The effect of information technology on coastal development in Asahan Regency, North Sumatra Province, Indonesia

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Abstract. This research aims to examine the relationship between information technology and coastal development in Asahan Regency, North Sumatra Province, Indonesia. Through this research, coastal community opinions were collected using structured questionnaires. A structural equation modeling (SEM) approach was employed to test a hypothesized model constructed based on theories and previous studies. In addition, a new combination of existing indicators was used as a novelty of this research. The research result indicates that information technology has not significantly affected coastal development. Theoretical and practical implications of the research findings for policymakers are discussed.

1. Introduction
Coastal areas have enormous potential, but on the other hand, they have various problems. The prospect of the coastal regions includes capturing fisheries and aquaculture, tourism, industry, maritime services, and marine transportation potential. Meanwhile, common issues encountered in coastal areas involve poverty, limited human resources, conflicts in using natural resources, and environmental damage. In addition, coastal areas are the most vulnerable to the impacts of climate change.

Information technology plays a crucial role in coastal resources management. Spatial information of coastal resources, for instance, can be used to identify the size and location of coastal resources [1]. Moreover, information systems have been developed to analyze and display coastal ecological characteristics and recommend solutions for wetland change/loss [2]. Furthermore, remote sensing applications have widely been used in assessing tropical coastal resources, including mapping of littoral and shallow marine habitats, change detection, bathymetry mapping, and the study of suspended sediment plumes and coastal currents. [3]

Many studies have explored the different aspects of information technology and coastal development presented in conferences and journals [1-5]. However, there has been no empirical analysis to examine the influence of information technology on coastal development from a coastal households' perspective. Thus, it is worthwhile to identify the relationship between information technology and coastal development.

2. Conceptual framework and research hypothesis
The basic concept of regional development is to improve people's welfare and ensure environmental sustainability by paying attention to regional advantages and reducing development gaps by increasing community access to production, processing, and marketing factors and facilitating the community with various means [6].
The success of regional development can be measured through several indicators: availability and sufficiency facilities and infrastructure, and service facilities, public health improvement, improved public formal education, increased community productivity, the broad availability of job opportunities, increased income, and people's attitudes and behavior [7]. Furthermore, household income, job opportunities, entrepreneurship opportunities, availability/ease of raw materials, and economic access to resources have to be considered in measuring coastal area development [8].

In addition, information technology indicators involve the use of computers and networks, internet access, internet connection methods, employees who have internet access, and internet sites [9]. Moreover, other indicators include online payments, online order value, online trading, internet usage in public administration, the types of interactions, impacts, and benefits of online transactions, business activities, number of employees, and location [9].

Based on the existing theories in regional development, coastal development, and information technology, the conceptual framework of this study was designed as follows.

**Figure 1. Conceptual framework**

Based on the conceptual framework, this study hypothesizes that information technology (X) significantly influences coastal development (Y).

3. **Materials and Method**

   The type of research is explanatory research with a quantitative approach. The study was conducted from January to May 2021 in the coastal area of Asahan Regency, including four sub-districts, namely Tanjung Balai sub-district, Silau Laut sub-district, Sei Kepayang sub-district, and Sei Kepayang Timur sub-district. The location was selected by considering that the coastal communities of Asahan Regency are most affected by the existence of the Bagan Asahan Port.

   The type of data used in this study is primary data. The data was collected from a questionnaire using a Likert Scale where the questions on the questionnaire required respondents' answers with a graded scale.

   The population used in this study is all households in the coastal area of Asahan Regency, which includes four sub-districts. Based on Asahan in Figures 2020 released by the Central Bureau of Statistics of Asahan Regency, the number of households in the coastal area of Asahan Regency at the end of 2019 was 19,691 households [10]. Hence, the number of respondents was:

   \[
   n = \frac{N}{1 + Ne^2} = \frac{19,691}{1 + 19,691 (0.05)^2} = 392.04 \approx 392 \text{ households}
   \]

   Data analysis in this study begins with descriptive analysis. Descriptive analysis was conducted to find out the description of the characteristics and answers of research respondents regarding information technology, port development, and coastal development.
Confirmatory Factor Analysis is used to test whether the existing indicators can explain a variable. This analysis will be known the level of influence of an indicator in explaining a variable. Next, data analysis in this study used Structural Equation Modeling (SEM).

4. Result and Discussion

4.1. Descriptive Analysis

Descriptive analysis was used to describe the essential characteristics of the collected data. The following standards measured respondents' answers to all variables.

| Table 1. Average respondents' responses criteria |
|-----------------------------------------------|
| Value                  | Criteria |
|-----------------------|----------|
| 1.00-1.79             | Bad      |
| 1.80-2.59             | Poor     |
| 2.60-3.39             | Fair     |
| 3.40-4.19             | Good     |
| 4.20-5.00             | Very Good|

Based on the descriptive analysis, the data can be presented as follows.

| Table 2. Number and percentage of respondents' responses on information technology |
|-----------------------------------------------|
| Indicators               | Respondents' response | F | Mean Value | Category |
|--------------------------|-----------------------|---|------------|----------|
|                          | 1 2 3 4 5             |   |            |          |
| X1.1                     | 9 2.3 75 19.1 181     | 392| 3.11       | Fair     |
| X1.2                     | 10 2.6 129 32.9 148   | 392| 2.90       | Fair     |
| X2.1                     | 152 38.8 109 27.8 92  | 392| 2.07       | Poor     |
| X2.2                     | 176 44.9 125 31.9 52  | 392| 1.91       | Poor     |
| X3.1                     | 18 4.6 32 8.2 89      | 392| 3.69       | Good     |
| X3.2                     | 18 4.6 35 8.9 69      | 392| 3.69       | Good     |
| X3.3                     | 22 5.6 31 7.9 69      | 392| 3.65       | Good     |
| X4.1                     | 12 3.1 111 28.3 131   | 392| 3.06       | Fair     |
| X4.2                     | 21 5.4 108 27.6 166   | 392| 2.95       | Fair     |
| Overall Mean Value       | 3.00                  |   |            |          |

Based on table 2 above, the lowest mean value is 1.91, namely X2.2, which is included in the poor category, while the highest mean value is 3.69, namely X3.1 and X3.2, which are included in the good category. Overall, the mean value of respondents' responses to variable X is 3.00, which is included in the fair category.

| Table 3. Number and percentage of respondents' responses on coastal development |
|-----------------------------------------------|
| Indicators               | Respondents' response | F | Mean Value | Category |
|--------------------------|-----------------------|---|------------|----------|
|                          | 1 2 3 4 5             |   |            |          |
| Y1.1                     | 31 7.9 85 21.7 248    | 392| 2.71       | Fair     |
| Y1.2                     | 69 17.6 148 37.8 130  | 392| 2.41       | Poor     |
| Y2.1                     | 13 3.3 35 8.9 48      | 392| 3.97       | Good     |
| Y2.3                     | 14 3.6 41 10.5 137    | 392| 3.41       | Good     |
| Y3.1                     | 11 2.8 90 23.0 168    | 392| 3.04       | Fair     |
Based on table 3 above, the lowest mean value is 2.41, namely Y1.2, which is included in the poor criteria, while the highest mean value is 3.97, namely Y2.1, which is included in the good criteria. Overall, the mean value of respondents' responses to variable Y is 3.05, which is included in the fair category.

4.2. Confirmatory Factor Analysis

Confirmatory Factor Analysis is used to assess the instrument's validity and reliability and assess whether a variable is a good indicator (valid and reliable) or not. The following are the results of the confirmatory analysis test for each variable:

![Figure 2. Confirmatory Factor Analysis model for information technology](image)

| Table 4. Confirmatory Factor Analysis result on information technology |
|---------------------------------------------------------------|
| Estimate | S.E. | C.R. | P   |
| X21 <--- X2 | .626 |  |  |  |
| X22 <--- X2 | .329 | .148 | 4.849 | *** |
| X23 <--- X2 | .322 | .134 | 5.069 | *** |
| X24 <--- X2 | .816 | .340 | 4.726 | *** |

Based on table 4 above, all indicators have a loading factor value greater than 0.3, so it can be concluded that all indicators in CFA Y are valid. Thus, all indicators are accepted and declared capable of measuring variables and included in the full model test.
Figure 3. Confirmatory Factor Analysis model for coastal development

Table 5. Confirmatory Factor Analysis result on port development

| Estimate | S.E. | C.R. | P     |
|----------|------|------|-------|
| Y1 <-- Y | .392 |      |       |
| Y2 <-- Y | .468 | .368 | 3.897 *** |
| Y3 <-- Y | .657 | .253 | 6.129 *** |
| Y4 <-- Y | .676 | .451 | 4.125 *** |

Based on table 5 above, all indicators have a loading factor value greater than 0.3, so it can be concluded that all indicators in coastal development are valid. Thus, all indicators are accepted and declared capable of measuring variables and will be included in the next full model test.

Table 6. Full model test result

| Relationship among variables | Estimate | S.E. | P    | Result        |
|------------------------------|----------|------|------|---------------|
| Y <-- X                      | .034     | .183 | .852 | Not Significant |

The analysis results prove that based on the results of the regression weight, it is known that X has a positive yet not significant effect on Y. The significance value (P) indicates that the P-value >0.05, namely P 0.852. The positive direction suggests a unidirectional relationship between X and Y, meaning that if X increases, then Y increases. Hence, the hypothesis is not accepted.

The analysis results show that information technology has not significantly affected the development of the Asahan Regency coastal area. This result implies that information technology has not provided an accurate and robust impact to support the development of the coastal area of Asahan Regency.

This result is in line with a previous study that indicated a positive relationship between information technology and regional development [9]. Still, some of the main challenges that may be faced are obstacles in adoption, business segmentation, awareness and managerial skills, the development business, and funding for technology development. Based on the answers from respondents, the factors that cause information technology in the coastal area of Asahan Regency have not had a significant effect, among others, are obstacles in adoption where in general, respondents consider that the use of information technology is relatively tricky. In addition, most respondents also rarely or never do online business, the quality of the internet network is poor, and the cost of internet access is still relatively expensive.
5. Conclusion
To sum up, it is proven that information technology has no significant effect on developing the coastal area of Asahan Regency. This research implies that the development of information technology is not an appropriate policy to improve facilities and infrastructure, increase community income, expand job and business opportunities in Asahan coastal area.

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