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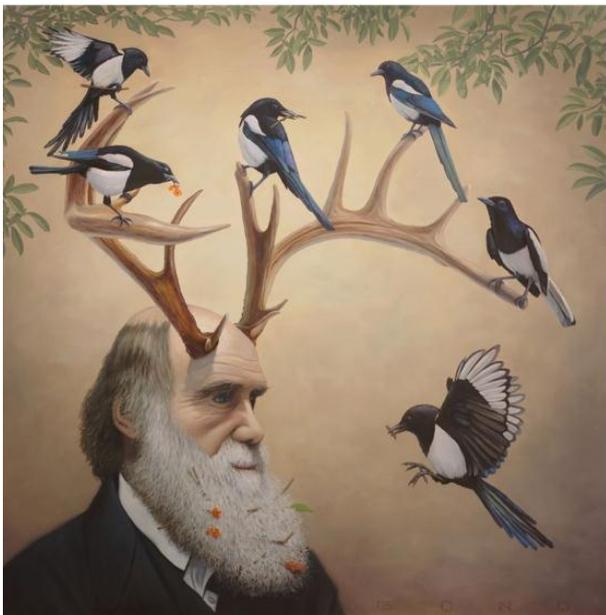
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## **Management of Buffer Stocks of Energy Based on Local Resources in Disaster-Prone Areas**

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### **Abstract**

**In the aftermath of a disaster, it is the unavailability of energy which causes the worst further economic, social and environmental distress. Optimal management before the disaster, at the preparedness stage, is a top priority and the best solution. We analyse the role of buffer stock management in disaster-prone areas, and develop a management model for the local resource of energy in this instance, coconut shell charcoal briquettes to establish power security beforehand and to remain environmentally friendly. The theoretical implications of this study enrich the literature in strategic planning and production, and the practical results are that communities stockpile energy based on local resources. Our findings apply throughout the world. All disaster areas, rural or urban, require a buffer stock of energy.**

**Keywords: Disaster, Renewable energy, Local resources, Buffer Stock Management**

## **Gestión de las reservas de energía de amortiguamiento basadas en recursos locales en áreas propensas a desastres**

### Resumen

Después de un desastre, es la falta de disponibilidad de energía lo que causa la peor angustia económica, social y ambiental. La gestión óptima antes del desastre, en la etapa de preparación, es una prioridad y la mejor solución. Analizamos el papel de la gestión de existencias amortiguadoras en áreas propensas a desastres, y desarrollamos un modelo de gestión para el recurso local de energía en este caso, las briquetas de carbón de cáscara de coco para establecer la seguridad energética de antemano y mantener el medioambiente. Las implicaciones teóricas de este estudio enriquecen la literatura en planificación estratégica y producción, y los resultados prácticos son que las comunidades almacenan energía basada en recursos locales. Nuestros hallazgos se aplican en todo el mundo. Todas las áreas de desastre, rurales o urbanas, requieren una reserva de energía de amortiguación.

Palabras clave: Desastres, energía renovable, recursos locales, gestión de existencias de amortiguamiento

### INTRODUCTION

Recently, disasters are of interest to academics, policymakers, and practitioners (Rubin et al, 2019). One of the reasons is the frequent occurrence of disasters in various regions including Indonesia. The fact is that Indonesia is situated on the Pacific Ring of Fire, and on variously the Australian Plate, the Eurasian Plate, and the Pacific Plate, making Indonesia a tectonic disaster-prone area. On September 28, 2018, three simultaneous disasters (earthquake, tsunami, and liquefaction) strike Central Sulawesi (Palu City, Sigi, Donggala and Parigi Mautong Regency), leaving 4,181 people dead, 12,568 injured, and 214,925 fleeing, homeless refugees. The total loss and damage total more than Rp. 23,000 billion (BPDB, 2019).

Difficulties in obtaining clean water, food, transportation, communication, and waste disposal are all due to the sudden loss of energy. Besides, inadequate disaster management results in even more deterioration of economic, social and environmental conditions (Ouariachi-Peralta & Fakhrudin, 2014). Therefore management science is required to respond to disasters

in an integrated, coordinated and comprehensive manner.

There are four stages known in the literature of disaster management. They are

- preparedness,
- emergency response,
- recovery, and
- mitigation

(Ouariachi-Peralta et al, 2014; Carter, 2004).

In disaster-prone areas, such as in Central Sulawesi, it is crucial at the preparedness stage to anticipate the scarcity of energy sources in all the aftermath of a disaster. All human activities require energy. Only a safety stock or buffer stock during a disaster allows people to survive and help others (Cleveland & Morris, 2013). We focus on disaster preparedness at all levels to allow better and more effective responses. Preparedness is not only the duty and responsibility of the government but should be community-based (Hadi, 2007). Especially, the community can play an active role in preparing the energy supply needed during a future disaster by utilizing local resources.

Capacity must be identified, local resources must be harnessed, the public must approve. Optimization depends on two things: the population of the area, in this instance Central Sulawesi, and the required period of self-sufficient survival in a time of disaster. The models must address all local resources as well as adequate and environmentally friendly energy.

## LITERATURE REVIEW

### Concept of Buffer Stock Management

Management is both science and art; it achieves goals effectively and efficiently (Drucker, 2008). In context, for disaster to be properly managed, previous professional planning, organizing, actuating and controlling is required (Daft, 2010). This is in line with the idea of Nurjanah et al (2013) who state that disaster management is a planned process carried out to manage disasters properly and safely. The United Nations Development Program (UNDP) divides disaster management into four major stages. As above,

- the first phase is preparedness (alert planning, early warning),
- the second stage is an emergency response (emergency study, operational plan, emergency assistance),
- the third phase is post-emergency (recovery, rehabilitation, completion, rebuilding), and

- the fourth stage is prevention and mitigation or taming.

It follows that prevention, mitigation, preparedness, early warning, emergency response, emergency assistance, recovery, rehabilitation, and reconstruction form a continuous and integrated sequence. In the preparedness phase, planning must particularly consider what supplies are needed in the event of a disaster. This inventory is referred to as safety stock or buffer stock. According to Rangkuti (2004) it is additional inventory held to maintain supply in emergencies..

### New and Renewable Energy

Renewable energy is the alternative to fossil fuels. It becomes generally and widely used (Can & Korkmaz, 2019). Renewable sources common in this decade are geothermal, hydroelectric (full-size, mini, and micro), biomass (thermal), solar power, wind, waves, tides, and biofuels, especially from municipal waste. The energy comes from natural processes renewing on a human time-scale (Cleveland & Morris, 2013). To generate renewable energy involves various parties (stakeholders), and both direct and indirect investment (Odabashian et al, 2019).

### Local Resources

To actualize a holistic and environmentally-oriented development, an alternative strategy is needed, namely a Resource Base Strategy (RBS), which includes the availability of resources, success factors, and the learning process. This approach is a local resource management strategy oriented toward quality, process, performance, development, culture, environment (management by the process) based on learning, competence, excellence, systematic thinking, and knowledge-based management (Efrizal, 2001). Resources include all financial, physical, human and cultural assets that are used by companies (businesses) to develop, create and sell products or services to customers. The Resources Based View (RBV) approach is required. To be unique and offer added value, the resources must meet several prerequisites, including difficulties in manufacturing, purchasing, substituting, and replicating them. According to Hitt et al, (2011) resources are inputs to the production process, such as capital goods, the competence of its workers, patents, finance, and talented managers. Generally, company resources can be classified into three categories, known as physical resources, human resources, and organization. One type of resource might not be able to produce sustainable competitive advantage on its own; ac-

cordingly, combination and integration are employed to achieve a competitive advantage. Capability is the competence of a group of resources to perform a task together. It is the result of an integrated group of resources. Capabilities are pivotal when they are uniquely combined to create core competencies that have long-term value. Local resources are those available in a region.

### Preliminary Studies

Even SMEs can build core competencies (Grand, 2010). Achieving sustainable competitive advantage is crucial to the Resources Based View (RBV); it directs the company's management to identify, master and develop strategic resources to yield optimal performance (Barney, 2005). Resources play a role in company performance (Ferreira, 2007; Suardika, 2011), specifically tangible resources (Husnah, 2005). Intangible resources do, too. Edelman et al, (2002) and Suardika, (2011) differ from Husnah (2005; 2013) on this point. Strategy enhances business performance (Suardika, 2011).

Model of strategic resource used (tangible and intangible), Environmental Dynamics, Competitive Strategy that is effective and efficient in producing a Model of Core Competencies Development of local products (local resources) with the RBV approach in Central Sulawesi (Husnah & Asngadi, 2015). Applied Research with the title New and Renewable Energy Development Strategy as a Model of Poverty Alleviation Based on Local Resources in Central Sulawesi (Wahyuningsih et al, 2019). Coconut is a local resource in Donggala Regency. Coconut shell charcoal converted into Briquettes is clean renewable energy which can be developed in Central Sulawesi.

### RESEARCH METHOD

Using the literature review method, we construct a model that integrates local resources, community empowerment strategies, and buffer stock management.

### FINDINGS AND DISCUSSION

To produce energy in a disaster requires local resources. The use of local resources as a competitive advantage has been suggested in various studies (Barney, 2001; Yasemin, 2006; Juhana, 2012). Resource Base Strategy (RBS) includes the availability of resources, success factors and learning processes that focus on local resource management strategies oriented to-

ward quality, process, performance, development, culture, environment, and knowledge-based management (Efrizal, 2001), all supported by the concept of Resource-Based View (RBV) which arranges resources and capabilities in a strategic and structured manner.

One of the local resources known as the primary commodities of Central Sulawesi is coconut (Asngadi, 2008). Research conducted by Husnah & Asngadi (2015) indicates that the RBV approach can obtain core competencies in local resources in Central Sulawesi. Wahyuningsih research results (2018, 2019) formulate an economic empowerment strategy based on local resources (new and renewable energy coconut charcoal briquettes) that can advance community income and lower poverty levels in Central Sulawesi.

Concerning available local resources, buffer stock management is necessitated to address safe inventory levels both for production needs and to meet uncertainty levels and precautionary motives (Heizer et al, 2009; Ritzman, 2013). Buffer stock management is crucial, especially in areas that have an uncertain degree of lead time, both due to natural factors and other disaster risks (Assauri, 2016).

One of the primary supplies needed during a disaster is energy. A lack of energy sources in a disaster leads to deteriorating health, economic collapse, social despair, and a worsening environment (Rubin & Rogers, 2019). Buffer stock energy preparation is essential because in the area affected by disaster everything becomes uncertain and unpredictable (Sharma & Kulkarni, 2002). Energy buffer stock preparation is no different from other needs such as food and vitamins needed by affected communities (Kachali & Storsjö, 2017). The urgency of buffer stocks of energy before D-day is crucial because during disasters supply uncertainty is very high, needs change dynamically and the psychology of demand is increasingly out of control (Assauri, 2016; Kachali & Storsjö, 2017; Sharifi et al, 2016). Wahyuningsih's (2018, 2019) formulate an economic empowerment strategy based on local resources (new and renewable energy coconut charcoal briquettes) that can promote community income and reduce poverty levels in Central Sulawesi. Applied research conducted in 2017-2019 has produced a model for poverty alleviation through community economic empowerment based on local resources. The community empowerment produces coconut shell charcoal briquettes as a source of New and Renewable Energy (Energi Baru dan Terbarukan/EBT).

Laboratory test results show that the briquettes have

- calories 8,338, 023 (dead charcoal by splash ingredients);
- calories 5,794,852 (dead charcoal by sprinkling ingredients);
- calories 5,083,589 (dead charcoal ingredients);
- strength of 1.5 KN (dead and flush dead charcoal material),
- 0% water content (dead and flush dead charcoal material); and
- 2 to 3 hours non-stop burning resistance.

Briquettes are one way to provide energy in a disaster. They are environmentally friendly, renewable and green. They generate income and reduce the risk of energy shortages. In vulnerable, insecure areas, buffer stock management involves planning, organizing, initiating and controlling the stockpiles of charcoal. See Figure 1.

## CONCLUSION

Energy scarcity which occurs in the aftermath of a disaster can be minimised by buffer stocks of energy based on local resources. In Central Sulawesi, coconut charcoal briquette production and buffer stock management (planning, organizing, actuating and controlling), is a valid model for disaster-prone areas throughout the world. It is based on the RBV concept, and is based on solid research both pure and applied.

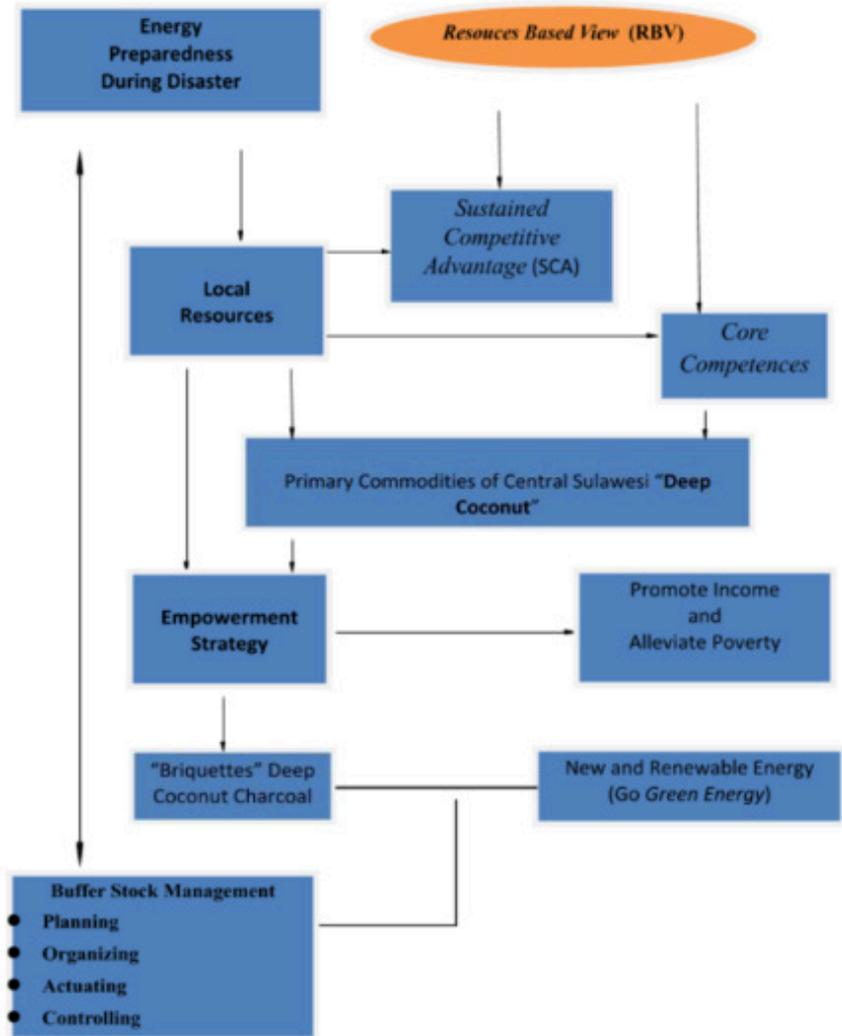


Figure 1. Model of Buffer Stock Management Local Resource-Based Energy In Disaster Prone Area

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