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Potency Analysis for Agro Science Techno Park Area Development Plan in Gorontalo Province

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ABSTRACT

Global competitiveness index report in 2015 has put Indonesia in the 30th rank on one of the research collaboration performance between university and industry as innovation pillar. This indicates that there is still lack of synergy between higher education institutions and industry to develop research output. As the answer to this challenge, the Indonesian government initiated the establishment of Science Techno Park (hereafter, STP) as business technology incubator to stimulate and to manage the flow of knowledge and technology in universities, research and development institutions, industry, and government. However, among eight existing STP and 78 more that were planned to be built, Gorontalo, as an agricultural province with the potential to develop agro STP, was not among them. This study is aimed at examining the area potentials, potential commodities, and agro-industry potentials that are feasible for developing a pilot area for agro STP in Gorontalo province as a basis for implementation of agro-industry cluster policy to strengthen the regional innovation system in Gorontalo province. The data were collected from survey and focus group discussion (FGD). The data were analyzed by using Location Quotient Method and Exponential Comparison Method. The results reveal three potential agro-industry regency areas; Gorontalo Regency, Boalemo Regency, and Gorontalo Utara Regency as well as seven leading commodities for these potential areas; corn, coconut, marine fisheries, cocoa, beef cattle, cassava, and chili. Further, for agro-industry, the most dominant potentials to be developed are flour, beef floss, chips, handicraft, and animal feed.

Keywords:
Agro STP; piloting area, commodity; agro-industry

1. Introduction

Global Competitiveness Index 2015-2016 showed that Indonesia experienced a decline from 34th rank in 2014-2015 to 37th in 2015-2016 and plummeted to 41st in 2016-2017 (WEF, 2015). The WEF report has given the 30th rank for one of the indicators of research collaboration performance between university and industry on Innovation Pillar indicates that synergy between higher education institutions and industry in developing the research result are lacking (Figure 1). In dealing with this challenge, the government of Indonesia has established the development of STP as business

technology incubator, which aimed at stimulating and managing the flow of knowledge and technology in universities, research and development institutions, and government (BAPPENAS, 2015).

12th Pillar : Innovation		
12.01	Capacity for innovation…….	4.7……..30
12.02	Quality of scientific research institutions……..	4.3……..41
12.03	Comapni spending on R&D……....	4.2……..24
12.04	University-industry collaboration in R&D……	4.5……..30
12.05	Gov't procurement of advanced tech products……..	4.2……..13
12.06	Avaliability of scientists and engineers…….	4.6……..34
12.07	PCT patents, applications/million pop.*…….....	0.1…….102

Figure 1. Innovation Pillar Indicator in Indonesia Global Competitiveness Index 2015-2016 (WEF, 2015)

Studies on STP have been widely conducted. Since 1950, science parks have been developed in the United States of America to bridge the gap between research and Industry. Nowadays, a science park is widely spread among developed countries, but not with the same plan, objectives, funds, equipped stocks and results (Mansour and Kanso, 2017). Even after the economic liberalization of 1991, the government of India established the software techno parks of India (STPI) scheme and opened numerous software parks around the country. These parks have played a critical role in the growth of India's software sector (Vaidyanathan, 2008). Although many authors have analyzed the role and the efficiency of science parks, only a few contributions have analyzed national science park systems (SPSs) as a whole. Albahari et al. (2013) which has tried to compare Italy and Spain systems, shows that science parks play a more important role in Spain than in Italy, caused by the support of policies, business models, and the role of national associations.

Related to policy support, science park is the part of policy intervention to promote leading potentials of a region, which designed to boost the economic development through companies that are based on the creation of technology as the result of knowledge transfer from a university (Albahari, 2015). Hence, in decentralization, decision-making in the regional level, it should be the focus of regional innovation policy to develop innovative networks through the development of Science Park or Techno Park in provincial or district/city area (Koschatzky and Kroll, 2007). Learning from agencies that are involved in promoting the science park, the applied policy, and the result as in Barcelona, Science Park has a strong character that enables the dynamic of economic innovation and acceleration of development in an area to be explored (Casselas, 2015). Conditions stating that University research parks constitute a potentially important mechanism for university technology transfer and regional economic development, supported by empirical results suggest that U.S. firms locating on university research parks are more research active and more diversified than the typical public firm reporting R&D activity (Leyden, Link, and Siegel, 2008). In recent years, there has been a substantial increase in public and private investment in university research parks (URPs). URPs are important as an infrastructural mechanism for the transfer of academic research findings, as a source of knowledge spillovers, and as a catalyst for national and regional economic growth (Link and Scott, 2007).

Studies have shown that companies with university links usually have higher productivity rates than comparable companies that do not have such links. They are

also better off in terms of market share, quality of products and services and cost competitiveness. Thus the link between firms and universities is considered fundamental to the concept of science parks (Malairaja and Zawdie, 2008). Its exemplified by the existence of techno parks in Malaysia is focused on automotive, biotechnology, and electronics in the case of the research and development collaboration (Rasiah and Govindaraju, 2009). Moreover, Korea has been able to map the innovation cluster based on the established science park (Deog-Seong and Yoem, 2013). China's techno parks have been proliferating in the decade that followed their establishment, in response to the policy incentives or there have been external economies from the concentration of high-technology firms in the techno parks as policymakers had hoped (Hu, 2007).

In Indonesia, development of science or techno park is marked with the establishment of Bandung High Tech Valley (BHTV) in 2006, which was established by Institut Teknologi Bandung (ITB) and the focus is on small technology companies to start their business (business start-up). Later, Solo Techno Park was also established in Solo. This techno park consists of IT and Research zone, training zone and business incubator, and industry and trade zone. This is in line with the Midterm development plan (henceforth called as RPJMN) 2015-2019, who has made the establishment of techno park all over Indonesia as a priority program (BAPPENAS, 2014). As in government work plan (henceforth called as RKP) 2016, the government has initiated the establishment and development of 100 techno parks all over Indonesia.

However, among currently existing 8 locations of the STP and 78 new locations of STP development for 2015-2016 (Soenarso, 2015), Gorontalo province was not among those places. Despite the fact that in the second quarter of 2015, the agriculture sector in Gorontalo has contributed by 36% to Gross Domestic Product (GDP) of Gorontalo Province (BPS, 2016). Gorontalo is potential to develop agro STP area. On the other hand, there are agricultural products that are potential to be developed yet have not yielded welfare improvement for its people. Hence, it is expected that each region can develop their agro-industry area in order to create added value and strengthen leading sectors (Baruadi *et al.,* 2016). In many parts outside Gorontalo, regional studies for the development of the commodity-based industry as the source of agro STP area has been started to be developed (Saddawesi *et al.,* 2010; Hidayat *et al.,* 2014). As the study conducted by Indah *et al.* (2017) has successfully identified the potential of plantation commodities in supporting the development of the agropolitan area in Ponorogo Regency, this gets agribusiness competitiveness through agropolitan by using Location Quotient (LQ) method.

Based on those facts, this study is aimed at examining the area potentials, potential commodities, and agro-industry potentials that are feasible for developing a pilot area for agro STP in Gorontalo province as a basis for implementation of agro-industry cluster policy to strengthen the regional innovation system in Gorontalo province.

2. Materials and Method

2.1. Data

The material in this study consisted of commodity data, location data, and agro-industry potential data. The data for this study were collected through literature review, observation, survey, and documents from related agencies and information from experts collected through focus group discussion.

2.2. Analysis

The research employed analysis method below:
- Regions' comparative analysis through *Location Quotient* (LQ) analysis.

This analysis was used to compare the role of a sector in a region toward a wider reference area (for instance district against province or province against nation). Hence, internal potential as the basis of the area can be identified. Isaard (1960) formulate LQ as:

$$LQ = \frac{Si/Ni}{S/N} = \frac{Si/S}{Ni/N}$$

The Si, S, NI, N values could be different, based on the observed object. As in this study, the LQ formula was used to find out the value of a commodity in a regency/city against the provincial area, where:

S_i = total production of a commodity in a certain sector in year X in a regency /city
S = total production of all commodities in that sector in year X in a regency/city
N_i = total production of a commodity in certain sector in year X in provincial level
N = total production of all commodities in that sector in year X in provincial level.

According to Bendavid (1991), there were three categories of LQ result analysis in a region, namely:

If LQ > 1, then the region is more specialized (is potential) on certain product/commodity in certain sector, compared to the referenced area
If LQ < 1, then the region is less specialized (less potential) on certain product/commodity in particular sector compared to the referenced area.
If LQ=1, then the region is specialized or has similar potential on the product/commodity in the certain sector as the referenced area.

- Exponential Comparison Method (ECM)

ECM was one of the methods to determine alternative priority decision with plural criteria. ECM was able to minimize the bias that might happen during the analysis because the score of the priority sequence becomes bigger (exponential function) which caused the sequence of alternative priority decision become more significant (Marimin, 2004). The formula for ECM was as follows:

$$Total\ Nilai\,(TN_i) = \sum_{j=1}^{m} (RK_{ij})^{TKK_j}$$

Where:
TN1 = total i alternative value
RKij = j relative significance level for i decision alternative
TKKj = relative significance of j decision criteria; TKKj > 0 or integers
n = number of decision options
m = number of decision criteria

3. Results and Discussion

3.1. Location Quotient Analysis

Table 1 to 5 shows the LQ value based on the production data of some commodities in food crops sub-sectors, horticulture, plantation, husbandry, and fisheries of each regency and city in Gorontalo province in 2015.

Table 1. LQ values for sub-sector of food crops commodity in Gorontalo province based on production data of 2015

Commodity	Boalemo	Gorontalo	Pohuwato	Bone Bolango	Gorontalo Utara	Gorontalo City	Average
Rice	0.02	0.94	1.66	1.84	0.96	0.26	**1.02**
Corn	1.39	1.01	0.74	0.67	1.01	1.31	**1.00**
Soy	1.63	0.01	0.04	0.95	0.69	0.00	0.55
Peanut	0.32	0.92	2.17	1.62	0.50	0.00	0.70
Cassava	0.45	4.47	0.95	0.49	2.61	0.00	**1.03**
	0.76	**1.47**	**1.11**	**1.11**	**1.16**	0.31	

Table 2. LQ values for sub-sector of horticulture commodity in Gorontalo province based on production data of 2015

Commodity	Boalemo	Gorontalo	Pohuwato	Bone Bolango	Gorontalo Utara	Gorontalo City	Average
Onion	1.29	0.58	0.58	1.70	0.59	-	**1.15**
Big Chili	2.02	0.50	0.02	0.27	0.69	-	0.48
Small chili (cayenne pepper)	0.88	0.13	1.51	1.00	1.26	-	**1.13**
Tomato	1.10	2.94	0.06	1.18	0.46	-	0.82
Eggplant	0.70	4.68	0.17	0.26	0.75	-	0.51
Duku/Langsat	3.44	0.93	0.55	0.15	0.02	-	0.06
Durian	3.26	0.65	3.84	0.08	0.02	-	0.03
Mango	0.11	1.45	0.68	1.45	0.15	1.59	**1.06**
Jackfruit	0.63	1.28	0.22	1.85	0.16	0.94	0.98
Banana	0.21	0.84	0.30	1.16	2.20	1.24	**1.53**
	1.49	**1.46**	0.85	0.88	0.46	0.63	

Table 3. LQ values for sub-sector plantation commodity in Gorontalo province based on production data of 2015

Commodity	Boalemo	Gorontalo	Pohuwato	Bone Bolango	Gorontalo Utara	Gorontalo City	Average
Coconut	0.96	0.89	1.07	1.11	0.91	-	1.01
Coffee	0.38	5.29	2.39	0.23	1.92	-	1.07
Cocoa	1.96	0.93	0.08	0.16	2.10	-	1.13
Clove	0.02	6.99	1.82	0.76	1.31	-	1.04
Aren	0.00	10.87	0.00	0.68	2.36	-	1.52
	0.66	4.99	1.07	0.59	1.72	-	

Table 4. LQ values for sub-sector animal husbandry commodity in Gorontalo province based on production data of 2015

Commodity	Boalemo	Gorontalo	Pohuwato	Bone Bolango	Gorontalo Utara	Gorontalo City	Ave.
Beef Cattle	1.87	0.49	1.61	0.55	1.65	1.62	1.27
Goat	0.00	0.08	0.06	0.01	2.33	2.39	1.57
Broiler Chicken	0.00	1.55	0.31	1.56	0.01	0.23	0.60
Layer chicken	1.00	2.59	1.62	1.53	2.47	0.02	1.34
Duck	4.47	0.98	0.37	1.23	0.25	0.73	0.74
	1.47	1.14	0.80	0.98	1.34	1.00	

Table 5. LQ values for fisheries commodity sub-sector in Gorontalo province based on production data of 2015

Commodity	Boalemo	Gorontalo	Pohuwato	Bone Bolango	Gorontalo Utara	Gorontalo city	Ave.
Marine fisheries	1.00	1.00	1.00	1.00	1.00	1.00	1.00
General water	1.28	3.21	0.00	0.00	0.25	2.63	0.96
	1.14	2.10	0.50	0.50	0.63	1.81	

There are 14 potential commodities that have average LQ > 1, which are: rice paddy (1.02), cassava (1.03), onion (1.15), small chili (1.13), mango (1.06), banana (1.53), coconut (1.01), coffee (1.07), cocoa (1.13), clove (1.04), Aren (1.52), beef-cattle (1.27), goat (1.57), and broiler chicken (1.34). Meanwhile, the commodities that have LQ=1 are rice paddy and marine fisheries, while the rest 11 commodities have LQ < 1. The average LQ for each regency and city is Gorontalo Regency (2.23), Boalemo Regency (1.11), and Gorontalo Utara regency (1.06). This LQ analysis is the basis to determine the pioneering area for agro STP in Gorontalo province.

3.2. Exponential Comparison Analysis

Further, 16 potential commodities with LQ values > 1 and LQ=1 are then reduced by using the Exponential Comparison Method to determine the leading commodities that are recommended in this study. This decision is reached through Focus Group Discussion (FGD) to collect information from experts who are representative from agencies that relevant in this study. Those agencies are 1) Agriculture and Plantation Agency, 2) Animal Husbandry and Animal Health Agency, 3) Marine and Fisheries Agency, 4) Regional Planning Agency, 5) General Work Agency, 6) Cooperative, Industry and Trade Agency, and 7) Environmental Agency in Gorontalo, Boalemo, and Gorontalo Utara Regencies. Assessment criteria and score used in ECM to determine the leading commodity are presented in Table 6.

Table 6. ECM assessment criteria to determine leading commodity

No	Assessment criteria	Score
1	Economic added value	9
2	Social added value	8
3	Raw materials availability and continuity	8
4	Marketing aspect	9
5	Policy support and government institution	8
6	Human resource support	7
7	Regional prestige	5
8	Community willingness and preparedness	6
9	Government willingness and preparedness	6
10	Business owners preparedness and willingness	7
11	Academia's preparedness and participation	5
12	Capital aspect	6
13	Availability of manufactured resources	5

Each discussion group (there are seven groups) provides scores for 16 potential commodities 16 based on its importance score (1-9). Moreover, the results are made into an average of a prime number. Based on the ECM result, the ranking is cerated. Hence, each region recommends four leading commodities (Tables 7, 8, 9).

Table 7. Ranking Result for Leading Commodity in Gorontalo Regency based on ECM

No	Commodity	ECM Value	Ranking
1	Rice Paddy	222,232,390	5
2	**Corn**	**255,874,755**	**1**
3	**Cassava**	**234,968,516**	**4**
4	Onion	188,280,119	9
5	Cayenne pepper (small chili)	190,929,251	8
6	Mango	157,226,323	15
7	Banana	181,216,021	10
8	**Coconut**	**243,549,319**	**2**
9	Coffee	171,578,921	13
10	Cocoa	146,515,074	16
11	Clove	172,792,520	12
12	Aren	179,651,046	11
13	**Beef cattle**	**241,614,005**	**3**
14	goat	204,998,368	6
15	Layer chicken	191,020,521	7
16	Marine fisheries	164,526,099	14

Table 8. Leading commodity ranking result in Boalemo regency based on the ECM value

No	Commodity	ECM Value	Ranking
1	Rice Paddy	229,153,328	5
2	**Corn**	**279,052,175**	**1**
3	Cassava	214,573,406	**7**
4	Onion	192,882,883	11
5	(Cayenne pepper) Small Chili	217,391,739	**6**
6	Mango	189,076,941	12
7	Banana	183,468,202	13
8	**Coconut**	**236,045,576**	**3**
9	Coffee	178,393,506	15
10	**Cocoa**	**269,919,022**	**2**
11	Clove	171,566,094	16
12	Aren	180,115,388	14
13	Beef Cattle	211,001,944	8
14	Goat	202,731,324	10
15	Layer Chicken	208,618,735	9
16	**Marine Fisheries**	**235,025,730**	**4**

Table 9. Ranking for leading commodity in Gorontalo Utara regency by ECM value

No	Commodity	ECM value	Ranking
1	Rice paddy	225,252,635	5
2	**Corn**	**253,377,318**	**2**
3	Cassava	196,552,349	**6**
4	Onion	191,140,885	9
5	**Cayenne pepper (small chili)**	**236,506,674**	**4**
6	Mango	160,087,089	16
7	Banana	186,020,215	10
8	**Coconut**	**266,193,782**	**1**
9	Coffee	177,556,164	14
10	Cocoa	194,295,091	7
11	Clove	174,426,860	15
12	Aren	181,825,451	13
13	Beef cattle	183,138,263	12
14	goat	184,602,077	11
15	Layer chicken	192,303,346	8
16	**Marine fisheries**	**253,204,334**	**3**

Interestingly, the results of ECM analysis shown in Tables 7, 8, and 9 are: although in LQ analysis results (Table 1 to Table 5) rice commodity is a very potential commodity and rice field is still quite dominate the various agricultural areas in Gorontalo province both in urban and rural areas, however, the results of ECM analysis conducted through FGD by experts just show different things. Rice paddy commodities are no longer a priority, taken over by corn, coconut, marine fisheries, cocoa, beef cattle, cassava, and chili commodities. This fact can be accepted from the perspective of the development of rice field farming (rice commodity producers), which in general has entered the post-green revolution phase caused by various socio-technical changes that potentially disrupt the social sustainability of rice field agribusiness (Yunus *et al.,* 2016). The results of ECM analysis become a natural thing if paired with some facts mentioning that commodities such as cocoa is now a major plantation in Sulawesi that has a competitive advantage in the form of products price ranging from local, national, and even international (Jumiyati *et al.,* 2017). Chili is a basic commodity in Indonesia, although the price the chili often fluctuates, but it still contributes to inflation (Sativa *et al.,* 2017). Even the utilization of local food sources derived from processed corn commodities and marine fishery commodities (*nike* fish flour) as basic ingredients in producing snack bars can provide value added products and reduce production costs (Kasim *et al.,* 2017).

In addition to determining leading commodity, there is also a process of determining the sub-district to develop the leading commodity in each regency/city by employing the ECM method through focus group discussion to collect information from relevant experts that represent three districts, Gorontalo Regency, Gorontalo Utara Regency, and Boalemo Regency.

Table 10. Criteria to Determine Location

No	Assessment Criteria	Score
1	Availability of sufficient transportation facilities and infrastructure	8
2	Availability of electricity infrastructure, water source, and telecommunication	9
3	Closeness to source of main raw material	9
4	Closeness to source of capital	6
5	Closeness to market	6
6	Climate condition and land potential	8
7	Included in spatial planning of the area	7

Tables 11, 12, and 13 present the result of sub-district-based location selection in each regency.

Table 11. Sub-district-based location ranking in Gorontalo Regency

No	Sub-District	ECM Value	Ranking
1	**Limboto**	**230,802,210**	**1**
2	**Boliyohuto**	**219,967,472**	**2**
3	Telaga Biru	215,691,865	3
4	Telaga	201,676,688	4
5	Batudaa	198,962,874	5
6	Limboto Barat	194,269,145	6
7	Telaga Jaya	193,289,289	7
8	Bilato	170,691,945	8
9	Tolangohula	169,285,456	9
10	Mootilango	160,344,423	10
11	Biluhu	158,525,732	11
12	Dungaliyo	150,820,830	12
13	Batudaa Pantai	149068291.1	13
14	Asparaga	148,534,655	14
15	Tabongo	146,648,019	15
16	Tilango	122,400,025	16
17	Pulubala	116,117,209	17
18	Tibawa	103,904,286	18
19	Bongomeme	103,159,635	19

Table 12. Sub-district-based location ranking in Gorontalo Utara Regency

No	Sub-District	ECM Value	Ranking
1	**Anggrek**	**194,269,145**	**1**
2	**Kwandang**	**194,234,034**	**2**
3	Atinggola	169,389,894	3
4	Gentuma Raya	155,692,085	4
5	Sumalata	152,914,584	5
6	Tomilito	151,992,046	6
7	Biau	151,884,649	7
8	Tolinggula	149,913,932	8
9	Monano	148,730,152	9
10	Sumalata Timur	106,051,152	10
11	Ponelo Kepulauan	104,276,726	11

Table 13. Sub-district-based location ranking in Boalemo Regency

No	Sub-District	ECM Value	Ranking
1	**Dulupi**	**192,595,589**	**1**
2	**Wonosari**	**190,156,240**	**2**
3	Tilamuta	175,648,119	3
4	Mananggu	159,430,253	4
5	Paguyaman	146,260,567	5
6	Botumoito	118,765,105	6
7	Paguyaman Pantai	93,902,140	7

Most potential agro-industry types to be developed out of these seven potential commodities are determined through Focus Group Discussion based on the approved criteria, including: (1) value added of the product; (2) technology; (3) capital; (4) market demand; (5) environmental impact. The result is presented in Table 15.

Table 14. Ranking of Agro-industry Types

No	Commodity	Area	Potential Agro-industry
1	Corn	Gorontalo Regency, Boalemo Regency, Gorontalo Utara Regency	Corn Flour, Corn Chips, Corn Noodle, Corn Syrup, Corn Sugar, Handicrafts (from corn stalk), animal feed
2	Coconut	Gorontalo Regency, Boalemo Regency, Gorontalo Utara Regency	Coconut flour, Nata de Coco, coconut oil, coconut sugar, coconut syrup, handicraft, animal feed
3	Marine fisheries	Gorontalo Utara Regency	Canned fish, smoked fish, dried fish, fish sauce, fish oil, fish flour, frozen fish, handicraft (fishbone), fish floss
4	Cocoa	Boalemo Regency	Cocoa powder, chocolate paste, chocolate jam, biogas (cocoa peel)
5	Beef-cattle	Gorontalo Regency, Gorontalo Utara Regency	Beef floss, Frozen beef, handicraft (beef skin)
6	Cassava	Gorontalo Utara Regency	Tapioca, cassava chips, fermented cassava
7	Small Chili (cayenne pepper)	Gorontalo regency, Boalemo Regency	Chili powder, grind chili, chili floss, chili sauce

Study on the area potential, commodity potential, and agro-industry potential of the leading products that were suitable to be further developed into agro STP areas in Gorontalo Province can be used as the basis for the implementation of agro-industry cluster development to strengthen region's innovation system in Gorontalo Province.

4. Conclusion

This study concludes that the potential areas of agro STP in Gorontalo province are two locations in each regency, Limboto and Boliyohuto sub-districts in Gorontalo regency, Dulupi and Wonosari sub-districts in Boalemo Regency, and Anggrek and Kwandang sub-districts in Gorontalo Utara Regency. Further, the leading commodities are corn, coconut, marine fisheries, cocoa, beef cattle, cassava, and chili. On the other hand, some of the potential agro-industries are flour, floss, chips, handicraft, and animal feed.

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