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Spatial Distribution vis-a-vis Agglomeration of Industry in Oromia Special Zone Surrounding Finfinnee, Ethiopia

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Abstract

Manufacturing industry has long been a vital component of emerging countries. Its relevance has been claimed in recent years even if the trends were decreased during the last 20-25 years, those results in premature de-industrialization or non-industrialization. This study explores the nature of spatial distribution and agglomeration of industry in Oromia Special Zone Surrounding Finfinnee, Ethiopia. Firm stage data set and distance-based method were used to answer research questions. Besides, two sets of indications for service and industrialized firms were set respectively to capture the findings in the intra-built-up neighborhood. Perhaps the most salient finding of the study indicates that the spatial pattern of most industries was agglomerated but not connected. Moreover, the index of space-based clustering for manufacturing firm is more than 0.05, but approximately 0.03 for service firm.

Keywords: Agglomeration, Industry, Spatial, Manufacturing, Ethiopia

JEL Code : R12, L60, O14, R58, O55

1. Introduction

Marshall (1890) utilized the notion of externalities to explain why proximity is beneficial to production. Such external factors have steadily been recognized in industrial location theories since then. According to Fujita (1988); Krugman (1991a; 1991b) and Venables (1999), to predict how firm agglomeration provides growing returns, new economic geography is based on Marshallian externalities. Furthermore, the achievement of various groups, such as ′3rd Italy′ and Silicon Valley, has demonstrated in fact the hypothetical relation among fiscal clustering as well

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as provincial development in reality. As a result, during the 1990s, there has been a revived curiosity in industrial clustering.

As Krugman pointed out, agglomeration is without a doubt the most noticeable feature of economic activities (1991a). Nonetheless, different fields have varied perspectives on this subject. Ciccone (2002); Bertinelli & Decrop (2005); Brülhart & Sbergami (2009); Lin et al., (2011) demonstrated that the majority of economists are concerned about the relationship among development and industrial clustering, and numerous studies in many nations have found a favorable alliance. These studies, on the other hand, simply planned the level of space-based clustering and neglected other agglomeration features such as space-based level clustering and sector divergence.

Space, place, and scale, on the other hand, are all fundamental to geographic investigation (Coe et al., 2007). In terms of geography, the space-based level at which industrial clustering occurs, as well as the sectoral range, is at slightest as important as its size. Besides, looking at the problem from a geographic outlook can assist to limit the use of natural resources during the industrialization procedure. In fact, in poor countries, this approach has depleted land resources. For example, Yeh & Li (1999); Yang &Wang (2008) narrated that in China, the establishment of a huge number of development zones has resulted in a significant loss of agricultural areas.

Longer-term economic growth is influenced by the geographic distribution of agglomeration and specialization. Because of inherent or historical comparative advantages, as well as lower innovation and transaction costs in specialized input and labor markets, specialized locations provide enterprises better cost and production functions. Furthermore, there is evidence that due to cross-pollination of ideas, individual industries expand quicker in more diversified urban areas (Glaeser et al., 1992). Henderson et al. (1995) suggest that established industries want the urbanization economics of diversity in the metropolis, whereas youthful dynamic industries seek the urbanization economics of diversity in the metropolis.

Haining, 2003; Fischer and Getis, 2009 pointed out that in modern years, a diversity of pointers plus techniques have been proposed to quantify the space-based clustering of firm. Nevertheless, according to HU all chain and Leslie (2009) in glow of discriminated aspires and datasets, there is nix agreement regarding what approaches are more suitable.

Duranton& Overman (2005) used K-density to analyze the manufacturing space-based prototype in the United Kingdom, as well as established 5 basic requirements for a ′good′ measure of geographic agglomeration. Duranton and Overman used a relative measure over the absolute measure employed by Ripley's algorithm. Explicitly, the concentration of a sector is determined by comparing its distribution to that of the entire industry. This method was also used by Barlet et al. (2013) in an empirical study on France. According to the findings, a distance-based technique is better appropriate for analyzing service site patterns than the typical EG cluster-based index of space-based clustering. While the majority of the literature focuses on establishing and enhancing methodologies, empirical research, particularly at the town level, is still needed. In this study, Duranton and Overman's method was used to check the manufacturing space-based prototype in an urban-edge locale.

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Finally, examining Ethiopia's industrial policy trajectory reveals that the philosophy of efficiency dictates the driving forces that drive the location of industries, despite the incumbent regime's claim that maintaining interregional industrial parity is also a priority. The existing industries in Ethiopia have been concentrated in and around Addis Ababa (Eshetu, 2004; Mulatu, 1994). Despite the existence of various laws and rules that state the necessity for balanced industrial growth, the government's industrial policy menu appears to pay little consideration to the uneven distribution of manufacturing industries in the country.

For example, during the imperial era, the key industrial actors were foreigners who sought to operate in places with a huge consumer base, skilled labor, and low transportation costs. Regardless of where industries were placed, the government was in favor of supporting them to their maximum potential. In other words, they engaged in industrial activity in order to increase their profit margin in every way feasible. Huge abroad investors were enticed in with tax breaks, import export rights, and financing, including the Dutch sugar company HVA and the British car firm Mitchell Cotts. Ethio-Italian, Ethio-Greek, and Ethio-Armenian populations, in particular, played key functions in the financial system (Sarah and Mesfin, 2011).

Hence, accordingly, this article will be basis on industry data to come across the attributes of space-based distribution and clustering across 8 industries and emphasize the disparities between them in Oromia Special Zone Surrounding Finfinnee, Ethiopia. Afterward we additionally look at the discrepancy of industrial concentration resultant from establishment magnitude. This study is supportive to recognize the industrial site in the intra-metropolitan vicinity for regional development.

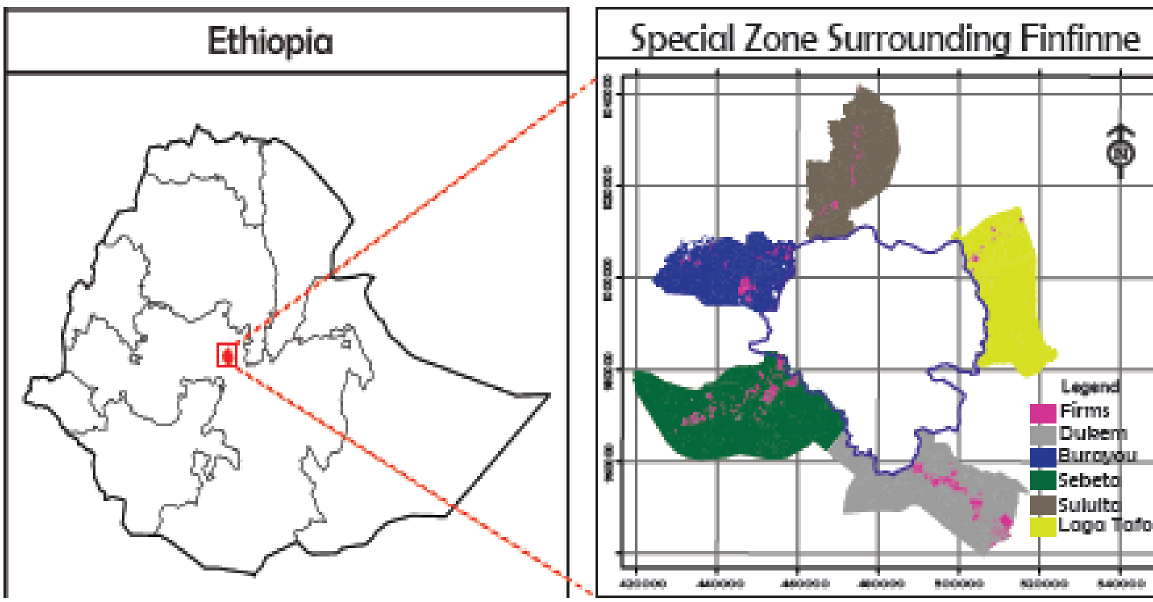
2. Data and Methodology

2.1. Data

Data accessibility is one of the most evident outfitted issues with distance-based techniques. These methods make it impossible to obtain the particular geographic coordinates of every industry, which are requested by the studies. In this study, we use an exceptional fact set: all recorded industries in 2010 from the Oromia Planning and Urban Institute. But, for this analysis we have selected Dukem town purposely for the reason that many firms are found in the area. The plant-level facts set comprise certain fundamental data such as address of firm, firm code, and company service dimension for the purposes of business registration and market monitoring. The address of a firm can be converted to a geographic coordinate using Baidu's API (Application Programming Interface). Arc GIs 9.3 was used to generate a drawing containing all industries in SHP file set-up based on the geographic coordinates of each firm (Figure 1). The data collection includes 320firms, comprising 171 service firms and 200 manufacturing firms. Clearly, Dukem's industrial development is dominated by the manufacturing industry.

The study highlights on the divergence of space-based agglomeration among diverse firms. The comparison of every firm is lengthy and superfluous; thus, we prefer 8 kinds of emblematic firms, comprising manufacturer and community services, labor-intensive as well as capital intensive manufacturing firms which require a huge quantity of employee, resources and know-how. To acquire a strong as well as analogous consequence, we regulate the bureaucrat class of the firms as revealed in the next Table 1.

Figure 1: Space-based distribution of firms in Oromia Special Zone Surrounding Finfinnee



Source: Field Survey,2021

2.2. Methodology

2.2.1 Kernel guesstimates of K-density

To guess the space-based dispersion of every firm, Duranton and Overman's technique was used. In the case of an industry A with n firms, we first calculate the n (n–1)/2 distinct two-sided distances among the entire couples of firms in that industry. After that, we guesstimate the dispersion of compactness of these two-sided remote nesses among the firms in the industry. For the industry A with n firms, the predictor of the compactness of two-sided distances at any point d is:

$$K(d) = \frac{1}{n(n-1)h} \sum_{i=1}^{i=n} \sum_{j=i+1}^{n} f\left(\frac{d-d_{ij}}{h}\right) \quad (1)$$

Where $(d - d_{ij})$ is the Euclidean remoteness among firms *i* and *j*. Gaussian kernel is used to explain the distribution. The bandwidth h is set as Silverman (1986) confirmed h= $0.9An^{-1/5}$.Where A = min (standard deviation, inter-quartile interval/1.34), n is the number of firms

Table 1: Groups of industries and quantity of firms

Type of industry	Class	Sector	Industrial category	Quantity of firms
Service industries	Education	Providing instruction and training services	Producer service	14
	Healthy	Providing medical care	Community service	5
	Religious	Beliefs and practices	Community service	6
	Municipal	Sanitation, water, streets, the public library, and police	Community service	4
Manufacturing industries	Agro	A host of agriculture related material	Labor-intensive manufacturing	23
	Cement	A construction material made of a mixture of cement	Capital-intensive manufacturing	109
	Leather	Restoration of opulence leather garments, furnishings and interior installation	Labor-intensive manufacturing	65
	Metal	Industrial machinery and equipment	Labor-intensive manufacturing	145

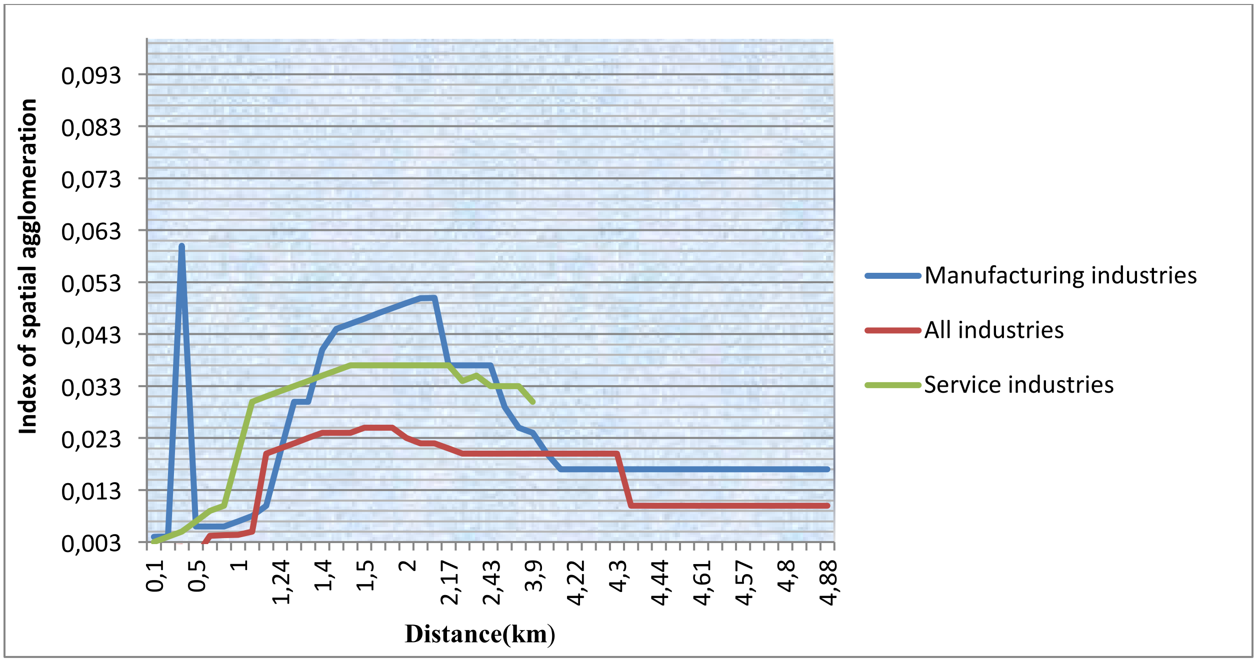
Source: Field survey, 2021

2.2.2. Selection of a location distribution

We, too, must describe a meaningful indication dispersion against which the K-densities of firms must be contrasted, as Duranton as well as Overman did. Due to the limits of zoning and planning, according to Duranton along with Overman, not every location in the entire space are acceptable for manufacturing sites, particularly for manufacturing firms. To manage the general inclination of space-based clustering, they named the set of promising manufacturing sites as the entire set of sites where an industry presently situates, in spite of the industry it belongs to. This target might be sensible at the regional stage. Therefore Barlet et al. (2013) assumed the identical target for the investigation of the manufacturing space-based dispersion in France.

Nonetheless, Duranton and Overman's aim appears to be sticking at the town stage. This is due to the fact that in the built-up area, there are often 2 kinds of property usage for fiscal actions: manufacturing land as well as service land. A number of regulations enacted by the adjacent government make it illegal for a manufacturing site to be located on service land and vice versa. Besides, manufacturing and service industry were taken as a benchmark to avoid under and over estimation of spatial agglomeration.

Figure 2: Firm spatial pattern in Dukem



Source: Field survey, 2021

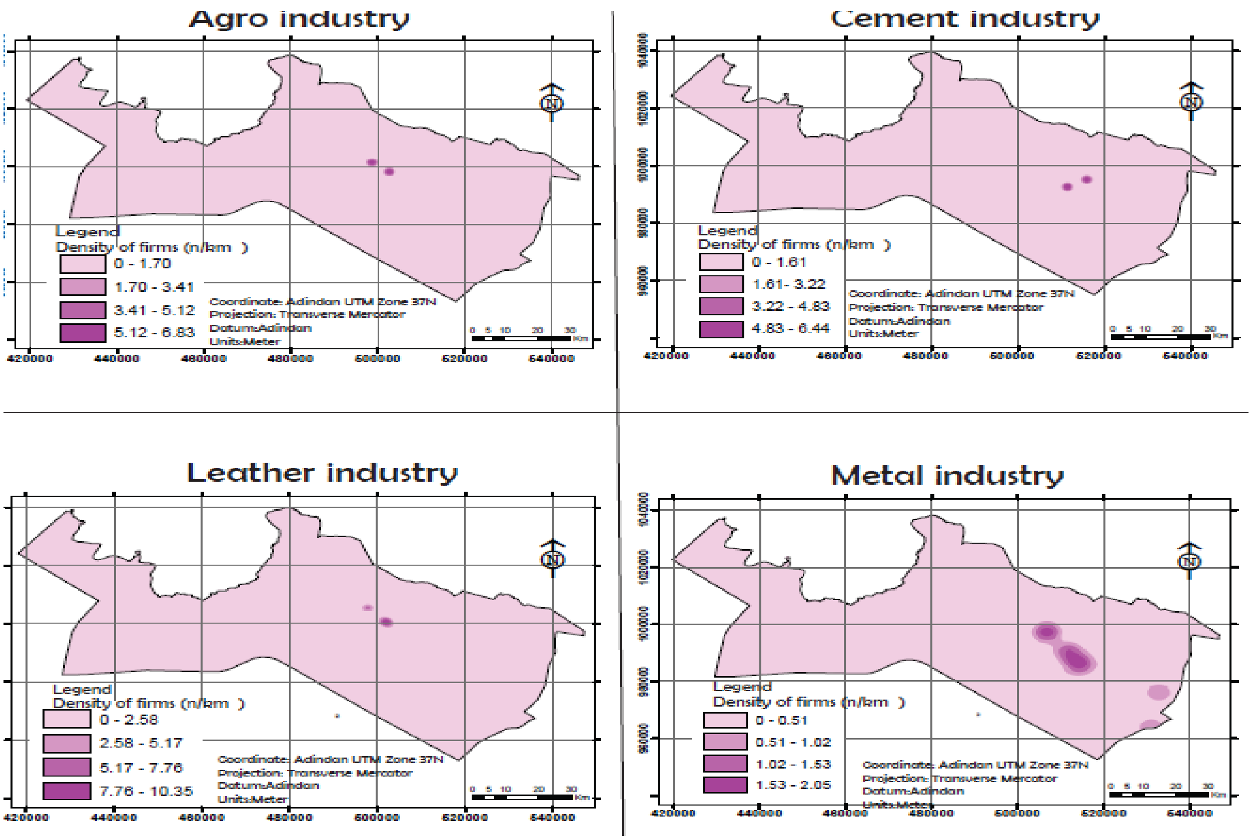
We have 4 confidence distances as well. Next to Duranton as well as Overman′s research, we grade our simulations in mounting array for every kilometer in this interval and use the 5-th as well as 15-th percentiles to acquire a lesser 5 percent as well as a greater 5 percent confidence distance for service as well as industrialized firms, respectively. While the estimate of K-density for service industry A is more than the greater 15% confidence remoteness of service industry at remoteness d, this industry is thought to indicate agglomeration at this distance. The industry exhibits scattering at this distance, even if its estimate is fewer than the minor 5 percent confidence range. Its space-based distribution is random among the two confidence intervals. Manufacturing companies can benefit from this method of sorting as well. This sorting way also works for manufacturing firms. Lastly, case study approach was used to study the relationship between firm size and space agglomeration.

3. Results

3.1. Comparative examination of space-based patterns among diverse sorts of industries

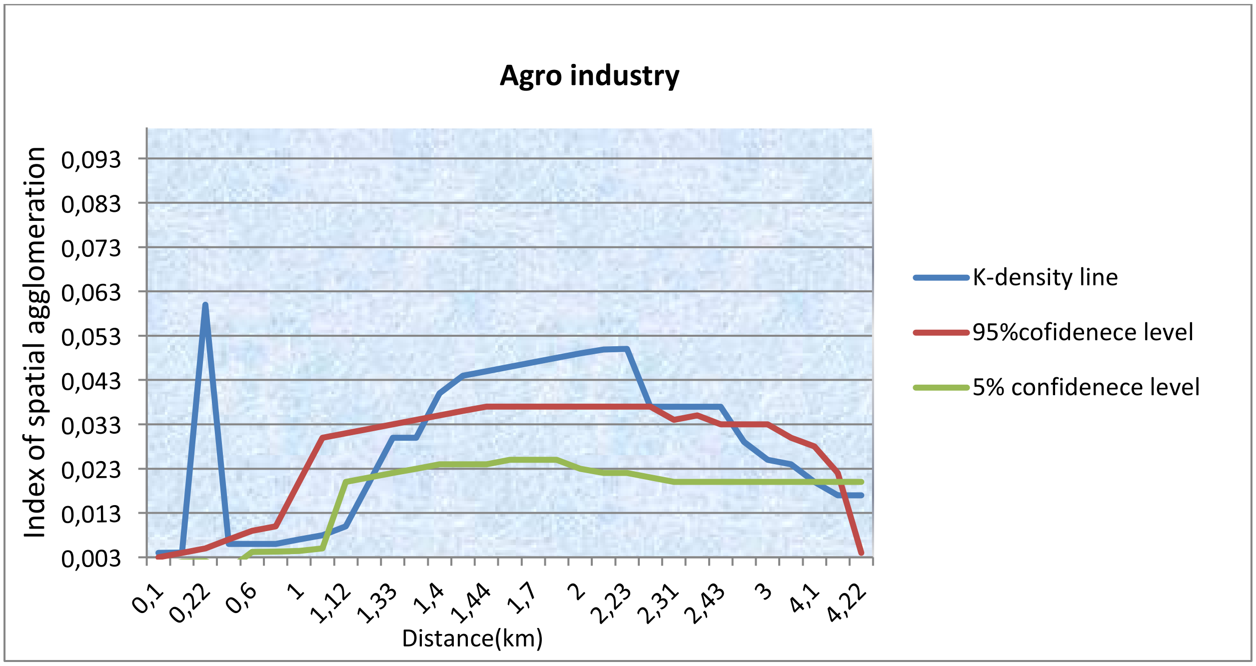
Data obtained from the study area indicated that there is a momentous disparity of the space-based dispersion among service as well as industrialized firms, as revealed in Figure 2. Due to the utterly leading figure of manufacturing firms (Figure 2); the entire space-based prototype of all firms is actually near to the service′s prototype in Dukem. The manufacturing industry has an elevated degree of agglomeration than the service industry, but it has a smaller agglomerating span. The index of space-based clustering for manufacturing industry is more than 0.05, but approximately 0.03 for service industry n-expressions of the overall trend of agglomeration, the level of manufacturing industry at initial swiftly boosts up to the climax at the remoteness of approximately 0.5 km and afterward falls stridently. This alters keeps on and becomes even lesser than the level of service industry after the distance arrives at 3.9km (Figure 2).

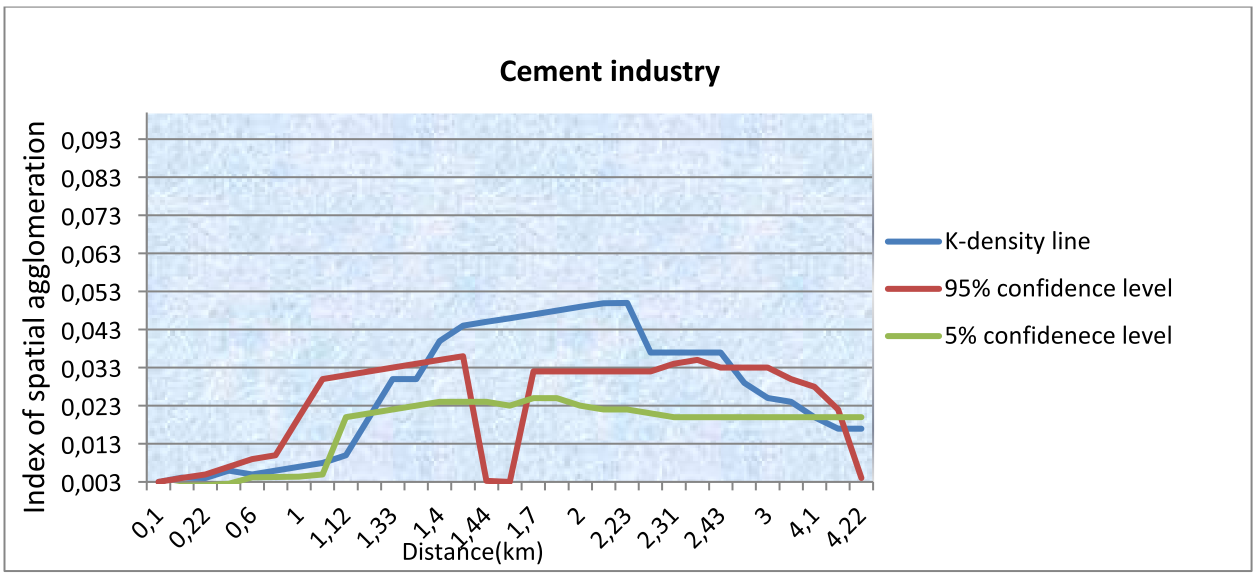
Figure 3: Space-based dispersion of industrialized industries (*n* is the number of firms)



Source; Field survey, 2021

Figure 4: Spatial pattern of manufacturing industries



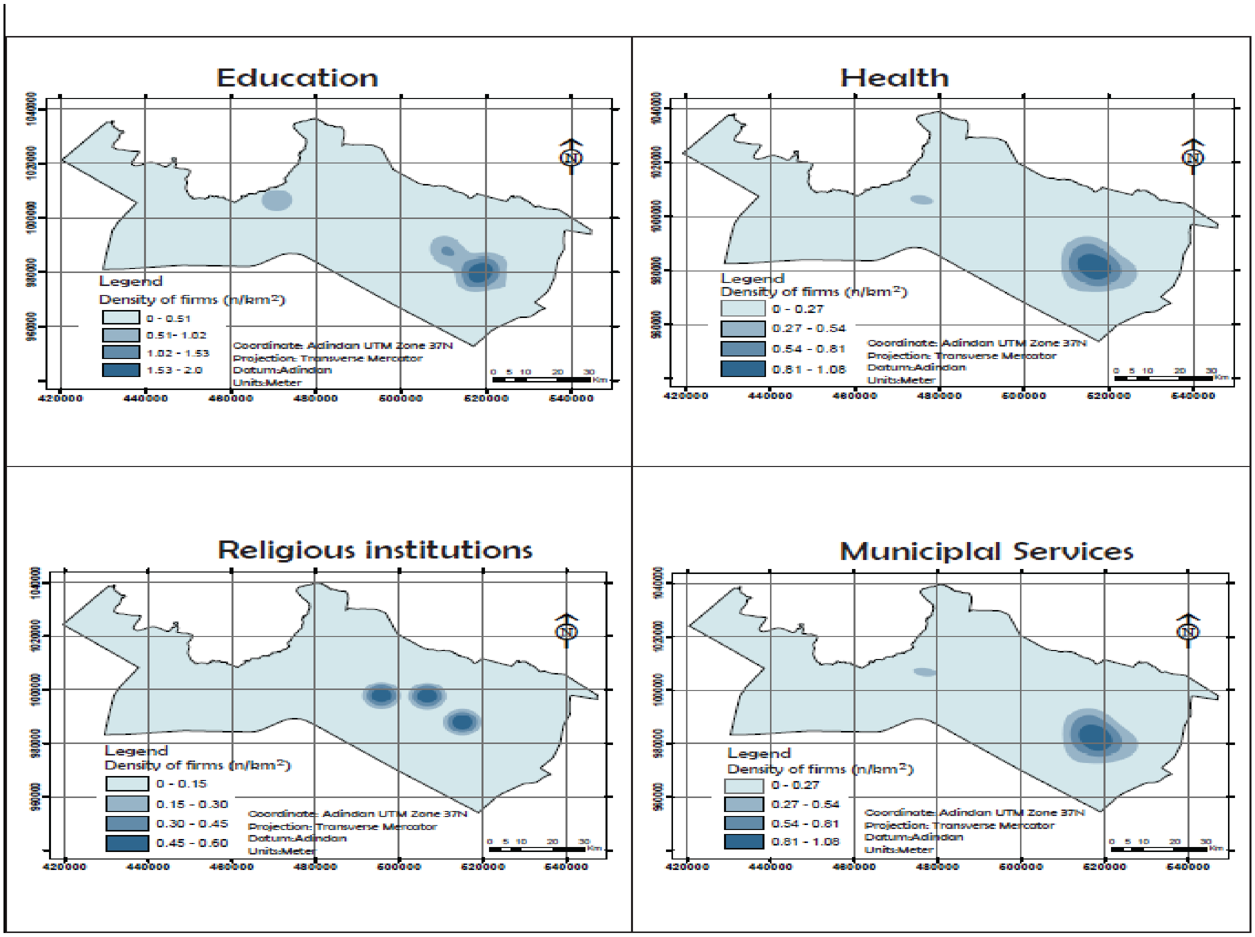


Source: field survey, 2021

3.2. Comparison between manufacturing industries

The peak agglomerating distance—around 2 km—is something that all four types of manufacturing sectors have in common. The level of manufacturing clustering area is roughly 2 km, independent of the kind of firm, because the climax clustering remoteness is the most preferred remoteness among industries. The concentration of manufacturing firms from diverse sectors within the center validates this result (Figure 3). Nevertheless, the discrepancies between these firms are noticeable in other characteristics of the space-based pattern. Regarding spatial agglomeration, undoubtedly, agro industry has the utmost level of space-based agglomeration (more than 0.053), pursued by cement industry (Figure. 4).

Figure 5: Space-based dispersion of service industries (*n* is the number of firms)

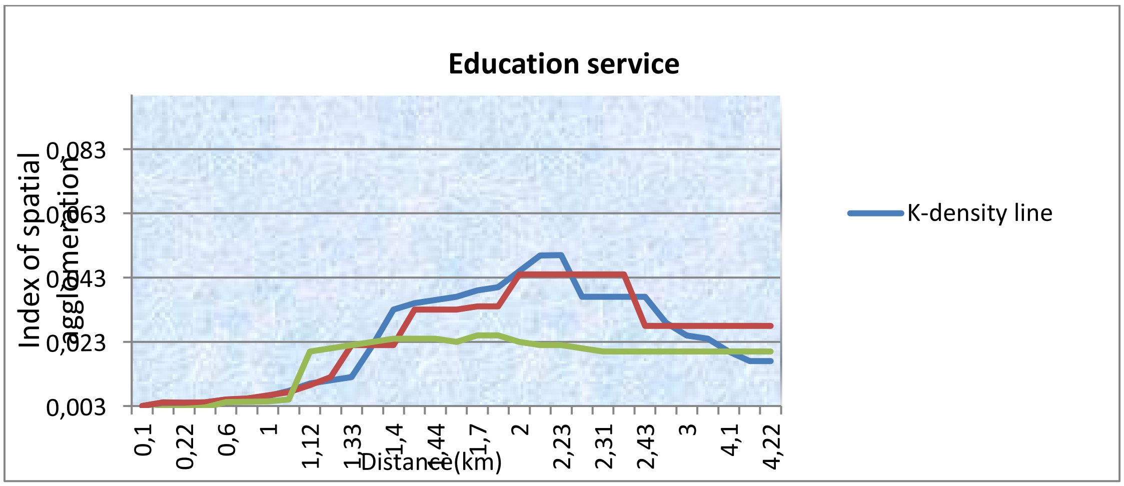


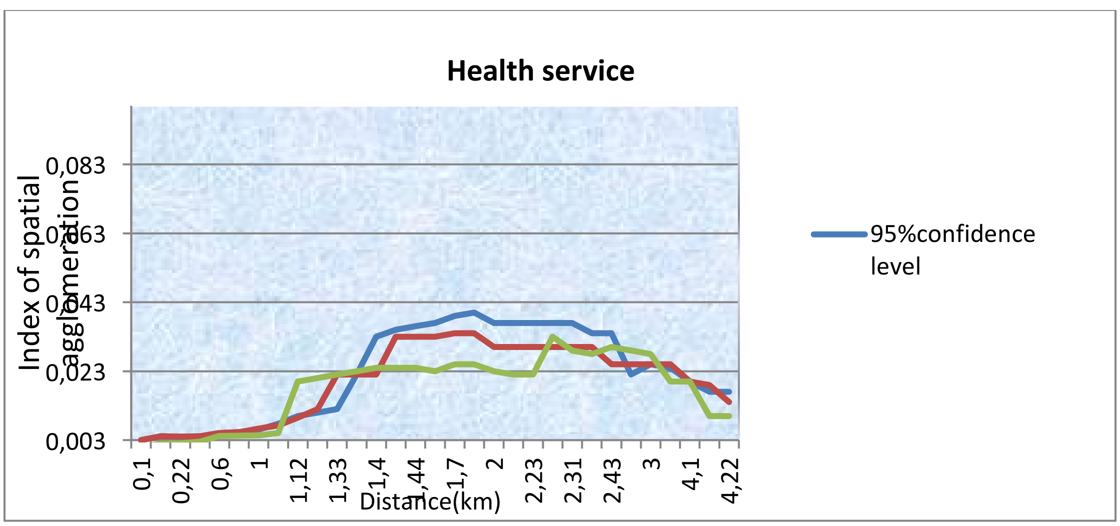
Source: Field survey, 2021

3.3. Comparison among service industries

Regarding manufacturing firms, the variation in climax clustering distance is less momentous than the disparity in the level of clustering between service firms. This actuality proposes us to concentrate on the divergence of clustering level. Result obtained from data analysis indicate that the scope of the space-based agglomeration of education service is extensively elevated (the up to 0.048), even elevated than health service (Figure 6). Besides, a large number of firms from service industry bunch in the center of the town (see Figure. 5). Thus, there is perhaps a lofty focused industrial locality in Dukem. Nevertheless, and the clustering levels of different service industries are moderately diverse. The climax agglomerating distance of education service is the same as health service which is purely 2 km. This result indicates that the distances between most service-intensive industries are found in the same distance. In other words, service -based industries are able to advantage more from the space-based closeness, such as overflow and ahead and toward the back linkage.

Figure 6: Space-based pattern of service industries





Source: Field survey, 2021

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This finale has been merged by industries′ space-based patterns. While education and health have a noticeable clustering outline at the remoteness of less than 3 km and less than 2 km (Figure 6). Normally, the site of educational services appears to be clustered, in spite of that there is a trivial scattering at the remoteness of less than 4 km (Figure 6). For healthy services, the dispersion prototype is also clustered (Figure 5). Though the service industry′s level of agglomeration is somewhat elevated than the superior 5% confidence range at the remoteness of greater than 4 km, this remoteness is too excellent to be benefited from clustering economy. The figures demonstrate that industries from these 2segmentscluster in built-up space to be benefited mutually; that even though there are numerous firms positioned in the inner town (Figure 5). However, data obtained from focus group discussion and interview with key stakeholders revealed that the industries were clustered but not connected in terms of employment, technology transfers, human resource management and local tax payment. These gaps have negative impact for local development.

Hence, accordingly, the findings of this study support partially the notion of location theory as narrated by R. Hayter and S. Nieweler (2018) (i.e., connectivity and proximity were the vital issues to locate industry in diverse location).

4. Conclusion and Recommendations

4.1. Conclusion

The most important aspect of the dispersion of industries is spatial agglomeration. In the case of industrial agglomeration, the geographical range and extent vicinity are just as essential as the clustering quantity from an economic and geographic perspective. This research investigates the disparities in the space-based patterns of diverse firms and company sizes in Dukem using a distance-based method that judges space as continuous. We create 2 sets of confidence intervals for service as well as industrialized sectors, correspondingly, to study the industrial space-based dispersion at the town level, in dissimilarity to earlier studies. In contrast to manufacturing firms, service industries have a moderately large coverage however a petite extent of clustering, according to our findings. It means that the service sector is more clustered than the manufacturing sector.

4.2. Recommendation

To enhance regional and local development, the local government or local partners has to introduce the notion of connectivity and proximity. The industries have to be clustered and connected in terms of skills, technology, employment, resource management and tax payment experiences

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