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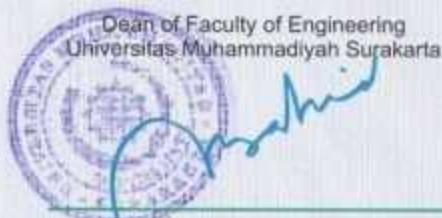
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The Software-Hardware of EWS-USD (Early Warning System-Urban Social Disaster)

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Abstract. This paper explores the software-hardware of EWS-USD (Early Warning System-Urban Social Disaster). The tools are developed to sustain the city, regarding to the Agenda 21. The background of research is related to the vulnerability of cities in Indonesia, especially in the city of Solo. Previous research has found the formula of EWS-USD, the main elements of USD, the trigger factors of USD, and the types of city spaces that are prone to USD, as well as alternative of USD treatment. Furthermore, in order to deepen the study of USD, the research focuses on the development of EWS-USD tools, a kind of city level stethoscope. The main finding of this research is the software-hardware of EWS-USD. The software covers the system and application of formula EWS-USD, while the hardware covers the IPO (Input-Process-Output) of formula EWS-USD, such as PC, LCD, worksheet; workstation and networking. Substantively, these tools can show the power of social stress in real time, which is shown in the range number of 1-9. This is the result number of three sums of EWS-USD variables, namely: Index of Economic Disparity (IED), Index of Leadership Crisis (ILC), and Index of Hypocrite Culture (IHC). The power of social stress (catharsis) could be written as: $Y=3(IED+ILC+IHC)$; while the USD could be written as $USD=Y+ETD$. This study uses a rationalistic paradigm, while the research method uses historical-interpretative and experimental-laboratory. The main purpose of this research is to assist the local government and institutions of disaster, such as BPBD (Regional Disaster Management Agency) and BNPB (National Disaster Management Agency). The tools of EWS-USD can help in overcoming the social disaster of the city, with a strategy focusing on prevention scopes. With this effort, it is expected that the global agenda of the city (Agenda 21), namely sustainable city, becomes easier to be implemented.

INTRODUCTION

The city of Solo has experienced many urban disasters, both urban social disasters, natural environment disasters and built environment disasters. Considering the first phenomenon, such as: riots, looting, mass rioting, bombing more prominent than the second and third as mentioned above, then the focal point of this research is on the urban social disaster (USD). The city would quickly perish, if the shredder is precisely from its social environment. Nowadays, the development of science in the Urban Design has reached the sustainable cities (Watson, 2003): the city that is not only being able to achieve the sustainability of the natural and built environment (ecological-technological), but must also be able to cover the sustainability of humanity (socio-economical). Currently, about sustainable city has become a strategic object to the various fields of science, such as: Architecture, Urban Design, Planning, Sociology, Ecology, Economics and Geography. The city problems have grown in many aspects of field and been developed to an uncontrollable situation. The city of Solo, which has been developed by the community of Arab, Chinese, Dutch and Javanese for hundreds of years, both the impression and reality, could not be separated from issues of the urban social disasters. To avoid the urban social disaster, it needs the tools of EWS-USD.

THEORETICAL

The research is guided by three theoretical frameworks: (1) grand concept; (2) substantive concept; and (3) state of the art. Grand concept means the form of a valid mindset; substantive concept means the form of crystallization of the literature; while state of the art means the form of affirmation that builds on the focus of research. The grand concept of this research is morphogenetic. This mindset accepts that the development of city can occur in a qualitative-quantitative and continuous-discontinuous. The substantive concept of the research is city as organism of HBL (Human-Building-Land); while state of the art of the research has built on developing city with impulsive model. Morphogenetic mindset can occur on matters relating to the development or historical, such as the growth of human/plant/animal life and urban also. So, the morphogenetic mindset is the physical changes associated with the change of time. Meanwhile, the HBL substantive concept is the crystallization of the related literature on urban history and development, such as: Leitmann (1999); Srinivas (1997); Moughtin (2005); WCED (1987); UN-Habitat (2001); Watson (2003); Haryadi (1995); Laurens (2004); Hardin (1991); Yeang (2006); Oswald (2003); Budiharjo (1998); Pruitt (2004); Soegijoko (2005); Sarwono (2009) and Qomarun (2009 and 2013). Elements of H (Human), B (Building) and L (land) or abbreviated HBL is the element of municipal entities, so that if the city is analogous to the organism, the genetic code is the HBL. However, this research has focus on the element of H (urban social environment). City can survive or continue due to a metabolic process that is driven by elements of H. Meanwhile, elements of H can be active and willing to do the dynamics of the city that they might achieve the quality of life, such as: health, happiness, prosperity and wealthy. Quality of life can be achieved if there are elements of B and L is available on an ongoing basis. Therefore, the chain reaction of H-B-L is the fundamental event of the occurrence of life and the sustainability of the city. In contrast, the compounds that failed between elements of H, B and L are the symptoms of the onset of illness/death of the city. City is the greatest art and the most complex work in the history of human creation. The complexity and diversity of entities make the city into the most spectacular works of the human species. This certainly could not be separated from the history of human ecology successful organisms on earth as compared to other creatures. The history of human ecology also repeatedly failed of success behind it. Therefore, the city as a form of human ecology also experienced up and down and age appropriate challenges. Organisms of the city, which had been scattered across the world, also have experienced the up and down. So, like the cycles of life, there was a time when the organism grow, stagnant and death or perish. The history and development of the city tend to be circular rather than linear. Life and the sustainability of cities always have dynamics, which sometimes rise, down or constant.

RESEARCH METHODS

The research is approached by rationalistic paradigm; while the method of study is conducted by the historical-archeology and experimental-laboratory. In epistemology (how to study), the selection of research methods always depend on the ontology (what the study) and axiology (what benefits). Based on the root of the problem, this study attempted to discover why and how urban social disasters (such as: riots, looting, mass rioting) can occur in the city of Solo; while the benefits of this research will help formulate ways to prevent a repeat of the incident. City can be destroyed in the blink of an eye, when the elements of the social environment that actually acts as crushing machines. To reach this issue, it is necessary to use qualitative-rationalistic approach (Muhadjir, 1993), post-positivist paradigm (Nasution, 1988), or a combination of empirical-rationalist paradigm (Gulo, 2002). Rationalistic approach made because researchers could not merge with the object of research that is already past (*ex post facto*); while the qualitative research paradigm in relation to the object of research in the form of an adjective, which is about social behavior. This study must penetrate past circumstances through the recordings printed and physical heritage, as was done in History and Archaeology. The past empirics can be stored both in text form (e.g.: manuscripts, images, chronicles) and physical form, such as: *artifacts* (e.g.: buildings, equipment, utility); *ecofacts* (e.g.: trees, rivers, caves); and *psyfacts* (e.g.: customs, language, song, religion). According to Chambert-Loir (1999), History is the study of past activities and culture in their lives, while Archaeology is the study of human relics that are more material. To build knowledge about the past, historians based on the method of relief printing, while the archaeologists based on the method of non-print. The study of urban social disaster is done by combining the two, which by Ubonwan (1985) referred to as historical-reading, or by Chambert-Loir (1999) referred to as historical-archeology, or by Groat and Wang (2002) called as interpretive-historical. Thus, the fundamental reason does rationalism approach is related to research objects in the form of the historical development of the ancient city of Solo to the present, so it should reach empiric sense, logic and ethics. Meanwhile, the qualitative approach as it

relates to the focus of the research in the form of social behavior until the time of the physical destruction of the city. Therefore, based on a combination of the two paradigms, the author called this research as a rationalism-qualitative model.

FINDINGS

Based on the compilation of data, there are 30 Urban Social Disasters (USD) that occurred in Solo during 274 years (1742-2016). Every urban social disaster occurs, it is always associated with several components of its compilers, namely: factors causing; perpetrators; victims and triggers. Disaster impacts can be life, body or property; while the causal factors may come from the social, economic, political and legal aspects. Meanwhile, due to the severity of the disaster, it can be classified low, medium, heavy and very heavy. Related to the occurrence of USD, it is seen that USD can occur since the time of the kingdom, the era of revolution until the time of the republic today. Meanwhile, related to the perpetrator and the trigger USD, it can happen in communal and individual. Furthermore, to facilitate the understanding of USD, the followings are presented table, graph and matrix:

TABLE 1. Identification of Urban Social Disasters in Solo, 1742-2016

No.	Years and Event Name	Intensity Disaster	Disaster Scale (0-12)	Category of Conflict
1.	1742: The Chinese Rebellion	Very Heavy	11	Political-Economical
2.	1755: The Mangkubumi Rebellion	Very Heavy	11	Political-Economical
3.	1757: The Mangkunegara Rebellion	Very Heavy	11	Political-Economical
4.	1825: The Anti Chinese-Dutch Rebellion	Very Heavy	10	Economical
5.	1871: The Anti Chinese-Dutch Rebellion	Heavy	6	Political
6.	1900: The Anti Chinese-Dutch Rebellion	Heavy	7	Economical
7.	1911: Javanese-Chinese Riot	Heavy	7	Economical
8.	1912: Legiun MN-Chinese Riot	Heavy	8	Economical
9.	1913: SI-Chinese Riot	Heavy	8	Economical
10.	1923: Movement of Misbach	Heavy	8	Political
11.	1942: The Dutch Homicide	Very Heavy	10	Political
12.	1946: Movement of Anti-Swapraja	Very Heavy	11	Political-Law
13.	1947: Javanese-Chinese Riot	Very Heavy	10	Political-Economical
14.	1948: Military Clashes	Very Heavy	9	Political-Law
15.	1948: PON Riot	Heavy	6	Political-Law
16.	1948: Santri-PKI Clashes	Very Heavy	10	Political
17.	1948: Movement of Boemi Hangoes	Very Heavy	11	Political
18.	1963: Mass Riots	Very Heavy	10	Ekonomi
19.	1965: Mass Riots	Very Heavy	11	Political
20.	1966: Mass Riots	Heavy	6	Economical
21.	1972: Mass Riots	Very Heavy	10	Economical
22.	1980: Mass Riots	Very Heavy	11	Economical
23.	1998: Mass Riots	Very Heavy	12	Economical-Political-Law
24.	1998: Motor Racing Riots	Heavy	7	Law
25.	1999: PDI-Perjuangan Mass Amok	Very Heavy	9	Political-Law
26.	2000: Football Riot	Heavy	6	Law
27.	2008: Kampong Clashes	Heavy	6	Law
28.	2009: Terrorist Attack	Heavy	7	Political-Law
29.	2011: Church Bombing	Heavy	7	Political-Law
30.	2016: Mapolersta Bombing	Heavy	7	Political-Law

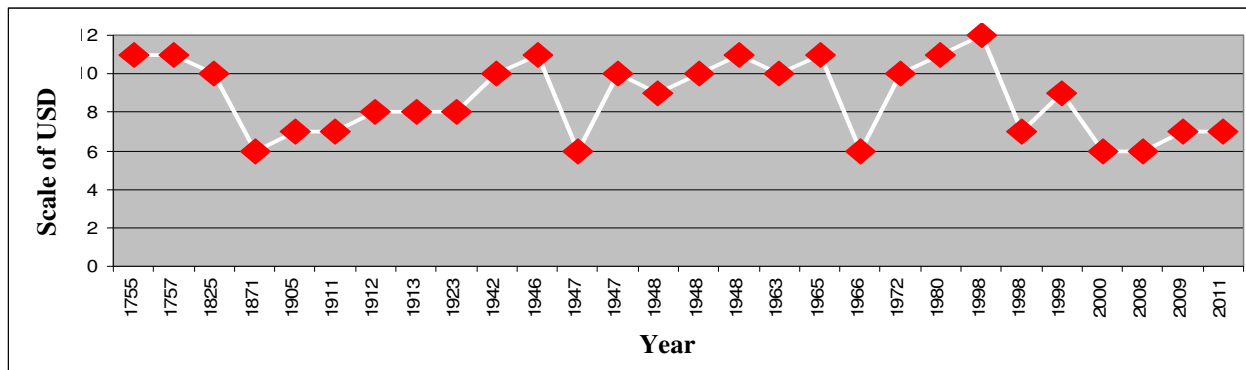


FIGURE 1. Scale of USD (Urban Social Disaster) in Solo, 1742-2016

Victim	Era of Kingdom										Era of Revolution						Era of Republic										Information				
	1742	1755	1757	1825	1871	1900	1911	1912	1913	1923	1942	1946	1947	1948	1948	1948	1948	1963	1965	1966	1972	1980	1998	1998	1999	2000		2008	2009	2011	2016
1. Javanese	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	During Solo there were 30 conflict cases. Javanese and Chinese casualties have a high frekfuensi (each half), while Arab and Dutch people are very rare.
2. Arabs																															
3. Chinese				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4. Dutch	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Information	In the era of this kingdom (1742-1945), the number of social conflict incidents reached 11 cases, while most victims died in Javanese, then China and the last Dutch. Arabs have never been victimized in the era of the kingdom. The Javanese are far more dead than Chinese and Dutch, because the events that occur are the types of warfare.										In the era of this revolution (1945-1950), the number of social conflict incidents reached 6 cases, while most victims were Javanese, then Dutch and Chinese.						In the era of this republic (1950-present), the number of social conflict events reached 13 cases, with the highest casualties in ethnic Chinese and then in Java. In contrast to the era of kingdom and revolution, the victims of this republic era, both in quality and quantity, are more in Chinese than Javanese. Meanwhile, the Arab race despite a conflict with Java, but the unrest still targeting the ethnic Chinese.														

FIGURE 2. Matrix of Solo City Development Era and BSK Event Survivors Year 1742-2016

From the above data it can be seen that the urban social disaster event in Solo is dominated by very heavy intensity (scale 9,00-12,00), that is 16 times from 30 times or equal to 53,4%. Meanwhile, from any severe or very serious tragedy, it is certain that there is damage to the urban space, especially in the built environment, such as charred buildings, chaotic roads and messy town equipment. In addition, the frequency of tragedy that reached 30 times for 274 years, then resulted in Solo City often experienced stagnation or even setback in the history of its development. Historical data can also give an illustration that on average once in every 9 years there is a social catastrophe of cities with weight category. As an illustration of the stagnation or setback events about the city's developmental conditions, an example can be drawn about the Surakarta City Hall building, which the building has experienced three times since the independence of the Republic of Indonesia in 1945. Each of the city hall buildings has been a victim of social conflict on the grounds that different. At the time of the Kingdom of Mataram Surakarta, the city hall building was originally used as Office Gubernur Dutch since 1928. After 20 years of standing, the building was in 1948 a victim of the Boemi Hangoes event by Slamet Riyadi forces. Furthermore, after being re-built in 1950 by President Soekarno, the building was burned again in the event of PDI-Perjuangan Mass Amok in 1999. Then, in 2000 the building was re-built by President Megawati, the founding daughter of the previous building.

Based on the diversity of social disasters above, there is a uniformity in the process of social conflict in Solo. For any social conflicts, there must be two things that always accompany it, namely: (1) there is a background that gives energy tragedy, that is in the form of social stress (catharsis); and (2) there are triggers that are always able to make the tragedy really appear on the fact. The background that dominates the tragedy is hereinafter referred to as the

latent conflict (lc), whereas the tragedy of the conflict itself is further referred to as the manifest conflict (mc), while the trigger for the tragedy is subsequently referred to as the trigger conflict (tc). Furthermore, based on the crystallization of the master sheet description and the diversity of the above conflict, the basic formula for social disaster of the city can be written as follows:

$$f(mc) = f(lc) + f(tc) \tag{1}$$

Based on the previous research reference, there are three kinds of factors that become the latent conflict of 30 conflict manifests above, namely: (1) the existence of economic disparity factor (from the socio-economic sector); (2) the existence of crisis factor of leadership (from socio-political sector); (3) the presence of hypocritical cultural factors (from the socio-economic-legal sector). Otherwise, the sums of these factors are equal to the social stress (catharsis). While based on conflict trigger actor category, there are three kinds of categories, namely massal action, communal action and individual action. Massal action can be demonstrations, carnivals, elections, campaigns, performances, parties, games; communal action refer to a movement of gangs, groups, associates; while individual action can be an accident, a fight, or a dispute. Regarding to the space of disaster, there are three kinds of place: local, regional and national. Furthermore, the trigger's conflict forms a matrix place vs actor as follows:

Place	Actor	Individual	Communal	Massal
Local		1	1,5	2
Regional		1,5	2	2,5
National		2	2,5	3

FIGURE 3. Matrix of Trigger's Conflict

To create an EWS-USD formula, then the graph and equation above are the reference, because it becomes a kind of field print. Furthermore, considering the disaster model using the MS (Mercalli Scale) model, then the sum of the above equation is a maximum of 12. The amount is composed by 4 components, namely: (1) economic disparity factor; (2) leadership crisis factors; (3) hypocritical cultural factors; and (4) trigger disaster factors. Meanwhile, related to the four factors that have the same role, then each factor has the same proportion, ie a maximum of 3 (the result of 12/4). Based on statistics, then the measurement of quality to self then usually use the term index (0-1). Otherwise, the power of USD (Y) is the result number of three sums of 4 EWS-USD variables, namely: index of economic disparity (IED), index of leadership crisis (ILC), index of hypocrite culture (IHC) and element of trigger's disaster (ETD). The rate number of IED, ILC and IHC are 0-1; while rate number of ETD is 1-3 (see Figure 3). Finally, this formula can be written as:

$$Y = 3(IED+ILC+IHC) +ETD \tag{2}$$

According to the formula above, the following are the software-hardware of EWS-USD. The software covers the system and application of formula EWS-USD, while the hardware covers the IPO (Input-Process-Output) of formula EWS-USD, such as PC, LCD, worksheet; workstation and networking. Substantively, these tools can show the power of social stress in real time, which is shown in the range number of 1-9. This is the result number of three sums of EWS-USD variables, namely: Index of Economic Disparity (IED), Index of Leadership Crisis (ILC), and Index of Hypocrite Culture (IHC). The power of social stress (catharsis) could be written as: $Y=3(IED+ILC+IHC)$; while the USD could be written as $USD=Y+ETD$.

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F(mc) = f(lc) + f(tc)
*mc = manifest conflict
*lc = latent conflict
*tc = trigger conflict

Y = 3(IED+ILC+IHC) +ETD
*ied = index economy disparity
*ilc = index leadership crisis
*ihc = index hiprocrite culture
*ETD=Element of Trigger's Disaster

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FIGURE 4. Software of EWS-USD

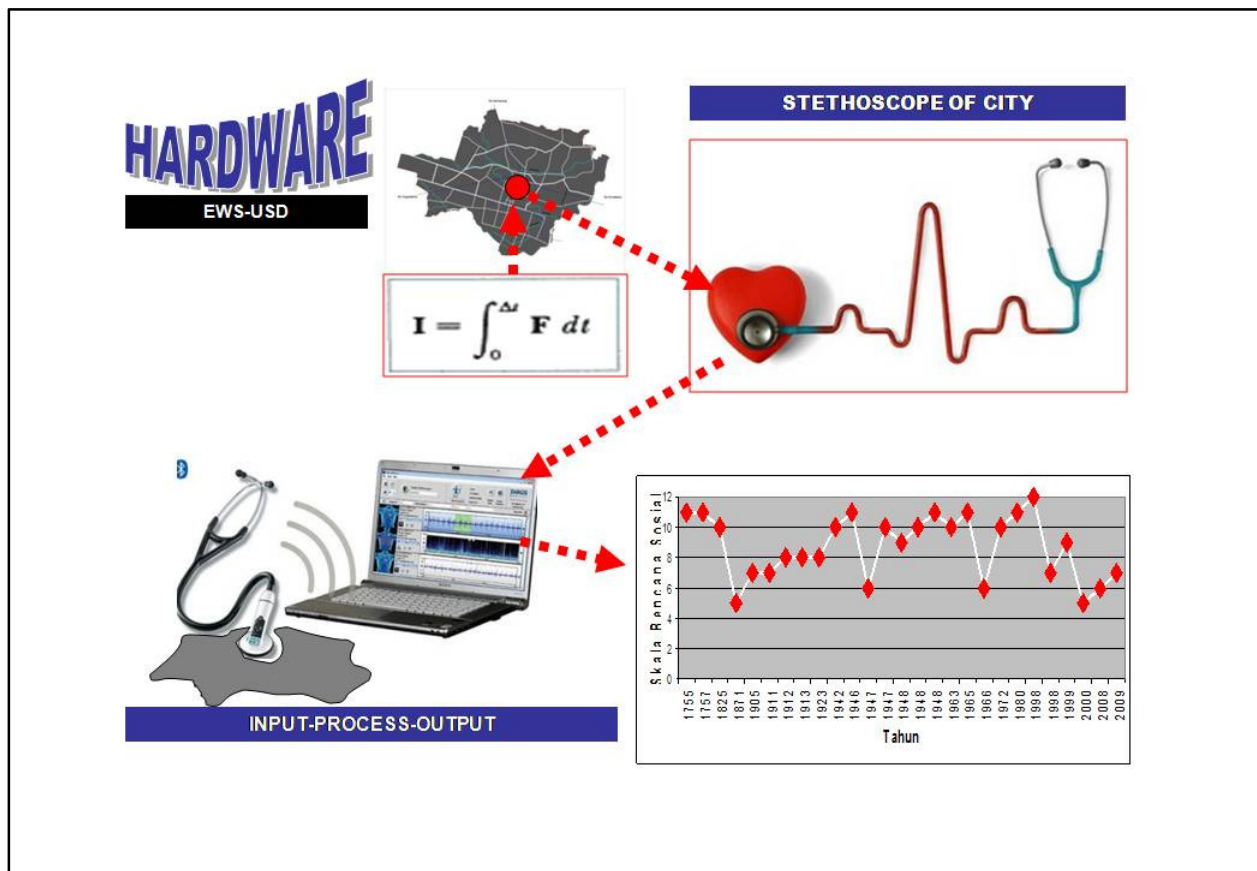


FIGURE 5. Hardware of EWS-USD

SUMMARY

There are 30 Urban Social Disasters (USD) that occurred in Solo during 274 years (1742-2016). Every urban social disaster occurs, it is always associated with several components of its compilers, namely: factors causing; perpetrators; victims and triggers. Disaster impacts can be life, body or property; while the causal factors may come from the social, economic, political and legal aspects. Meanwhile, due to the severity of the disaster, it can be classified low, medium, heavy and very heavy. Related to the occurrence of USD, it is seen that USD can occur since the time of the kingdom, the era of revolution until the time of the republic today. Meanwhile, related to the perpetrator and the trigger USD, it can happen in communal and individual. The urban social disaster event in Solo is dominated by very heavy intensity (scale 9,00-12,00), that is 16 times from 30 times or equal to 53,4%. Meanwhile, from any severe or very serious tragedy, it is certain that there is damage to the urban space, especially in the built environment, such as charred buildings, chaotic roads and messy town equipment. To avoid the urban social disaster, it needs the tools of EWS-USD. This activity is to record and to analyze the root causes of urban social disaster, then to present and to deliver the result easily and quickly to the stakeholders. To create an EWS-USD tools, then the research found a basic formula, which written as: $Y = 3(IED+ILC+IHC) +ETD$. Otherwise, the power of USD (Y) is the result number of three sums of 4 EWS-USD variables, namely: Index of Economic Disparity (IED), Index of Leadership Crisis (ILC), Index of Hypocrite Culture (IHC) and Element of Trigger's Disaster (ETD).

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