases beyond any one's control.

In this study is going to focus on one type of crises listed above. The crisis is natural crisis. In natural crisis, we will focus on flood as the topic to be study.A study by D/iya Sani, G. Gasim Muhd Barzani,Toriman Mohd Ekhwan and Abdullahi Musa G. A(D/iya et al. 2014) suggest that flood can be defined as a water flow that exceed the natural or artificial river. So, when a river bank is overtopped, the water outspreads over river bank to the plain field and usually turn out to be threat to the public. According to research by Associated Program on Flood Management(Associated Programme on Flood Management 2008), there are a two major factor contributing to a flood which is meteorological and hydrological

extremes as showed in the table 1. But human to influence the factors of flood to happen.

Factor contributing to flood

Table 1.1: Factor Contributing to Flood

Meteorological Factors	Hydrological factors	Human factors aggravating natural flood hazards
• Rainfall • Cyclonic storms • Small-scale storms • Temperature • Snowfall and snowmelt	• Soil moisture level • Groundwater level prior to storm • Natural surface infiltration rate • Presence of impervious cover • Channel cross-sectional shape and roughness • Presence or absence of over bank flow, channel network • Synchronization of run-offs from various parts of watershed • High tide impeding drainage	• Land-use changes (e.g. surface sealing due to urbanization, deforestation) increase run-off and may be sedimentation • Occupation of the flood plain obstructing flows • Inefficiency or non-maintenance of infrastructure • Too efficient drainage of upstream areas increases flood peaks • Climate change affects magnitude and frequency of precipitations and floods

		• Urban microclimate may enforce precipitation events

As mention by Associated Program on Flood Management too, they have divide flood in urban area to four categories which is:

1) Local Floods

2) Riverine Floods

3) Coastal Floods

4) Flash Floods

This study are going to focus on flash floods instead of focusing all of the floods categories listed above.

In studies by M.Sahara, Kirstetter Pierre Emmanuel, Vergara Humberto, Gourley Jonathan J and Hong Yang(Saharia et al. 2017) has define a flash flood criteria. Flash flood is happen because of a heavy or extreme rainfall and this rain is happen in a short period of time. Normally it is less than 6 hours times. The occurrences of flood will be sudden that normally victims are not prepared to it coming. As mention in studies by Gautam K P and Hoek E E Van Der(Gautam & Hoek 2003), the impact of flash flood is so sudden but in a big impact compared to normal flood that allow victims to prepare themselves and make a recovery process. So basically flash flood is a crisis as it will bring disaster and danger to society.

Crisis happen in many form and effect many level. It can effected whole world like civil war or financial crashing. It may be effected only one continent, country, state or just a small town like flood or accident. Whatever it is when it has the same consequences, it will trigger panic and chaos among effected community. Crisis will have impact not only on

human physical or psychology, it also give impact to state, organization or human financial direct and indirectly. This impact is happen whether during crisis and after the crises happened. To effectively managing natural disaster, an integrated approach has been developed in paper An integrated approach to natural disaster management(Lin Moe & Pathranarakul 2006). In this paper authors has divide disaster management phase into 5 phases. Each phases has it own task that need to be completed by either authorities, related agencies or effected personal of crisis. This study are going to focus on phase number three which is emergency relief. During this phase, assistance and help are pouring in and a lot of parties are involve. So in this situation a communication is very crucial.

During time of crisis and disaster, communication are very important element. In this situation other than people try to communicate to learn and reduce their unknown situation to gain control on the situation. This is so that victims can learn to reduce insecurity and trying to take control over the situation. Communication also allow in giving the affected area if crisis early and fast aid. In the literature by Seeger and Reynolds they have mention that both risk and crisis communication principal goal is to limit and mitigate harm during an event.

There are a lot of methodology to develop and design a system. One of the popular method exists is Agile methodology. In the picture below is a sample of an agile methodology lifecycle for software development. As this is just a sample of agile methodology, this lifecycle may vary for every project depend on their nature and requirement of the project.
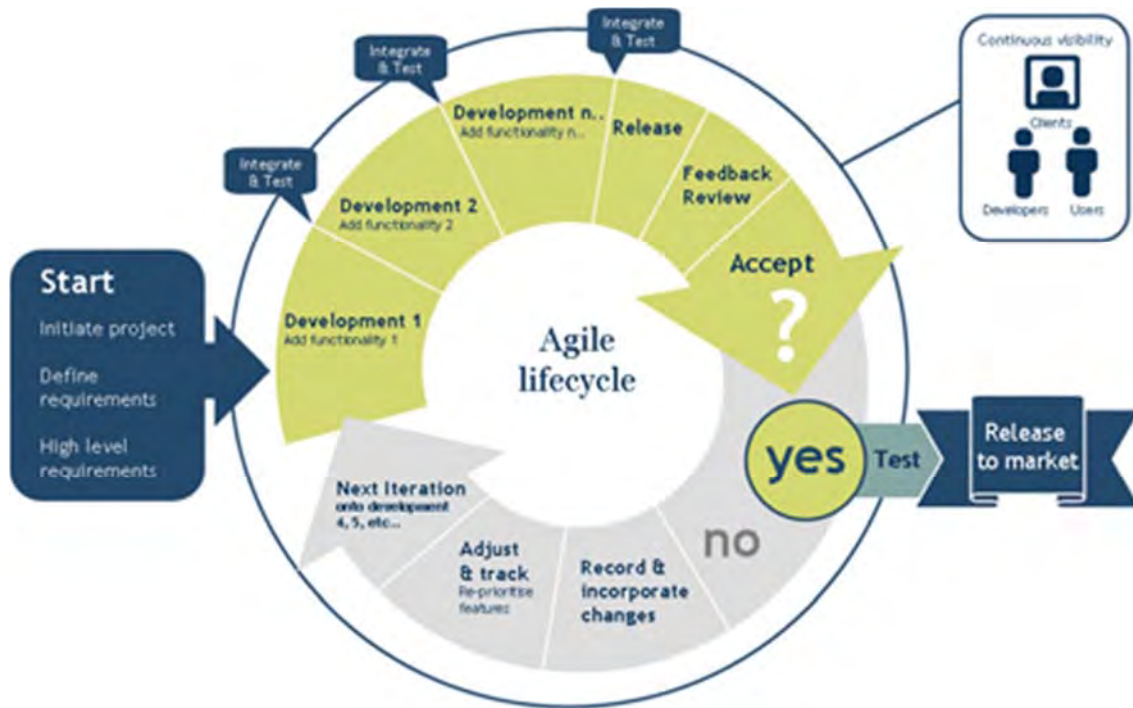
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Figure 1.1: Sample of Agile Methodology Lifecycle

Agile methodology is a methodology for development that allow constant changes and rapid development compare to old methodology which is normally predictive and a lot of analysis and design before development is start. It is also more flexible and has a few advantages like can handle requirement change in the middle of the project compare to traditional method as mention in the paper(Campanelli & Parreiras 2015). It also mention by authors in paper(Jamil et al. 2016) that agile is short and speedy process. Below are the table that describe the advantages and disadvantages in agile methodology.

Table 1.2: Advantages and Disadvantages of Agile Methodology

Advantages	Disadvantages
Focus on customer satisfaction by delivery useful software continuous.	Project can easily be divert from it track if customer does not perfectly understand their mission.

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Focus on interaction between people and not relying too much on process, tools and documentation. That mean Customers, developers and testers always working together completing the project.	No proper documentation for analysis and design.
Working software is provided regularly	It is difficult to evaluate the effort needed to complete a project especially a large one.
Regular alteration to changing situations. Even a late alteration in requirements	Senior programmers are the only one skilled of making decisions required in development process. New programmers, must be pair with experienced resources
A functional product are always the focus	

Cynefin framework is a framework that can assists a decision maker making a decision(McLeod & Childs 2013). Cynefin is also a framework that help analyst complex decision making process(Gorzeń-Mitka & Okręglicka 2014).each category are explained in the table below. In the Cynefin framework a problem is characterize into 5 domain. Each domain are explained in the table below.

Table 1.3: Cynefin Category

Obvious (formerly known as Simple) is the domain of best practices. Characteristics: Problems are well understood and solutions are evident. Solving problems requires minimal expertise. Many issues addressed by help desks fall into this category. They are handled via pre-written scripts.

Approach: Problems here are well known. The correct approach is to sense the situation, categorize it into a known bucket, and apply a well-known, and potentially scripted, solution.

Complicated is the domain of good practices.

Characteristics: You have a general idea of the known unknowns — you likely know the questions you need to answer and how to obtain the answers. Assessing the situation requires expert knowledge to determine the appropriate course of action. Given enough time, you could reasonably identify known risk and devise a relatively accurate plan. Expertise is required, but the work is evolutionary, not revolutionary.

Approach: Sense the problem and analyze. Apply expert knowledge to assess the situation and determine a course of action. Execute the plan.

Complex is the domain of emergent solutions.

Characteristics: There are unknown unknowns — you don't even know the right questions to ask. Even beginning to understand the problem requires experimentation. The final solution is only apparent once discovered. In hindsight it seems obvious, but it was not apparent at the outset. No matter how much time you spend in analysis, it is not possible to identify the risks or accurately predict the solution or effort required to solve the problem.

Approach: Develop and experiment to gather more knowledge. Execute and evaluate. As you gather more knowledge, determine your next steps. Repeat as necessary, with the goal of moving your problem into the "Complicated" domain.

Chaotic is the domain of novel solutions.

Characteristics: As the name implies, this is where things get a bit crazy. Things have gone off the rails and the immediate priority is containment. Example: Production defects. Your initial focus is to correct the problem and contain the issue. Your initial