Identifying aid items of survival kit for natural disasters

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Abstract. Incompatible aid supplies, in which received aid items do not match with the need of the victims, appears to be one of persistent problems in relief operations. The mismatch can be argued as the need of aid supplies may vary over time and the nature of disaster creates different need of aid items which are not available in standard survival kit. The purpose of the present paper is to empirically identify aid items that should be available in survival kit by considering time-after-disaster and the nature of disaster. A survey with a total of 120 respondents, was conducted in Bantul and Sleman districts where earthquake and volcanoes eruption have occurred respectively. The respondents were asked to rate the urgency level of the aid items during the first and the second week after disaster. Results indicate the time after disaster, the nature of disaster, and the culture are significant factors influencing the required items of the survival kit. Furthermore, the required aid items during the first week are significantly different than those during the second week after disaster. It is also worth mentioning that the type of disaster determines crucial specific aid items that should be provided in the survival kit.

1. Introduction
During post disaster, helps from government, non-governmental organization, and society were usually available at large stake. However, it was found that the received supplies do sometimes not match with the aids required by the victims. In fact, incompatible aid supplies appears to be one of persistent problems in relief operations. Although standard survival kit has been available, the actual needs in the field might be slightly different [1]. Mentioned that there was no industry-wide guidelines on the contents of survival kits and data regarding their use.

Heterogeneous and changing needs of disaster victims, nature of disaster, cultural-related factors are some significant contributing factors to explain the incompatible aid received by the victims. Children have different needs from adults. The aid items needed by women are not similar to those of men. The fact that the needs may vary over time may complicates the issue. The need of disaster victims on a day and 14 days after disaster are completely different. The first day after the disaster, the victims require ready-to-eat foods and first aids such as medicines, whereas the several days after disaster, the victims also require cooking utensils to make foods and tools to rearrange their houses. The nature of disaster is also influencing specific aid items. For instance, masks during volcano eruption disaster are highly required to avoid respiratory disorders, whereas they are not quite necessary for earthquake. Cultural and/or religion factor is also regarded as one of explanatory variable in incompatible aid supplies. Based on the interview [2], it was evidenced that during Aceh tsunami in 2004, survival kit from international donor, particularly when it comes to foods, has been wasted due to doubt whether or not the foods are halal. Furthermore, some rejected porridge foods because they were used to eat steamed rice. Given the fact that different aid items are required, it is therefore necessary to design survival kit which considers
the heterogeneous needs of victims, anticipated future needs, the nature of disaster, and cultural-related factors.

Due to the aforementioned incompatibility between the aid items needed with aid supply, the present paper therefore aims at empirically identifying aid items that should be available in survival kits by considering time-after-disaster, the nature of disaster, and the cultural wisdom. The paper focuses on the identification of required aid items of survival kit, rather than survival kit design. The present study is, however, a first stage to design customized survival kit for typical disaster occurring in Indonesia, by understanding the needs of Indonesian at the first place. Empirical survey is consequently adopted for collecting the data. As volcano eruptions and earthquakes appear to the most two frequent natural disasters occurring in Indonesia, both natural disasters are taken as studied disasters. Empirical data from the victims of volcano eruption and earthquake at Yogyakarta was collected through a survey.

Supporting the research objective which focuses on need identification for survival kit, the section reviews brief theories related to need identification in general and basic survival items in particular. Following [3], product development involves a series of activities starting from the analysis of perceptions and market opportunities, and then followed by a production stage, sales and delivery of the product. The economic success of a manufacturing company depends on the ability to identify customer needs, then quickly create products that can meet those needs while the associated costs are low. Identification of customer needs is an integral part of the product development process. The need identification stage relates to the process of decline of the concept, the concept selection, the benchmark with a competitor and setting specifications product. The objective of the identification stage is to satisfy the customer's needs while accommodating a team of developers to design an effective and efficient product. To acquire data of customer needs, interview or survey (questionnaire) can be used. The questionnaire includes a set of questions that customers’ needs are clustered attractively, and arranged in a list hierarchically, with weighting for each interest needs [3]. The present study hence used a questionnaire for empirical data collection.

With respect to survival kit, some sources such as [4] has provided information on items of survival kit for different contexts such as e.g., military kit, lifeboat survival kit, spacecraft survival kit, vehicle kit, earthquake kit, and hurricane kit. Unfortunately, none of literatures discusses survival kit for volcano eruption. Very few existing literatures has discussed about the survival kit such as [1] focuses on item identification for aircraft survival kit. Another study such as [5] focused on how to manage relevant kits for humanitarian context, discussing kit design, kit supply and assembly, kit deployment to kit monitoring and evaluation.

Given the fact that there is no such of survival kit guidelines [1] and no information on survival kit for natural disasters, particularly for earthquake and volcano eruption. The present study is also contributing to the body of knowledge by providing a case from developing country which may have different safety culture than that of developed country. According to the best knowledge of the authors, existing literatures was dominated by cases from developed country. Furthermore, the present study contributes to the knowledge on the effect of the time after disaster, the nature of disaster, and the cultural aspect on the required items of survival kit.

2. Methodology
To acquire empirical data on the required items for survival kit, a survey was conducted. The survey was conducted in Bantul and Sleman districts where earthquake with a magnitude of 6.5 Richter scale and volcano eruption have occurred respectively. The section is consequently divided into two parts, i.e., the design of questionnaire and the method of data collection as below.

2.1. Questionnaire
To design a questionnaire, both literature review aiming at collecting potential items of survival kit and interviews with National Disaster Management Agency (Badan Nasional Penanggulangan Bencana - BNPB) aiming at contrasting the results of literature review and field experiences. Items which were
consistent were adopted. Questions were constructed in such as that the respondents rate the urgency level of the items with 5-Likert scale in which the scale of 1 refers to not important at all - the scale of 5 refers to the most important. The respondents were also asked to rate each item for both one week after disaster and two weeks after disaster separately. In addition to the questions on the required items of survival kit, the questionnaire includes questions on socio-demographic data (such as age, gender, education), disaster experiences, and disaster training.

Once the questionnaire was constructed, it went through a pilot study. The pilot study was to test both content validity and reliability. The content validity was conducted by testing the questionnaire against the knowledge from representatives of Regional Disaster Management Agency (Badan Penanggulangan Bencana Daerah – BPBD), academics with disaster-related competency, Non-Governmental Organizations, Disaster Research Centre, and disaster victims who experienced earthquake and volcano eruption. The reliability test was conducted by analysing the results of 30 responses.

2.2. Data Collection and Analysis
The data was collected from residents of Bantul district who experienced earthquake in 2006 and residents of Cangkringan, Sleman District who experienced volcano eruption in 2010. Both locations reside in Yogyakarta province. It can be concluded that both residents have similar culture. The data was collected in 2014.

A total of 120 respondents, consisting 65 respondents from Bantul district and 55 respondents from Sleman (Cangkringan), participated in the study. The empirical was then analysed using descriptive statistics in order to examine respondent profile, the preference on few items, as well as, using t-test to evaluate the difference of the required items with respect to the time after disaster (one-week versus two-week after disaster), the nature of disaster (earthquake versus volcano eruption), and the interaction between the time after disaster and the nature of disaster.

3. Results and Discussion
Following the data analysis, the section is divided into three parts, i.e., respondent profile, preferred aid items (involving habit/cultural aspect), and the perceived urgency level of the aid items.

3.1. Respondent Profile
Profile of all respondents are presented in Table 1. The respondents are dominated by those with productive age, female, and has finished elementary and high school. It can be explained that the respondents reside in rural areas in which most of their occupation was farmer and household-scale entrepreneur.

3.2. Preferred Aid Items Cultural Aspect
As it has been highlighted that the previous main issues on survival kit from international agency when aiding Indonesian people was food and sanitary. While western people are get used to eat porridge, Indonesain are get used to eat steam rice. Similarly, western people use dry toilet, whereas Indonesian people use wet toilet. As no quantitative data is available for the aforementioned issue, this sub-section therefore presents the empirical-based quantitative data on various food options and various sanitary options which is presented in Table 2.
Table 1. Respondent Profile

| Socio-demographic factors | Category | Percentage (%) |
|---------------------------|----------|----------------|
| Age (years)               | < 20     | 10.68          |
|                           | 21 – 30  | 18.45          |
|                           | 31 – 40  | 39.80          |
|                           | 41 – 50  | 21.36          |
|                           | 51 – 60  | 6.79           |
|                           | > 60     | 2.91           |
| Gender                    | Male     | 34.95          |
|                           | Female   | 65.05          |
| Education                 | Primary School | 21.36  |
|                           | Elementary School | 38.83  |
|                           | High School | 35.92          |
|                           | University | 3.88           |
| Disaster experiences      | Volcano eruption | 43.69  |
|                           | Earthquake | 50.49          |
|                           | Both      | 5.83           |
| Disaster training         | Been in disaster training | 24.27  |
|                           | Never joined disaster training | 75.73  |

With respect to food and beverage items, it appears that fresh steam rice is preferable to instant noodle and instant porridge in the first week of disaster. During the second week after disaster, instant noodle is preferable to fresh steamed rice. Instant porridge seems to be the least preferred. On the other hand, survival kit from international donor usually contains instant porridge. It is also worthy to note that the required food item are similar regardless the type of disaster. Similar results are evidenced for the sanitary items in which the respondents require water-based toilet than using dry-based toilet (using tissue paper).

Table 2. Preference of the aid items

| Aid items                        | Mean value of preferred items for Week 1 | Mean value of preferred items for Week 2 |
|----------------------------------|------------------------------------------|------------------------------------------|
| **Food and Beverages**           |                                          |                                          |
| Instant Noodle                   | 4.15                                     | 4.15                                     |
| Fresh steamed rice               | 4.63                                     | 2.82                                     |
| Canned porridge (ready-to-serve) | 2.53                                     | 2.53                                     |
| **Sanitary**                     |                                          |                                          |
| Toilet tissue                    | 2.90                                     | 2.90                                     |
| Water for sanitary               | 4.72                                     | 4.72                                     |

Statistical analysis using t-test to compare between international survival kit (porridge and dry toilet) and preferred survival kit (steamed rice (week 1) and instant noodle (week 2) and wet toilet) indicates significant difference for both Week 1 and Week 2 (Week 1: t-value = 10.294, df = 2, p < 0.01** and Week 2: t-value = 10.294, df = 2, p < 0.01**).

3.3. Perceived urgency of the aid items: The effect of the time after disaster and the nature of disaster

Based on the result of previous sub-section, it was found that fresh steamed rice, instant noodle, and wet toilet are preferred aid items in the survival kit. The next analysis are therefore based on the preferred items, leaving out the un-preferred items (i.e., instant porridge and dry toilet). Table 3 presents perceived urgency of the aid items which is categorized into the time after disaster and the nature of disaster.
Table 3. Perceived urgency of the aid items (aggregated)

| Aid items                | Mean value of perceived urgency in Week 1 | Mean value of perceived urgency in Week 2 | Mean value of perceived urgency for earthquake | Mean value of perceived urgency volcano eruption |
|--------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------------|------------------------------------------------|
| **Food and Beverages**   |                                          |                                         |                                             |                                                |
| Bottled water            | 4.42                                    | 4.42                                    | 4.19                                       | 4.67                                          |
| Instant Noodle           | 4.15                                    | 4.15                                    | 4.07                                       | 4.22                                          |
| Fresh steamed rice       | 4.63                                    | 2.82                                    | 3.81                                       | 3.62                                          |
| **Shelter**              |                                          |                                         |                                             |                                                |
| Mat/bedding              | 4.82                                    | 3.01                                    | 3.96                                       | 3.86                                          |
| Blanket                  | 4.81                                    | 3.06                                    | 3.94                                       | 3.92                                          |
| Tent                     | 3.75                                    | 2.89                                    | 3.91                                       | 2.67                                          |
| **Sanitary**             |                                          |                                         |                                             |                                                |
| Portable toilet          | 4.48                                    | 2.84                                    | 3.76                                       | 3.55                                          |
| Water for sanitary       | 4.72                                    | 4.72                                    | 4.74                                       | 4.69                                          |
| Amenities                | 4.93                                    | 4.93                                    | 4.96                                       | 4.90                                          |
| Clothes                  | 4.92                                    | 4.92                                    | 4.93                                       | 4.92                                          |
| Sanitary napkins         | 4.30                                    | 4.30                                    | 4.31                                       | 4.29                                          |
| **Medicines**            |                                          |                                         |                                             |                                                |
| First aids               | 4.94                                    | 4.94                                    | 4.94                                       | 4.94                                          |
| Mask                     | 4.37                                    | 4.37                                    | 3.81                                       | 4.98                                          |
| Insect repellent         | 3.95                                    | 3.95                                    | 4.22                                       | 3.65                                          |
| **Tools**                |                                          |                                         |                                             |                                                |
| Knives                   | 2.21                                    | 1.92                                    | 2.46                                       | 1.63                                          |
| Cooking tools            | 4.21                                    | 4.21                                    | 4.61                                       | 3.78                                          |
| Rope                     | 3.00                                    | 2.46                                    | 2.94                                       | 2.49                                          |
| Sandal                   | 4.19                                    | 2.43                                    | 3.44                                       | 3.16                                          |
| Electrical plugs         | 3.51                                    | 2.48                                    | 3.44                                       | 2.51                                          |
| Emergency lamp           | 3.81                                    | 2.50                                    | 3.59                                       | 2.66                                          |
| Flashlight               | 4.21                                    | 2.59                                    | 3.82                                       | 2.94                                          |
| Umbrella                 | 3.65                                    | 2.47                                    | 3.37                                       | 2.71                                          |
| Raincoat                 | 4.07                                    | 2.36                                    | 3.37                                       | 3.04                                          |

Statistical analysis using t-test indicates significant difference between the required aid items for Week 1 and that of Week 2 (\(t\)-value = 2.988, \(df = 44\), \(p < 0.01\)). Careful investigation on Table 3 indicates that the differences lie on the high urgency of fresh steamed rice in Week 1 (4.63 out of 5.00) and much lesser urgency of fresh steamed rice in Week 2 (2.82 out of 5.00). Other items with contribute to the significant difference between Week 1 and Week 2 are tent, sandal, blanket, and raincoat.

It is also interesting to evaluate whether or not the items of survival kit for earthquake disaster is different from those for volcano eruption. Statistical analysis indicate that the required items for earthquake disaster is not statistically different from those for volcano eruption (\(t\)-value = 1.228, \(df = 44\), \(p = 0.226\)). Although most items are perceived to have similar urgency, it is worth mentioning that tent and mask are perceived differently between these two disasters. It is understandable that tent is more urgent during earthquake that volcano eruption, whereas mask is more urgent for volcano eruption than earthquake, in order to avoid respiratory disorder due to fine dust of the eruption.

Further analysis is also conducted to evaluate the interaction between the time after disaster and he nature of the disaster toward the required items of survival kit. Table 4 present mean values of perceived urgency for different time after disaster for each disaster type.
Table 4. Perceived urgency of the aid items (by week and by disaster type)

| Aid items       | Mean value of perceived urgency in Week 1, earthquake | Mean value of perceived urgency in Week 2, earthquake | Mean value of perceived urgency in Week 1, volcano eruption | Mean value of perceived urgency in Week 2, volcano eruption |
|-----------------|--------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| **Food and Beverages** |                                                        |                                                        |                                                          |                                                          |
| Bottled water   | 4.19                                                   | 4.19                                                  | 4.67                                                     | 4.67                                                     |
| Instant Noodle  | 4.07                                                   | 4.07                                                  | 4.22                                                     | 4.22                                                     |
| Ready rice wrap | 4.76                                                   | 2.87                                                  | 4.49                                                     | 2.76                                                     |
| **Shelter**     |                                                        |                                                        |                                                          |                                                          |
| Mat/bedding     | 4.89                                                   | 3.04                                                  | 4.73                                                     | 2.98                                                     |
| Blanket         | 4.81                                                   | 3.07                                                  | 4.80                                                     | 3.04                                                     |
| Tent            | 4.98                                                   | 2.83                                                  | 2.39                                                     | 2.96                                                     |
| **Sanitary**    |                                                        |                                                        |                                                          |                                                          |
| Portable toilet | 4.63                                                   | 2.89                                                  | 4.31                                                     | 4.69                                                     |
| Water for sanitary | 4.74                                                    | 4.74                                                  | 4.69                                                     | 4.90                                                     |
| Amenities       | 4.96                                                   | 4.96                                                  | 4.90                                                     | 4.29                                                     |
| Clothes         | 4.93                                                   | 4.93                                                  | 4.92                                                     | 4.94                                                     |
| Sanitary napkins| 4.31                                                   | 4.31                                                  | 4.29                                                     | 4.29                                                     |
| **Medicines**   |                                                        |                                                        |                                                          |                                                          |
| First aids      | 4.94                                                   | 4.94                                                  | 4.94                                                     | 4.94                                                     |
| Mask            | 3.81                                                   | 3.81                                                  | 4.98                                                     | 4.98                                                     |
| Insect repellent| 4.22                                                   | 4.22                                                  | 3.65                                                     | 3.65                                                     |
| **Tools**       |                                                        |                                                        |                                                          |                                                          |
| Knives          | 2.70                                                   | 2.22                                                  | 1.67                                                     | 1.59                                                     |
| Cooking tools   | 4.61                                                   | 4.61                                                  | 3.78                                                     | 3.78                                                     |
| Rope            | 3.37                                                   | 2.52                                                  | 2.59                                                     | 2.39                                                     |
| Sandal          | 4.33                                                   | 2.56                                                  | 4.04                                                     | 2.29                                                     |
| Electrical plugs| 4.19                                                   | 2.69                                                  | 2.78                                                     | 2.24                                                     |
| Emergency lamp  | 4.52                                                   | 2.67                                                  | 3.02                                                     | 2.31                                                     |
| Flashlight      | 4.74                                                   | 2.91                                                  | 3.63                                                     | 2.24                                                     |
| Umbrella        | 4.13                                                   | 2.61                                                  | 3.12                                                     | 2.31                                                     |
| Raincoat        | 4.26                                                   | 2.48                                                  | 3.86                                                     | 2.22                                                     |

Statistical analysis using t-test results in significant different of the required items for earthquake and volcano eruption during the first week after disaster (t-value = 2.027, df = 44, p < 0.05*). However, it is interesting to note that there is non-significant difference of the required item in Week 2 between the earthquake and the volcano eruption (t-value = 6.422, df = 44, p = 0.675). Given the fact that the first week after disaster is usually the most critical week, the result implies that it is necessary to customize the items of survival kit to accommodate the specific needs on the first week following the following the nature of the disaster.

4. Conclusion
The present study aims at identifying the required items of survival kit for both earthquake and volcano eruption by considering the time after disaster, the nature of disaster, and the culture. Empirical survey of 120 respondents were conducted to obtain empirical data of the perceived urgency of survival kit items. Findings of the present study indicate that it is important to consider the time after disaster, the nature of disaster, and the culture, when designing survival kit.

The findings show that cultural aspect plays a role in determining the required items. It appears that Indonesian people prefer fresh steamed rice/instant noodle and wet toilet to instant porridge and dry toilet (which are normally included in the survival kit from international donors). It is also interesting to
note that that the required items for the first week after disaster is statistically different than those for the second week. The survival kit for the first week after disaster (critical period) should anticipate items which accommodate the nature of the disaster, whereas the required items for the non-critical period are very much similar regardless the nature of the disaster. The findings therefore call for future research which may focus on designing/providing kit management, how to design the customized and the standard survival kit, to supply the items of survival kit, to assembly/design production line for survival kit, and eventually to re-evaluate the survival kit. Future research working on refining the findings of the present study is also worthy as the empirical data on the required items and their usage are still lacking.

Last but not least, the present study has contributed the existing literatures when it comes to its contribution to provide empirical evidences that the time after disaster, the nature of disaster, and the culture are found to be significant factors influencing the required items of the survival kit. The present study also provides empirical data that could be used to design the survival kit which is relevant for Indonesian people for both earthquake and volcano eruption.

5. References
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