Smart economy for coastal resource management in Surabaya City

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Abstract. Smart economy as a part of smart city concept has been emerging in recent years to promote urban growth. It infuses digital infrastructure in the economic activities, not only to organize around finance or information but also the production and distribution of goods. This paper provides a review of smart economy concept for coastal resource management in a large coastal city in Indonesia. Surabaya is taken as a case as it is the second largest city in Indonesia with abundant fisheries resources. However, these resources are vulnerable due to the dynamic urban demand and pressures. The approach used in this study considers the supply chain aspects of fishery commodities, involving supply and demand characteristics, the chain of distributions, and the price variation along the supply chain. In addition to the literature review, an evidence-based study is also presented by considering the Indonesian government program in managing the national fisheries logistic system. This paper offers two-fold contributions. It shows the urgency in promoting smart economy concepts in coastal resources in coastal cities and the importance for determining a suitable concept of supply chain management practice and digital prototype design of fisheries resources management as instruments of smart economy concepts.

Keywords: smart economy, coastal resources, coastal cities

1. Introduction

The democratization of ICT around the world has led many scholars and policy makers to a discussion on sustainable, resource-conserving, and resilient smart cities. One of the emerging topics is smart city economic development that is appropriate to different cities, countries, and continents. It can be possible that each city in particular country and continent possess differing challenges to smart city economic development. Smart economy as part of smart city concept has been emerging in recent years to promote urban growth. It infuses digital infrastructure in the economic activities, not only to organize around finance or information but also the production and distribution of goods. There is no unanimous definition on smart city or smart economy. The interrelationship of smart economy with smart city is also difficult to decipher. It is not clear whether a city is smart because of its smart economy or smart city is the reason behind the workings of a smart economy. It is also not clear from the literature how...
A Smart City System comprises of six key building blocks: (i) smart people, (ii) smart economy, (iii) smart mobility, (iv) smart environment, (v) smart living, and (vi) smart governance. These six building blocks are closely interlinked and contribute to the ‘Smart City System’. Smart economy has these emerging characteristics: competitiveness; knowledge-based economy; creativity and innovation; establishment of innovation clusters; innovation through networks; IoT; sharing economy; mutual cooperation between enterprises, research institutions, and citizens; entrepreneurship; job creation; social responsibility; green economy; Triple Helix Model in which governments, businesses, and academia have changing roles; and the use of ICTs. Within the digitally networked society of today, ‘sharing economy’ has emerged as a new economic or business model, which goes hand in hand with smart cities. The sharing economy can be defined as the economic model in which demand and supply are immediately in contact through an online platform, in order for the supply side to directly provide services and/or products with an underlying aim to improve the use of assets and to reduce transaction costs. Two distinct sharing economy models are in operation: (i) asset hubs where ‘a single company owns the goods or assets and sells access to users on a temporary basis’ (by hour or day), and (ii) peer-to-peer networks where ‘various would-be suppliers are connected with various would-be users’ using an online platform [3,5].

Cities on the coast are often associated with major ports, which facilitate cheap sea transport of goods, which in turn attracts major industries. Economic growth provides employment and investment opportunities, coastal cities acting as a magnet for people looking to improve their economic status. In response, many urban areas are being developed or expanded to meet the needs of new coastal residents for housing, sanitation and transport. Since 1970, houses have been built at the rate of 2000 units per day in coastal areas of the US and tourism continues to develop in the Mediterranean, the area could host up to 350 million seasonal tourists every year by 2025 [3,6]. Coastal resource refers to the natural and cultural resources of the coastal zone. Coastal land is usually owned and/or managed by multiple agents of private, communal, corporate and government bodies, whereas coastal waters are usually owned and/or managed solely by governments. The uniqueness of the coast is further enhanced by the value of its resource such as fish and offshore mineral reserves, and more recently recreation, economic development, and aquaculture sites, considered by the population to be common property in high demand, and for subsistence use by coastal dwellers. Exploitation of such resources raises their value, with a consequential demand for equitable resource allocation. Therefore, resource planning often forms an integral part of coastal management programs. Renewable coastal resources are primarily exploited in the fisheries sector by commercial, subsistence and recreational fishers and the aquaculture industry.

Surabaya is the second biggest city in Indonesia, which geographically located as coastal city where coastal resource, both natural and cultural resource are abundant yet vulnerable and facing many threats due to urban pressures. To fulfill the coastal resource demands of its 3.5 million populations and beyond, especially for fish commodities, Surabaya is struggling to manage this resource as daily basis supply from 18 community-scale fish ports and from larger area in East Java. According to the Surabaya Spatial Planning documents, there will be 4 city-scale fish ports established in Surabaya and considering the dynamics of economic situation that Surabaya has, the integration of smart economy concepts is an important need to be applied. The use of smart economy concept has the urgency to balance supply and demand, and mitigate environmental degradation through greater efficiency, also reduce the strain on resources by streamlining the delivery of energy and services as well [4]. The readiness of Surabaya city implementing smart economy has been long recognized as Surabaya has already integrate the use of technology to connect, supervise, and control the resource in the city in effective and efficient way so that the citizen of Surabaya can achieve optimal services. There are many awards that given to Surabaya related to its success implementing Smart City concept; i.e. Indonesia Smart City Index in 2015. So far, the use of technology as instruments toward Smart City has been focused in environment, education, procurement, and citizen administration needs. There is opportunity to develop more, especially for coastal resource management.
This paper provides a review of smart economy concept for coastal resource management in a large coastal city in Indonesia. Surabaya is taken as a case as it is the second largest city in Indonesia with abundant fisheries resources. However, these resources are vulnerable due to the dynamic urban demand and pressures. This paper offers two-fold contributions. Firstly, it shows the reason why we need to promote smart economy concepts in coastal resources in coastal cities. Secondly, this paper is important for further stages, particularly in determining a suitable concept of supply chain management practice and digital prototype design of fisheries resources management as instruments of smart economy concepts.

2. Methods
This research employs two main stages which are described as follows. First, we explore the smart economy concepts that require to consider in making coastal resources to be essential parts of smart city. In doing so, a desk study is conducted, particularly in reviewing the available practices of smart economy in coastal cities in various countries. This theoretical-driven approach provides a foundation that is expected be a basis of understanding the potential of a coastal resources toward smart city. Second, we analyse empirical evidences related to fish resource management in Surabaya city, one of the large coastal city in Indonesia taken as study case. The primary data is collected through observation and interviews, while the secondary data is obtained from the city government. A simple correlation analysis is used to characterize the fishery problems. Hypothesis testing is also performed to infer the significance of the statistical relationship.

There are variables specifically set to this study, reviewed from smart city literatures and coastal management literatures, and synthesized in the context of this study. The variables are mentioned in Table 1 below.

| Indicator          | Variables                                                        |
|--------------------|------------------------------------------------------------------|
| Smart Economy      | Innovation cluster in economic activities                       |
|                    | Digital infrastructure and IoT (Internet of Things) in economic activities |
|                    | Mutual cooperation between economy actors                        |
| Coastal Management | Fish commodities/ resources                                      |
|                    | Facilities in fisheries management                               |

3. Results and Discussions
3.1 Exploring smart economy concept related to coastal resource
Technological needs in managing logistics, such as fisheries resources, smart concepts are important to be carried out in the management of material handling and movement processes. This is because consumers require accurate information and certainty on the availability of goods at affordable prices. Robotics and Automation News Report states that in order to support this, perfect supply chain management is needed and is supported by optimal inventory efficiency and processes in all aspects from production to distribution to end customers. Innovation in terms of logistics is important to do because the more supply chains that can integrate and coordinate activities, the greater the possibility to optimize the flow of goods from suppliers to consumers. The condition of the company in dealing with fluctuations in demand changes and shorter delivery times, thus requiring greater flexibility in managing goods to be more efficient. This is done so that companies can continue to be sustainable and have competitive and good capabilities [8].

Information disclosure or data is an important aspect in realizing smart cities in the aspect of supply chain management because of the many processes and participation involved in it. One of the innovations is the blockchain and IoT that helps all participants to get involved together. Blockchain in
the field of logistics has been widely applied in American states, especially in the port sector. However, apart from all existing technologies, human involvement in supply chain management is important for planning and making the right decisions, because not all decisions can be taken automatically needed by human logical thinking. Smart Logistic and Supply Chain is used to make the logistics system more efficient, effective, connected and flexible to meet needs quickly, if viewed further to connect the economy in all aspects and improve real-time economy. Besides that, it is used to change the way of working in managing aspects such as data / information analysis and it requires a skill to do the management in making the right and fast decisions along with changing demand. The following is an overview of smart logistics and supply chains in various fields. In Figure 1 illustrates the evolution of the logistics system and supply chain towards broader and more flexible autonomy, even to the point where there are no more warehouses in the supply chain system [10,11].

![Figure 1. The Evolution of Logistic System and Supply Chain as Smart System](image)

Source: I-Scoop, 2016

Coordination between economic activity actors, especially in the field of fisheries commodity management is very important to do especially the nature of consumers who demand an economical and varied product with an increase in service parts and fast delivery. Changes to business processes are needed such as low costs and fast delivery processes [12,13]. In this case the company must excel in several fields such as innovation in capacity and speed of responding to consumer demand. To deal with these problems, it is necessary to implement efficient supply chain management and adapt it to the needs and objectives of the company with good responsiveness to fluctuations in demand changes. Business competition is not only about competition between companies but also competition that occurs between economic activity actors involved in the supply chain of fish resources. Coordination between economic activity actors or supply chain stakeholders must go well to be able to face business competition and be an effective way of handling all processes and operations involved in making goods to the end customer. At present, supply chain is closely related to smart city because it provides opportunities and constraints in the process of managing collaboration systems between companies, end customers and the government [14,15,16,17,18].

Meanwhile in Indonesia, the policy and programs supporting the implementation of smart economy and coastal management in Indonesia already provided. According to Republic of Indonesia Ministry of Maritime Affairs and Fisheries Regulation No 5 / Permen-KP / 2014 concerning National Fish Logistic System, fisheries are stated as all activities related to the management and utilization of fish resources and their environment ranging from preproduction, production, processing to marketing, which are carried out in a fisheries business system. The National Fish Logistics System, hereinafter abbreviated as SLIN, is a management system for fish and fishery product supply chains, materials and production...
equipment, and information ranging from procurement, storage, to distribution, as a unity of policies to increase capacity and stabilize upstream fisheries production systems - downstream, controlling price disparity, and for meeting domestic consumption needs [7,9].

3.2 Surabaya indication in Smart Economy integration of coastal resources management
This section is to describe the analysis of phenomenon appears in Surabaya related to fish resource management. The analysis is described as follows:
Identification of fish resource supply characteristics in the city of Surabaya was conducted to determine the number and type of fish resources produced. The analysis is carried out through the compilation of secondary data from various agencies related to the fish resource supply chain. In this case, the Surabaya City Government of Food Security and Agriculture Board and the East Java Province Government of Marine and Fisheries Board became the main provider of data that was supported by some literature and related stakeholder interviews. Fish resource supply in Surabaya City consists of marine waters and public waters. Based on 2017 data compilation, it was noted that the largest catches in the fisheries sector were in the third quarter with a total production of more than 3000 tons and production values reaching Rp 80 billion. The 5 types of marine fish with the largest supply are shown in the following graph (Figure 2).

![Figure 2. Marine Fishery Production and Commodities in Surabaya (top five)](image)

Marine fishery production is dominated by mullet, manyung fish and shelled marine animals such as crabs and white shrimp, while in general fisheries are dominated by cork fish. Variations in the height and yield of fish caught by marine fishermen are influenced by several factors such as climate, fish catch distance, number of hours worked on the sea, rain and wave height. This is reinforced by the results of interviews with the Surabaya Food and Agriculture Security Agency as follows:

“Yes, so if the Surabaya fishermen have few catches, especially when there is no fish famine, Ma’am, they are very small. But they are indeed abundant during the certain harvest season, for example grago and the dried small shrimp, ebi.” – Aris Munandar, Head Division of Fisheries, Surabaya

While the largest ground fishery production is shown in Figure 3. When compared to other regions in East Java Province, Surabaya City has a very low production rate. This is because the area of fish
catching in the city of Surabaya is too narrow and most of the fishermen in Surabaya only rely on a one day fishing system. When compared with the level of fish consumption of the people of Surabaya City, fish production in a year is still not sufficient for fish consumption needs that reach 43 kg / capita / year and the national target of 47 kg / capita / year. Figure 4 shown the position of Surabaya City based on its fish production compared to other coastal districts / cities in East Java on average over the past 7 years (2010-2016). To meet the fish consumption needs of the people of Surabaya City, fish supplies are imported from other regions. Based on information from one of the stakeholders of the Surabaya city government, most of the fish demands in Surabaya are supplied from various regions such as Pekalongan, Brebes, Tuban, Lamongan, Gresik, Probolinggo and Pasuruan. Fish distribution originating from outside the city of Surabaya enters the *Pasar Papean*, which is one of the largest fish markets in the city of Surabaya. The function of the Pasar Papean in the fisheries supply chain roled as collector and distributor of fish supply to a variety of smaller markets in the city of Surabaya and surroundings.

![Figure 3. Ground Fishery Production and Commodities in Surabaya (top five)](image-url)

| Month     | Nile | Tuna | Mahi | Gahal | Coke |
|-----------|------|------|------|-------|------|
| Oct-Dec   | 2.9  | 2.9  | 4.2  | 3.3   | 0.7  |
| Jul-Sep   | 6.1  | 6.1  | 6.1  | 9.2   | 1.5  |
| Apr-Jun   | 6.2  | 6.6  | 5.6  | 6.9   | 1.5  |
| Jan-Mar   | 5.7  | 5.2  | 4.4  | 3.1   | 1.3  |
The next stage of analysis is identification of stakeholders involved in the fish auction process in the Surabaya City scope. The analysis was carried out by identifying the types and roles of stakeholders from the literature, then content analysis was carried out to confirm the truth of the results of the literature study to those who understood the research context. The results obtained are 7 affected and interested stakeholders in fisheries auction activities in the city of Surabaya. The stakeholders consist of fishermen, middlemen/collectors, wholesalers, retail traders, distribution service providers, consumers, and the Surabaya City Government as follows:

**Fishermen**
There are around 2,600 fishermen that exist in Surabaya city up to 2017 with the potential of capture fisheries along the coastline of 47.4 km2. The existing fishing groups are spread in 9 sub-districts in Surabaya: Gununganyar, Rungkut, Sukolilo, Mulyorejo, Bulak, Kenjeran, Krembangan, Asemrowo, and Benowo Subdistricts. They conduct traditional fishing with daily patterns with the main role are catching fish, selling fish directly in local ports (mostly through middlemen), earning money from the sale of fish, and providing good quality fish.
Collectors/middlemen
They offer prices to fish buyers, get services from a fish auction and provide information on fish prices appropriately.

Wholesalers
Their role is selling fish on a broad scale and/or to other areas. They benefit from the sale of fish and they provide fish needed by consumers.

Retail traders
Their role is selling fish on a smaller scale (e.g. in housing or kampung area). They benefit from the sale of fish by providing fish needed by consumers.

Distribution service provider
Their role is transporting the fish from fish auction/market to other regions, both in the city or outside the city. They have to transport the commodities to destination with good quality, using cold chain.

Consumer
Their role as a final consumer of fish and want to have good quality fish. They spend money according to the agreed price. They also the key of fisheries demand.

The government of Surabaya
The Surabaya City Government for fisheries activities consists of the Food Security and Agriculture Board of Surabaya City (DKPP) and Market Coordinator in Surabaya (PD Pasar Surya). Their role is to regulate the fisheries policy, conduct management of Fish Auction Places (TPI) and fish markets. They have rights in authority of regulating or implementing policies. Their obligation is to handle related issues in the field of fisheries management in accordance with the main tasks of the governmental function.

The last stage of analysis is to find the correlation between the fish resources and the fisheries actors. In dry season, the fish production level is higher than in the wet season. This is because the fishermen should cope with seasonal challenges in the sea during the wet season. To understand whether any correlation exist between the level of production and price, a simple correlation analysis is conducted and shown in Table 2. From the analysis, there is no significance correlation between the level of fishery production and price in Surabaya. This is an interesting finding as in urban areas the production level of fish does not have a significant impact on the market price in the same areas related to fish resource management.

Table 2. The summary output of correlation analysis using linear regression

| SUMMARY OUTPUT |
|----------------|
| Regression Statistics |          |
| Multiple R | 0.116977709 |
| R Square | 0.013683784 |
| Adjusted R Square | 0.000532901 |
| Standard Error | 0.522368142 |
| Observations | 77 |

| ANOVA |        |
|--- | --- |
| df | SS | MS | F | Significance F |
| Regression | 1 | 0.283925682 | 0.283925682 | 1.04522108 | 0.310979271 |
| Residual | 75 | 20.46513567 | 0.272868476 | |
| Total | 76 | 20.74908136 | | |

| Coefficients | Standard Error | t Stat | P-value | Lower 95% | Upper 95% | Lower 95.0% | Upper 95.0% | Lower 95.0% | Upper 95.0% | Lower 95.0% | Upper 95.0% |
|--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Intercept | 0.067793991 | 0.059781237 | 1.134034602 | 0.260391808 | -0.65129634 | 0.186864322 | -0.65129634 | 0.186864322 | |
| Percentage of price changes | 0.524935836 | 0.514612778 | 1.02059855 | 0.310979271 | 0.500225388 | 1.55009706 | 0.500225388 | 1.55009706 | |

We also test the correlation between the number of fishermen and the price disparity. The price disparity considered is between the fish selling price sold by the fishermen to the collector and the fish price at the consumer level. This test is carried out against the background of the phenomenon of competition, where the more competitors, the price will be set lower than other competitors. As can be
seen in Table 3, there is no correlation between these two factors. This indicates that the higher number of fishermen does not cause changes in fish price set by the fishermen.

### Table 3. Correlation test between the number of fishermen and price disparity of fishermen and collectors

| Number of fishermen | The average of price disparity between fishermen and middlemen |
|---------------------|---------------------------------------------------------------|
| 1                   | 0.052884284                                                   |

#### 4. Conclusion

Surabaya City’s fish production which is still not sufficient for consumption needs, the fair trade concept among players in the fisheries supply chain is also not valid. Based on the primary data collected, the fishermen sell their catch or cultivation with relatively high price disparities compared to the prices offered by middlemen. The profit margins obtained by fishermen and are very much different when compared to middlemen, especially for hard-shelled commodities, such as lobsters, crabs, crabs, and white snapper. This can occur due to several factors, such as the waiter not knowing the market price directly, the middleman is the main customer or the only customer so that fishermen do not have other options to sell their catch or cultivation, and also the role of TPI does not function properly. Therefore, smart systems for fisheries resource management can be one solution so that fishermen can interact with potential customers in fisheries supply chains so that fishermen have access to prices and have the freedom to determine prices.

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