



## An Application of Von Thunen Model of Location Theory in South Africa: An Unemployment Mitigation Tool

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### **Abstract**

The government in South Africa seeks to achieve an inclusive economic growth and eradicate socio-economic inequality. However, it has been almost 30 years since the transition to democracy in South Africa and unemployment rate is still high. There are a number of unemployment alleviation initiatives in place; however, such initiatives are seemingly not producing adequate jobs. The paper aims to apply von Thunen model of Location Theory as unemployment mitigation tool in South Africa. Von Thunen model is a land use theory that seeks to predict optimal location choice for agricultural farms. The paper adopted qualitative research approach and found that, assumptions in von Thunen's model of Location Theory is not applicable in South Africa and the world as a whole. However, the paper argues that the four concentric rings in von Thunen model can contribute to job creation in South Africa.

**Keywords:** *Location Theory; Von Thunen, Agriculture; Employment Growth; Local Economic Development*

### **1. Introduction**

South Africa is one of the country with highest inequality rate in the world (World Bank, 2023). Apartheid regime left South Africa with overwhelming socio-economic inequality. As a result, the government put in place a number of inclusive socio-economic measures since the transition to democracy in 1994. However, South Africa is still facing socio-economic inequality to date. Unemployment remain the key economic challenge with the rate of 32.9% (Stats SA, 2023). Unemployment not only widens the inequality gap but also leads to declining economy. The remedy for such socio-economic inequality is the creation of job opportunities (Meyer, 2014). The creation of job opportunities affords people an opportunity to participate in the economy and thereby promote the notion of inclusive socio-economic growth. Meyer (2014) state that the creation of jobs leads to development through the following aspects: "improved living standards as a result of earnings and income; poverty

reduction; improved productivity and global integration”. According to the 2030 National Development Plan (NDP) there should be inclusive economic activities and opportunities in South Africa by the year 2030 (National Planning Commission, 2012). The NDP also state that agriculture economic activities should be used to mitigate unemployment (National Planning Commission, 2012).

The Von Thunen model of Location Theory provide the spatial distribution framework that can be used to boost agriculture economic activities in South Africa. The Location Theory predicts optimal location choice by analyzing land use. It explains the manner in which firms select its location by providing profit maximization and cost minimization model (Leigh & Blakely, 2013). Von Thunen assumed that the optimal location choice have lower transport cost, maximum utility and maximum income. Krumn & Strotmann (2013) and Masahsa, Jacques-Francious & Yves (1997) undertook a study on the impact of location choice on job creation and found that optimal location choice promotes the generation of job opportunities in an area. Location Theory explains how farms choose the location by providing minimisation of transport and rent cost model based on land use (Leigh & Blakely, 2013). Location Theory composes its models with assumptions that shape the land use. However, the theory is often perceived as obscure due to the lack of experiment in distribution and behavioural patterns (Parr, & Reynolds-Feighan, 2000).

Location Theory was initially developed in the early 1800s as the oldest division of local economy (Capello, 2011). The theory explains the factors that determine optimal location choice and spatial distribution of farms (Von Thünen, 1826; Weber, 1929; Clark, 1967). The location theory is still relevant today as several scholars write about it since its inception in 1826 (Mashabela, 2021; Leigh & Blakely, 2013; Capello, 2011; Pascaciu & Puscaciu, 2007, Nkuna, 2016).

There are numerous models of location theories by different authors however for the purpose of this paper only Von Thunen’s model is applied since more agriculture production leads to increase in creation of sustainable job opportunities at a larger scale in the economy. The complementary nature of agriculture sector results in increased GDP, foreign direct investment, imports substitution, exports and job opportunities. The agriculture sector lead to significantly developed local economies. The application of Von Thunen model of Location Theory can be guided by spatial development policies and frameworks in South Africa.

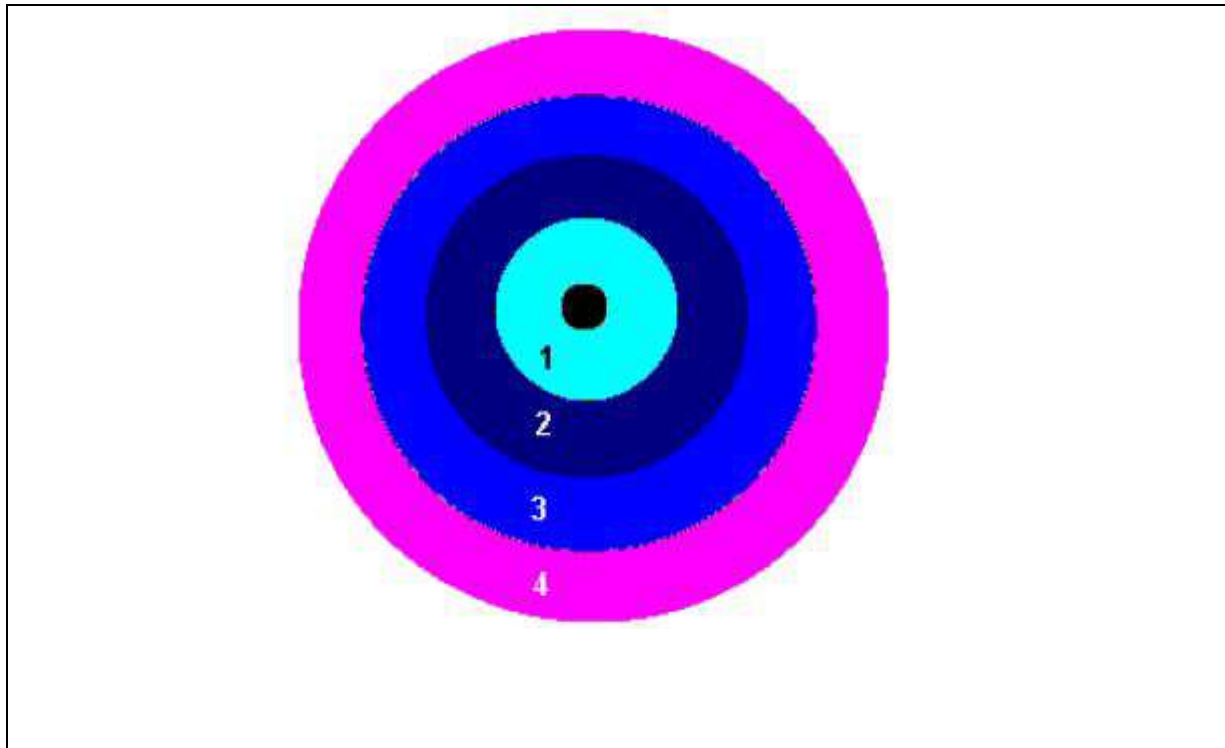
## **2. Material and Methods**

The paper employed qualitative research method to address the research problem in the paper. The method assisted the study to collect comprehensive data on Von Thunen model of Location Theory and agriculture sector. The purpose of the paper is to apply the von thunen model of location theory as an unemployment mitigation tool, with intention to curb unemployment in South Africa. The von Thunen model of Location Theory presents a land use framework for agriculture farms that has the potential to increase job opportunities in South Africa. The paper address the unemployment debacle that is overwhelming in South Africa. It aims to explain and predict spatial development framework that has the potential to stimulate economic growth in South Africa. The paper assumes that the optimal location for agriculture sector will stimulate the rate of job creation and foster inclusive economic growth in South Africa. Thus, theories can be used to predict the reaction of certain phenomena and it can also be applied to solve real life problems (Sebola, 2015). The paper is prevent to present issue as it address unemployment debacle in South Africa.

### 3. Von Thünen's Location Theory Model

Heinrich Johann Heinrich von Thünen was a German economist and farmer. His model was formulated for agriculture production in Northern Germany during the 1800 (von Thünen 1826, translated in 1966). Von Thünen analysed patterns of land use such as distance from the farm to the market place, land rent and transport cost. Von Thünen assumes the following: "Imagine a very large town, at the centre of a fertile plain which is crossed by no navigable river or canal. Throughout the plain, the soil is capable of cultivation and the same fertility. Far from the town, the plain turns into the uncultivated wilderness which cuts off all communication between this state and the outside world. There are no other towns on the plain. The central town must, therefore, supply the rural areas with all manufactured products and in return, it will obtain all its provisions from the surrounding countryside" (von Thünen 1826, translated in 1966). The costs of production and interest per capital are assumed to remain similar everywhere (Djwa, 1958). Von Thünen's model is illustrated in the diagram below:

Figure 1: Von Thünen Concentric Rings



(Source: von Thünen, 1826)

The figure above demonstrates the model of von Thunen in which there are four rings of agriculture farms that share the same markets. The main ring represents a big town isolated from the world with a perfect fertile landscape and climate change. Von Thunen also assumed that mobility of transport was possible in all parts of the state and labour rate was the same throughout the state. Von Thunen assumed that the isolated state is surrounded by uncultivated wilderness and has no outside influence. The rings used as dividers within the central ring represent different types of agriculture production in the isolated state.

The first black dot in the middle of the ring represents markets place. Ring 1 (light green) represent farms that produce perishable goods such as fruits, vegetables and dairy products. Farms are located in the first ring (1) next to the city in order to be near the markets as they produced perishable goods that needed to reach the markets at the earliest time. This is because there were no refrigerators in

1800 (von Thünen, 1826). Ring 2 (dark blue) represent farms that produce forestry. Forestry farms located in the second ring as timber is heavy to transport and had the highest demand since woods were needed for building houses and for fire (von Thünen, 1826). Ring 3 (Light blue) represent farms that produce field crops such as grains. Farms locate in this ring as goods produced such as grain does not perish quickly fresh and stay longer than dairy products and are easy to transport (von Thünen, 1826). Ring 4 (purple) represent animal production and ranching farms. Animal production farms locate in the last ring of the isolated city since the animal can walk to the market place and thus, safe transport cost (von Thünen, 1826).

Farms proximate to the city based on transport cost and the nature of the produced goods. According to Von Thünen, there is a specific agricultural location pattern developing in the surroundings of the city since land rent, and transport cost determine the type of agricultural farm (Greenhunt, 1956). Land rent and transport cost are assumed to decrease as the farms in the rings get further from the city, vice-vase (Leigh, 2013). The farms planting bulky or heavy crops with difficulties in transportation and have higher transport cost and would be located in the rings that are closer to the market place (von Thünen, 1826). The farm that plants light crops with lower transportation cost would be located in the rings further from the market place. Von Thünen assumed that capital and labour are not mobile and market place located in central town purchased all agricultural produced goods (Jones & Woods, 2002). The predominant shortcoming is that this theory is out-dated and modern companies have numerous interdependent elements that determine location choice (Leigh & Blakely, 2013). It is almost impossible to observe the same plane surrounding one market place in the modern economy (Gomez & Helmsing, 2008).

#### **4. Application of the Location Theory in South African Context**

Von Thunen's model is neoclassical and therefore is not entirely applicable in South Africa due to economic transformation (Demir & Kockal, 2019). The model was applicable in the 1800 but not entirely applicable in 2000 (Hallett, 2014). Moreover, the model was created based on the unrealistic assumption of the isolated state that is not applicable in the South African context.

##### **4.1 Von Thunen Assumptions in Relation to South Africa**

Von Thunen's assumptions in the South African context are the following: 1) nowhere in South Africa do we find perfect landscape, climate change and soil fertility across the country. South Africa has a diverse landscapes, climate change and soil fertility. 2) There is no large town that does not connect with the rest of the country or the world. Every town has some external influence. South Africa has 9 provinces with each town influenced by national and the international community. 3) Transport and labour are not uniform in South Africa. Von Thunen model was developed for the German economic system during 1800. Von Thunen has pointed out that although the theory has unrealistic assumptions, the theory is still applicable (Von Thunen, 1826). Von Thunen also pointed out that the agricultural activities would not follow each other as stipulated in the concentric rings of the isolated state, the farm would locate based on climate change (Hall, 1966). This is contrary to scholars and suggestions that the Von Thunen's model is not applicable today.

The assumptions in Von Thunen's theory is no longer entirely applicable because of its changes in factual conditions, however, the four concentric rings are useful (Predohl, 1928). Von Thunen's concentric rings also cannot be entirely applied in the South African context because South Africa has diverse climate change, land fertility and landscape. Therefore, agriculture farms cannot be located anywhere in the country which is different from von Thunen's model where it assumed that the landscape, climate change and fertility are uniform. Sustainable agriculture farms requires a specific location in South Africa.

#### **4.2 Von Thunen's 4 Concentric Rings in Relation to South Africa**

The von Thunen's 4 rings can be used to create job opportunities in South Africa. The 4 rings will not be concentric as stipulated in von Thunen's model. The agricultural activities in von Thunen's four rings are similar to the South African agricultural sector. The agricultural sector in South Africa ranges from extensive and intensive farming to animal ranching and production (Worldwide Fund-SA (WWF-SA), nd: 2). Farms in South Africa are located based on land fertility and climate change. Sustainable farming requires favourable climate change, such as, frequent rainfall within an area. The von Thunen's four rings can be applied differently in South Africa given the diverse climate conditions and landscape. Intensive, extensive and forestry farming can be located next to the river since there is a water deficit in the country. Livestock farming can be located in a location with good temperature and rainfall for livestock. Intensive, extensive and forestry patterns can only be developed next to dams, rivers and wetlands in South Africa. Therefore, there will be 4 spatial distributions of agricultural economic activities with many consumption centres in each South African municipality.

Rainfall is scarce in South Africa, which leads to drought and river drying out. This poses a threat to agriculture in South Africa. Municipalities in South Africa can initiate the establishment of extensive, intensive and forestry farms around rivers, dams and wetlands for sustainable farming. There are also a number of wetlands in the South Africa which can be used for farming. Municipalities can alternatively use the available fertile land and provide water bores for a sustainable farming. This can be applied to the establishment of all types of agriculture production. This also demonstrates the unfeasible structure of the von Thunen model in South Africa. However, the government can initiate and promote agriculture activities in line with South African climate change and modify the von Thunen's model where necessary. The von Thunen's model can serve as a point of reference for agricultural development in line with the municipal environment.

#### **4.3 Minimisation of Transport Cost**

Municipalities should place small farmers who directly sell to consumers next to the markets in order to assist small farms in cutting transport costs. Therefore, patterns of small farms next to river, dams and wetlands will form from the marketplace further into the wilderness. Municipalities can also place the big farms from the wilderness towards the marketplace, since, they do not incur market transport cost. A Pattern of established farms will also form from the wilderness towards the small farms within the jurisdiction of the municipality. Both established and small farms can use funds saved from the transport cost to create more jobs for unemployed people in local communities.

#### **4.4 Minimisation of Land Rent**

The value of land rent decreases as the distance from the city to the wilderness increases in South Africa. Therefore, small farmers can be located at the point where rent is higher and transport cost is low. Big farms can be located at the point where rent is cheaper since they do not incur transport costs. The municipalities should provide small farmers with subsidies for land rent since they incur transport costs and charge big farmers the market price of land rent since their located at the point where rent is cheap and they don't incur transport cost. Essentially, small farms will pay low rent compared to big farms. The value of land rent can be influenced by climate change, proximity to markets, rivers, dams and wetlands. The land rent can increase the income stream of municipalities which will enhance the rate of job creation in the locality. The municipality will gain rent income as it leases municipal land to the farmers and where the land belongs to tribal kings the farmers will pay rent to the king. However, in a case where the municipality operates a farm entity, it will save rent expenses and only pay rent to land that belongs to the tribal authorities.

#### 4.5 Empirical Literature

Literature review reveals that several scholars have recently applied Von Thunen's model around the world. Although the assumptions of Von Thunen's model are unrealistic, numerous scholars applied the model of Von Thunen in different parts of the world in different years. Those who applied the theory are positive that the theory depicts economic development through land use. Folefack and Adamowski (2012) applied Von Thunen's model to determine the optimal location to transport compost for crop production in Cameroon. They argue that, Von Thunen's model is still useful. Moreover, they argue that the transportation cost explains land use and the location of markets reflects the application and value of Von Thunen's model. Mkwara and Marsh (2009) applied Von Thunen's model to clarify the reason why poor people live next to or in the forest in Malawi. They argue that the model helped to establish how poverty drives deforestation. Rent assumption in Von Thunen's theory is applicable in the global economies (Hallett, 2014). Zaucha and Gee (2019) applied the model of Von Thunen and found that the assumptions in Von Thunen's model depict the reality of rent in maritime space. Von Thunen attests that indeed his model is applicable by stating that "this method of analysis has illuminated and solved many problems in my life, and appears to me to be capable of such widespread application, that I regard it as the most important matter contained in all my work" (Von Thunen, 1966: 4). Sharma (2000) applied Von Thunen's model to determine the impact of distance on farming. Based on the empirical findings, Von Thunen's theory is applicable in today's space. It may have out-dated assumptions but is still applicable.

#### 5. Agriculture and Job Creation

Agricultural farms can have a significant contribution to job creation (Nyanga, 2013). Thus agricultural farms have been the major employer throughout the world (Christiaensen, Rutledge & Taylor, 2020). The sector employs majority of the population in rural communities (Tersoo, 2012), and it will play a vital role in youth employment in the next decade (Gendreau, 2010). The Agriculture sector in South Africa could significantly curb unemployment rate if financial and technical support can be injected in the sector (National Planning Commission, 2012). The sector has the potential to promote food security, stimulate social enterprise, supplement income, and develop social and human capital (Vitiello & Wolf-Powers, 2014). However, Christiaensen, Rutledge and Taylor (2020) argues that the role of agriculture as domestic employer declines in most countries since agriculture tends to produce seasonal jobs with unpredictable productivity in labour. Water scarcity, climate change, political and market instability poses as a risk to agriculture (Steensland & Zeigler, 2020).

According to the World Bank Group Jobs (2020) Africa needs to move from small subsistence farming and transition into integrated food system as well as market orientated system in order to leverage job potential in agriculture. There should be periodization of agriculture education in order to boost economic growth in Africa. Agriculture education will contribute to increase in job creation and the agriculture sector as whole (Udofia, Eka & Etim: nd:1). The following measure needs to be implemented in African countries in order to institute agriculture education: Access to farmland; provision of agriculture subsidies; compulsory agriculture education in all the education curriculum and tertiary students can have agriculture modules as general study programme; agriculture training centres must be well equipped; incentives for best agriculture student in order to encourage commitment from other students (Ojo & Iyoha, nd: 189-190).

The spatial distribution of agriculture will promote job creation in South African municipalities as more jobs will be created. People in local communities will be afforded equal opportunity to participate in the local economy. Moreover, agricultural economic activities will immensely contribute to local economic growth. The agriculture sector in South Africa is concentrated by field crops and the

percentage of agriculture on GDP has decreased (International Monetary Fund, 2020:4). Agricultural economic activities in Polokwane Local Municipality are low. The agriculture sector needs to expand to accommodate the increasing population in South Africa (WWF-SA, nd:3). The population growth rate is 2% per annual and the population is expected to be growing by 82 million in 2035 (WWF-SA, nd:3).

Farmers are confronted by land constraints in South Africa. Therefore, local municipalities can use the available land to stimulate agricultural activities by using municipal land to initiate agriculture activities. The agriculture land stimulation can be through leasing of land at an affordable rate and appropriate land per year intervals. Rent will be paid to private owners where land is owned by tribal kings and other private stakeholders. The municipality must provide agricultural infrastructure and machinery where necessary. The municipality can also provide agriculture education in order to achieve a sustainable agriculture production and job creation.

## 6. Limitation

The author did not test the model and only relied on literature in which authors applied the theory in various countries around the world. The paper is based on literature review which could limit the applicability and accuracy of the theory in South Africa given the complexities in each country.

## 7. Discussion and Recommendation

The paper discussed and applied Location Theory. It also discussed agriculture and its significance in job creation. The paper assumes that Von Thunen's model of Location Theory serves a tool to mitigate unemployment. The predictions in von Thunen's model can be adopted as a tool that generates adequate and sustainable job opportunities in South African communities. Von Thunen's assumptions is not entirely applicable given the technology evolution, however, his prediction can be effectively applied. Patterns of farms can form but will not form as stipulated in his model. The nexus of rent and transport will not be as stipulated in von Thunen's model. On one hand, established farms will enjoy lower rental cost and on the other hand small farms will enjoy subsidised rental cost as well as lower transport cost. The surplus income that farms could enjoy from saving on rent and transport can be directed to creating more job opportunities in the locality. The small farms can enjoy surplus income derived from lower transport cost as well as subsidised rental cost and established farms can enjoy surplus income saved from lower rental cost. The paper recommends that local government in South Africa should implement the von Thunen's model in South African context. The von Thunen's model can have a significant impact on the creation of sustainable job opportunities, investment attraction and local economic growth as well as development. There will be increase in household income which will reduce the burden on social spending by the government. The von Thunen's model has the potential to curb rural migration that often results to people leaving rural area to often dire urban settlement in search of greener pastures. The model can ignite the notion that rural will be supported by agricultural farms by the year 2030 in South Africa (National Planning Commission (2012). Literature shows that indeed the von Thunen's model can be used to solve real life problems.

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