Recklinghäuser Beiträge zu Recht und Wirtschaft

Westfälische Hochschule

ReWir

Nr. 47 / 2019

Fachbereich Wirtschaftsrecht

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ISSN 2191-866X

Enhancing transport economies in Rwanda through balanced transport chain by smart transport of agricultural products from rural farmers to Kigali and other Rwandan cities

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1. Introduction

"*We want to put a lot of effort into horticulture. It is an opportunity that can create a big source of income for the population and also contribute to the export earnings of the country,"* said Ruzindaza, former permanent secretary in the Ministry of Agriculture and Animal Resources.[1]

1.1 Background

Rwanda is a developing country with huge ambitions for the future. In its Vision 2050 the country states the aim to become an upper middle-income country by 2035 and a high-income country by 2050.[2] With its vision the government wants to ensure among others sustained food security and a modern infrastructure.[3] The country already achieved first steps to accomplish the target. The gross domestic product (GDP) per capita of the country had the second-fastest growth on the continent, over two decades.[4] It had a value of 774 USD in 2017.[5] Whereby agriculture is significant for the economy and the main source of livelihood. The contribution of agriculture on GDP was 31 % in 2017.[6] In 2018 55.3 % (3,855,029 people) of working age population worked in the agriculture sector of which 32.8 % operated in markets and 22.5 % worked for household consumption only.[7] However, there are still problems in agriculture sector to solve until the vision 2050 is achieved. Many farmers have problems to get their agro-products[8] to customers. The farmers can produce more than they need for their needs but instead of selling them,

1 *Crisafulli P./Redmond A.,* Rwanda Inc (2014), p. 140f.

2 *The Republic of Rwanda,* 7 Years Government Programme: National Strategy for Transformation (NST 1) 2017-2024, p. 24.

3 *Republic of Rwanda/Sida,* Country profile - Rwanda (2017), p. 11.

4 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 2.

5 ibid., p. V.

6 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. V.

7 *NISR,* Labour Force Survey (2018), p. IV.

8 Abbreviation for agricultural products.

the fruits and vegetables perish on the fields. The customers on the other hand can only be found at markets in cities far away where the supply of food is not always sufficient despite imports. Therefore, somehow the agro-products must be transported to the cities. Also, the OECD acknowledges the importance of trade in agriculture because agro-products are cultivated in areas where only few people live. Therefore, agricultural trade is important for food security and an important source of income.[9] Furthermore, sufficient income is important to attract younger people in the agriculture sector because currently the farmers have an average age of 55 years whereas, the life expectancy is between 60 and 65[10] and in 10-15 years Rwanda could have significant problems in food supply. But how can the farmers transport their produce to cities in Rwanda? A possible solution could be the transportation of agro-products by bus. This concept will be examined in this Thesis. Busses drive throughout the whole country and can connect the farmers with their customers. However, can this concept be realized and can it improve the life of farmers in Rwanda?

1.2 Method and Scope

To examine if the concept can be realized, the method of this thesis has consisted of working with documentary materials from the government of Rwanda, from several non-profit organisations as well as consulting firms, newspaper articles and one report from the German Corporation for International Cooperation GmbH.

The first part deals with the infrastructure in Rwanda including the geography of the country and their integration with its neighbouring countries as well as its mobility. To consider if a bus network is working in Rwanda the current main routes are explained.

Secondly, it will be explained what has to be considered when two groups of people from different areas will be connected on a theoretical basis. Moreover, a theory will be on how to calculate the relation of market prices and transport costs of agro-products. After demonstrating the theory on which the thesis is based on the current supply chain will be illustrated. A new supply chain through bus transport will be created to highlight differences with the current supply chain and as a support to examine necessary changes.

The fourth part approaches the barriers that a new supply chain can have while considering the theory part. First a possible organization form for the farmers will be explained in form of the cooperative. Then necessary information will be analysed and possible ways how to share them will be described. After that a product range will be determined based on cultural preferences. Lastly, a transport possibility will be described.

After exploring the barriers, the economic aspects will be considered with a calculation. For the calculation several information sources were researched such as market prices, bus transport prices and seed prices. Market prices were accessible on a website of the government of Rwanda. For the bus prices two bus transport companies were contacted by e-mail, social media and telephone but no information could be given, therefore tariffs from the Rwandan government were used. Seed companies were also contacted by different communication channels, however only one company answered which could not provide the needed information and therefore seed prices were excluded. Lastly, different financial supports will be introduced for an impression how the concept can be financed.

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9 *OECD,* OECD-FAO Agricultural Outlook 2019-2028 (2019), p. 52.

10 *MINAGRI,* Annual Report FY 2016-2017 (2017), p. 33.

2 Infrastructure

To gain an understanding of Rwanda and to examine if the requirements for bus transportation exists, the geography and infrastructure of Rwanda will be described in the following.

2.1 Geography

"Rwanda's geography borrowed from both sides of the Rift, blending jungle and lakes, mountains and moorland into a symphony of green, brown and grey."[11]

Rwanda is a landlocked country with its capital Kigali in the middle. The country is called "the land of thousands hills" due to its "Plateau Central" with its hilly relief.[12] It has a total surface of 26,338 km² whereof 2,120 km² are under water and swamps.[13] The country is surrounded by Uganda (north), Tanzania (east), Burundi (south) and the Democratic Republic of Congo (west). It is part of the Great Lakes region of central Africa. The country has five volcanoes, 23 lakes and numerous rivers.[14] Rwanda itself is divided in five provinces namely Kigali City, Southern, Western, Northern and Eastern, which have 30 districts (figure 1). It is further separated in sectors, cells and villages.[15] In 2017 the country had an urban population of 2,347,098 and 9,462,201 people lived in rural areas which results in a population density of 467 people/km². Hence, Rwanda is a crowded country.[16]

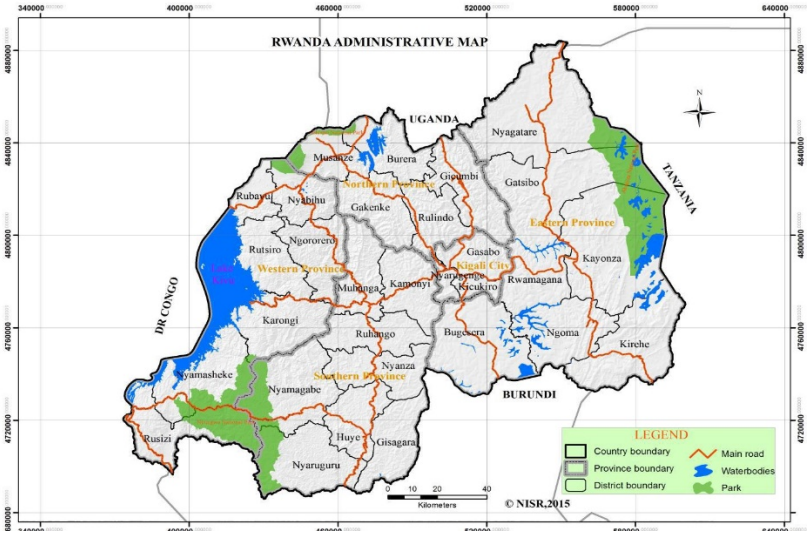

Figure 1: NISR December 2018 - Rwanda[17]

Rwanda is well integrated in the region. It is a member of the East African Community (EAC) and the Common Market for Eastern and Southern Africa (COMESA). Moreover,

11 *Perry,* The Rift (2015), p. 155.
12 *König, D.,* Erosionsschutz in Agroforstsystemen (1992), p. 27.
13 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. XV.
14 *Republic of Rwanda/Sida,* Country profile - Rwanda (2017), p. 1.
15 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. XVII.
16 ibid., p. XV.
17 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. XVI.

Rwanda is a strong supporter of free trade, it ratified the African Continental Free Trade Area (AfCFTA).[18]

The country is connected with the Northern Corridor which links the seaport of Mombasa in Kenya to the landlocked countries Burundi, Democratic Republic of Congo, Kenya, South Sudan, Uganda and of course Rwanda.[19] With the route Central Corridor the country is connected with the port of Dar es Salaam in Tanzania whereof cargos are transported to Burundi, D.R. Congo, Rwanda and Uganda.[20]

The country exported the most products from 2016 quarter 4 to 2018 quarter 2 to Kenya followed by United Arab Emirates, Democratic Republic of Congo and Switzerland. Germany is on place 14 in the ranking of destinations of exports.[21] The main commodities exported are food (mainly coffee) and live animals followed by crude materials, inedible and except fuels.[22] It has exported USD 609.46 million in the fiscal year (FY) 2017/18.[23] This included USD 251,494 of Pineapple, USD 318,404 passion fruit, USD 129,964 of mangoes.[24] There are also exports of minerals[25] but Rwanda has not significant raw material resources[26]. Comparing Rwanda's total natural resources rents (% of GDP) with its neighbouring countries, Rwanda's percent of minerals of GDP with 5.90 in 2017 (D.R. Congo 32.7, Uganda 13.9 and Tanzania 6.62) is quite low.[27]

The currency of Rwanda is the Rwandan franc (RWF).[28]

2.2 Mobility

"[...] if you blink twice, you will see a building that wasn't just the other day." - joke among residents and visitors to Kigali.[29]

The above joke refers to the fast growing of buildings in the country and highlights how fast the country develops in its infrastructure. But not only buildings, also are also improved or constructed.

In Rwanda transportation of goods or passengers can be done by road or air. The country has no railway.[30] Inland water transport is limited. There are the Lakes Kivu, Muhazi, Mugesera, Burera, Ruhondo, Sake, Akagera, Cyohoha and Nyabugogo.[31] From January

18 *Secretariat,* Trade Policy Review (2019), S. 195.

19 *Transport Observatory Reliable Northern Corridor Performance Data,* Northern Corridor Transport Observatory report (2019), p. vi.

20 *Central Corridor Transit Transport Facilitation Agency,* Performance Monitoring Report (2019), p. 2.

21 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. 148.

22 ibid., p. 145.

23 ibid., p. 145.

24 ibid., p. 66ff.

25 ibid., p. 62.

26 *INROS LACKNER SE,* Market Analysis of the Digitalization in the Transport/Logistics Sector in Rwanda (2019), p. 25.

27 *World-statistics.org,* total natural resources rents (% of GDP), https://world-statistics.org/index-res.php?code=NY.GDP.TOTL.RT.ZS?name=Total%20natural%20resources%20rents%20(%%20of%20GDP) (effective: 2019), accessed 15 October 2019.

28 *Republic of Rwanda/Sida,* Country profile - Rwanda (2017), p. 2.

29 *Crisafulli P./Redmond A.,* Rwanda Inc (2014), p. 1.

30 *MININFRA,* Transport Sector Strategic Plan for EDPRS2 (2013), p. i.

31 *Economic Regulation Unit,* Statistics in Transport Sector as of March of the Year 2019 (2019), p. 3.

to March 2019 were 325 authorized vessels used by 242 waterways operators.[32] Moreover, there are 15 airports and airfields, whereof Gregoire Kayibanda International Airport in Kigali is the only international one. Most of the flights are for passengers and not for cargos.[33] Hence, the most traffic is done by road. According to the law "Governing Roads in Rwanda" No. 55/2011 of 14/12/2011 there are national roads which are "*international roads that link Rwanda with neighbouring countries, [… with] Districts*" or "*that link a District and the City of Kigali*" and "*roads that link areas of tourist significance and facilities of national or international importance such as ports and airports*", article 3 paragraph A. Moreover, there are class 1 roads "*linking different Sectors' headquarters within the same District or those that are used within the same Sector*", article 3 paragraph B. Those roads have a minimum viable widths of 3.5 m, article 15. Then there are class 2 roads which are "*arterial roads that connect District roads to rural community centres that are inhabited as an agglomeration*", article 3 paragraph C with an minimum width of 6 m. Lastly, there are specific roads which are "*specifically constructed to connect national roads or District roads to Kigali City and other urban areas to the centres for private sector's activities such agriculture production, natural resources processing or to tourist sites*", article 3 paragraph D. Rwanda has 2,749 km of national roads, 3,906 km of Class one, 9,706 km of Class two and 21,145 km of unclassified roads in the FY 2017/2018.[34] Except for national roads, the roads are considered as feeder roads with 78% unpaved roads.[35] As the main streets are all connecting Kigali, most of the passengers and freight transport come from, go to or pass through Kigali.[36]

In Rwanda transport costs can be as high as 75 % of the value of exports.[37] In the Logistic Performance Index (LPI) Rwanda has the position 57 from around 180 countries in 2018 (61.68 % of the highest performer Germany). The country is ranked on position 65 in the performance 'infrastructure'. [38] The LPI provides a ranking on how easy or difficult it is in specific countries to transport general merchandise.[39] The country has still some transport challenges like various hills and valleys, and road accidents due to narrow roads.[40] Moreover, extreme weather conditions can destroy roads. For example between December 2017 and May 2018 was the last torrential rains which caused major damages on the national road network including landslides, embankment failure, rock fall, flooding, bridge wash away and damages.[41] Especially, a lot of unpaved roads have a poor quality and lack of accessibility during rainy seasons.[42] Furthermore, road construction is quite expensive. Nevertheless, the infrastructure gap is continuously closing particularly in road transport through large public investments and external support.[43]

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32 ibid.

33 *INROS LACKNER SE,* Market Analysis of the Digitalization in the Transport/Logistics Sector in Rwanda (2019), p. 17f.

34 *RTDA,* Annual Report Fiscal Year 2017/2018 (2018), p. 9.

35 ibid.

36 *MININFRA,* Transport Sector Strategic Plan for EDPRS2 (2013), S. 32.

37 *Adewole, A*, in: *Adewole, A/Struthers J.* (Editors), Logistics and Global Value Chains in Africa (2019), p. 22.

38 *The World Bank,* International LPI, https://lpi.worldbank.org/international/global (effective: 2019), accessed 15 October 2019.

39 *Arvis et al.,* Connecting to Compete 2018 (2018), p. 1.

40 *Republic of Rwanda/Sida,* Country profile - Rwanda (2017), p. 15.

41 *RTDA,* Annual Report Fiscal Year 2017/2018 (2018), p. 21.

42 *MININFRA,* Transport Sector Strategic Plan for EDPRS2 (2013), p. iv.

43 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 3.

One important player regarding road construction is China. Huge state-owned Chinese companies are building a lot of roads and infrastructure in Rwanda.[44]

Despite the problems in infrastructure, Rwanda has a steady growth of vehicles, the number increased from 125,159 (31.12.2012) to 183,073 (31.12.2016) and 198,518 (31.12.2017). In 2017 the number included 1,464 busses, 17,953 pick-ups, 6,343 mini-buses, 35,062 cars and 101,694 motors.[45]

One key priority of the transport sector is to develop an integrated public transport system.[46] Public transport is important to ensure accessibility and mobility for people in rural areas.[47] For improving the rural public transport service the existing National and District unpaved roads have to be upgraded into paved roads and bus services have to be ensured in rural areas[48] independent of their level of demand[49]. The road-based public transport is mainly provided by minibuses, coaches and motorcycle taxis.[50] The transport sector and with it the public transport is under the responsibility of the Rwanda Utilities Regulatory Authority (RURA). They set up tariffs for public transport and has divided the country in 8 "*corridors*"[51]:

I. Kigali - Gicumbi (blue)
II. Kigali - Kayonza - Nyagatare (maroon)
III. Kigali - Muhanga - Huye (Butare) - Rusizi (green)
IV. Kigali - Muhanga - Karongi - Ruzizi (purple)
V. Kigali - Muhanga - Ngororero - Rubavu (yellow)
VI. Kigali - Musanze - Rubavu (black)
VII. Kigali - Mwaragana - Ngoma - Rusumo (brown)
VIII. Kigali - Bugesera – Zaza (orange)[52]

The licenced operators of public transport offer free capacity in the luggage compartment (which is not used by passengers) for carriage of parcels and small cargo items. This free space could be used for transporting agro-products. Tariff and delivery patterns as well as invoicing and booking systems are accessible.53 One company which offers public transport is the Rwanda Interlink Transport Company Limited (Ritco Ltd). Ritco Ltd is a public-private partnership transport company and started in June 2016. It has the target to reduce isolation of people in rural areas by regular transportation.[54]

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44 *Kuo, L.*, Rwanda is a landlocked country with few natural resources. So why is China investing so heavily in it?, https://qz.com/africa/827935/rwanda-is-a-landlocked-country-with-few-natural-resources-so-why-is-china-investing-so-heavily-in-it/ (22.11.2016), accessed 15 October 2019.

45 *NISR,* Rwanda Statistical YearBook 2018 (2018), p. 86.

46 *MININFRA,* Transport Sector Strategic Plan for EDPRS2 (2013), p. vii.

47 ibid., p. i.

48 ibid., p. viii.

49 ibid., p. 20.

50 ibid., p. 32.

51 *RURA,* RURA's Responsibilities in road transport Regulation, https://rura.rw/index.php?id=81, accessed 15 October 2019.

52 *Veerkamp, J./Buses World Wide,* Rwanda Regional Bus Services, http://www.bus-planet.com/aworldofbuses/buses-in-africa-nw/rwanda/rw-regional/ (effective: mid-2016), accessed 15 October 2019.

53 *INROS LACKNER SE,* Market Analysis of the Digitalization in the Transport/Logistics Sector in Rwanda (2019), p. 16.

54 *RITCO*, Ritco link people with places https://www.ritco.rw/ (effective: 2018), accessed 15 Ocotber 2019.

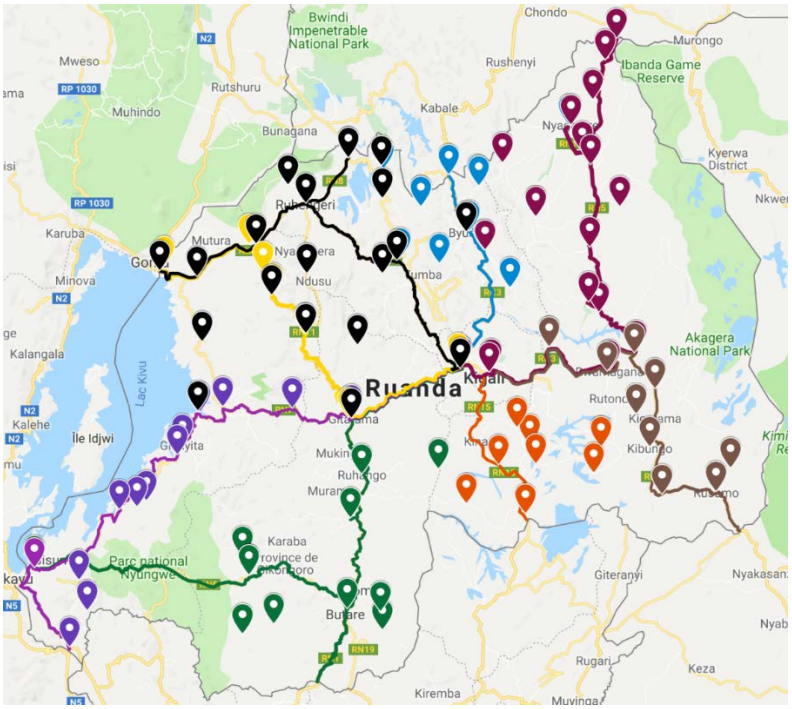

Figure 2: Bus transport map[55]

A working infrastructure can connect the people in Rwanda and stimulate economic growth. The rehabilitation and development of transport infrastructure and services is essential to lower costs of doing business in Rwanda.[56] The existing road network can be used to transport agro-products from the farm to the next city.

3 Theory

The examination of the bus transport concept will be based on two theories: the gravity model and a theory of agricultural land use by J. H. von Thünen.

3.1 Gravity Model

The gravity model explains why and when two regions trade. Usually it is used for trade between two countries, therefore the model is also known as a gravity model of world trade.[57] But in this context the model will be used to explain intraregional trade between the rural region and cities in Rwanda. There are three aspects that affect trade. One is a substantial relationship between the size of a region's economy and their trade with other regions.[58] On an international basis this means, that there is more trade between two countries when they both have a high GDP, e.g. USA and Germany.[59] Referred to Rwanda the trade between the rural farmers and the cities will increase when both will produce and offer more goods and services. This can be achieved on the rural side when the farmers will form a cooperative to offer more agricultural products in the city and to

55 ibid.

56 *MININFRA,* Transport Sector Strategic Plan for EDPRS2 (2013), p. 19.

57 *Krugman, P./Obstfeld, M./Melitz M.,* International economics (2018), p. 40f.

58 ibid., p. 39.

59 ibid., p. 40.

receive higher revenues. The profits can pay manufacturers goods and services from the city which increases the income of the urban population. Furthermore, the distance between two regions has a strong negative effect on trade.[60] Distance matters because it is essential for transport costs and therefore important for the calculated price. Moreover, it indicates the time during which the product is shipped which is very crucial for perishable goods.[61] The distance between the farmers' home and the next city as well as no way to overcome the distance is exactly the problem why farmers cannot trade. The transport costs must be lower than the profit of selling agricultural goods and the products must have the ability to be transported to the city. This will be calculated in the chapter *6 Economic Aspects*. Lastly, there is the third aspect: cultural distance.[62] Trade among two regions also depends on cultural affinity.[63] In this aspect cultural affinity can be education and technology knowhow. Generally, people in cities are better educated and have access to technologies like smartphones, computers and the Internet. Moreover, there are different eating habits between people in rural areas and in cities which will be explained in chapter *5.3 Product*. Another cultural point is trust. Especially the rural farmers need to trust the concept for selling their products in the cities. All three aspects, size of economy, distance and cultural affinity have to be considered in the following study.

3.2 Theory of agricultural land use by J.H. von Thünen

J. H. von Thünen established a theory of agricultural land use in his book "The isolated state" in 1826. The theory explains that certain farms should specialize on specific agricultural products within a region. Due to specialization an interregional relationship of trade between farmers and a city may happen.[64] In this case the farmers specialize in agro-products and the urban population in services and manufactured goods. But what is the effect of the distance to the city on agriculture?[65] Like in the theory of the gravity model, the distance is essential. Thünen explains that a product has no value when there is no customer. The farmer has agro-products for himself and for selling. Now to have customers the farmer has to transport his goods to the city.[66] In the theory there are different premises. The farmer has a place of "production" like a farm which is normally inherited and he has a certain freedom to choose which agro-products he will produce.[67] On which agro-product the farmer will specialise will be decided based on different factors in chapter *5 Barriers* and *6 Economic Aspects*. Furthermore, soil and climate are homogenous.[68] And the customers have no preferences between equal products, e.g. potatoes and rye.[69] The market is a big city in the centre of the region[70] and the transport costs are proportional to the distance of the farm to the market as well as the weight of the agro-products.[71] Thünen assumes that there is a market with perfect competition.[72]

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60 ibid., p. 42.

61 *Head K.,* Gravity for Beginners (2003), p. 8.

62 ibid.

63 *Krugman, P./Obstfeld, M./Melitz, M.,* International economics (2018), p. 41.

64 *Palme, G./Musil, R.,* Wirtschaftsgeographie (2012), p. 40.

65 *Thünen, J. H. von,* Der isolierte Staat (1910), p. 12.

66 ibid., p. 45.

67 *Bathelt, H./Glückler, J.,* Wirtschaftsgeographie (2018), p. 110.

68 ibid., p. 111.

69 *Thünen, J. H. von,* Der isolierte Staat (1910), p. 200.

70 *Bathelt, H./Glückler J.,* Wirtschaftsgeographie (2018), p. 111.

71 *Liefner, I./Schätzl, L.,* Theorien der Wirtschaftsgeographie (2017), p. 41.

72 *Palme, G./Musil, R.,* Wirtschaftsgeographie (2012), p. 40.

When the farmer sells his agro-product in the city the value of one product decreases with longer distance to the market because the transport costs increases.[73] To calculate this, Thünen developed a formula for so-called land rent:

R = (p-a) * E - F * d * E

R = land rent (€/ha)
p = market price
a = production costs
E = yield per ha
f = transport costs
d = distance[74]

According to this formula the land rent is the difference between the revenue for selling the products minus production and transport costs. Due to the different transports costs and therefore different land rents concentrically circles arise around the city. In each circle the farmers produce different agro-products.[75] With reference to Rwanda this formula will be used to calculate if a farmer can sell his agro-products profitably considering bus prices as transport costs. It can be shown which agro-products can be produced and sold with a profit.

However, there are critics of the theory by Thünen. One is that there are more cities in a country than just one. Thünen admits in his book that there are differences between his theory and the real world and that in a country there is one capital and several smaller cities.[76] But he also points out that the smaller cities need groceries as well and farmers in the near of those cities will supply the food. Therefore the theory can be applied to smaller cities, too.[77] Another criticism is that there is an unrealistic assumption of homogeneity like soil, climate, and mode of transport.[78] Regarding the homogeneity of transport in this thesis, the agro-products will all be transported by bus which makes the comparison as homogeneously as possible. Relating to climate and soil the different climate in the region has to be considered. There is only homogeneity in specific parts of the country which will be discussed in chapter *5.3 Product*. Therefore in Rwanda are no verifiable concentrically circles around the cities. Another aspect that has to be considered is the fact that for Thünen there is no preference. Still, in reality people have preferences. Like already mentioned in the theory of the gravity model people have different eating habits. Those differences will be explained later on.

4 Supply chain

To understand how the agro-products will be transported, a supply chain and a logistic concept needs to be analysed. Logistic can be "*described as a means of having the right thing of the right quality and quantity at the right place, at the right time*"[79]. Whereas

73 *Thünen, J. H. von,* Der isolierte Staat (1910), p. 45.

74 *Bathelt, H./Glückler, J.,* Wirtschaftsgeographie (2018), p. 113.

75 ibid., p. 111.

76 *Thünen, J. H. von,* Der isolierte Staat (1910), p. 268f.

77 ibid., p. 272.

78 *Bathelt H./Glückler J.,* Wirtschaftsgeographie (2018), p. 116.

79 *Adewole, A*, in: *Adewole, A/Struthers, J.* (Editors), Logistics and Global Value Chains in Africa (2019), p. 20.

"*supply chain activities are usually organised as flow-through processes across a network of organisations"*[80]*.* For establishing a supply chain, the product characteristics have to be considered for understanding what is to be moved or stored and what it is about the product that will require special attention or handling throughout the chain.[81] The products that are transported are agricultural products, mainly fruits and vegetables, which are perishable. Therefore the transportation time should not be too long and the products should be more or less immediately sold in the cities. A supply chain for agriculture can have the components of farm, transport, process, transport, warehouse, transport and store as shown figure 3.

Farm → Transport → Process → Transport → Warehouse → Transport → Shop

Figure 3: simplified supply chain[82]

In Rwanda a middlemen (like wholesale trader) purchases the agro-products from smallholder farms early in the morning and sells them at markets in the city.[83] Wholesale traders, retail traders, processors and cooperatives and other specialty retail markets are the common buyers for horticulture products. Whereas processors are not that common in Rwanda because it is difficult to compete with cheap importers. [84] Generally, wholesale traders buy higher volumes of product and transport it to larger markets.[85]

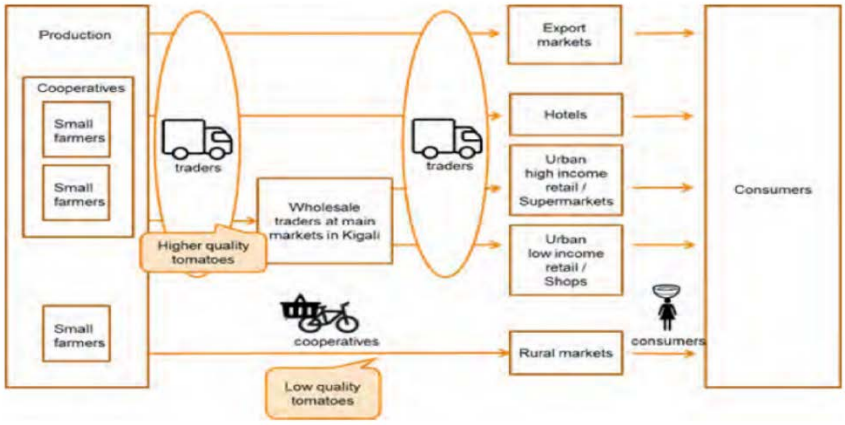

Figure 4: The current supply chain of tomatoes in Rwanda[86]

Van Dijk et al. have researched how the supply chain of tomatoes looks like in Rwanda. On the first day the tomatoes are harvested and stored on plastic on the ground overnight. Then, early in the morning (04:00) they are sold to traders at the farm and transported to the market in large traditional baskets facilitated by the farmers[87] in open or closed trucks without cold transport chain. The trucks are generally highly loaded and

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80 *Bvepfepfe, B. S.,* in *Adewole, A/Struther, J.* (Editors), Logistics and Global Value Chains in Africa (2019), p. 20.

81 ibid., p. 49.

82 *Adewole, A. in Adewole, A./Struther, J. (Editors)*, Logistics and global value chains in Africa (2019), p. 20.

83 *Dijk, N. van/Dijkxhoorn, Y./Merrienboer, S. van,* SMART Tomato Supply Chain analysis for Rwanda (2015), p. 5.

84 ibid., p. 17.

85 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 31.

86 *Dijk, N. van/Dijkxhoorn, Y./Merrienboer, S. van,* SMART Tomato Supply Chain analysis for Rwanda (2015), p. 11.

87 ibid., p. 12

can create serious damage and losses.[88]. At the market the tomatoes are sold in other smaller, traditional basket to the customer.[89] The tomatoes are offered on daily spot markets without spaces for cooling and storing. The farmers receive for their tomatoes 150-200 RWF per kg whereas the wholesaler sells them for 300-400 RWF. The price difference comes from costs for collection and transportation.[90] To rural markets the tomatoes are transported in all sorts of baskets (often heavily overloaded with direct exposure to the sun) by foot or bicycle from the farmers themselves.[91] The main problems that van Dijk et al emphasize is that the tomatoes are repacked with each transaction in the supply chain which causes post-harvest losses and low quality.[92]

To receive a higher bargaining power and to ensure better transportation quality an organization, which sells its product directly to the market trader could be included in the value chain. Then the components of the value chain would be a farm where the products are cultivated and harvested. The organization, e.g. a cooperative which buys the product from the farmers and forwarded them to the bus. The cooperative will be located closely to the farm therefore there is no huge transportation needed. Lastly, the bus company which transports the products to the market in the city and sells them to retailer at the market (figure 6). How the transfer from the bus to the market retailer can take place will be discussed in the chapter *5.3 Transportation*.

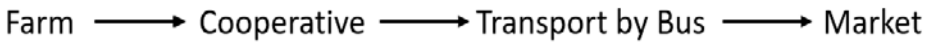

Figure 5: supply chain[93]

5 Barriers

For realizing the supply chain some aspects have to be considered. The questions are in which organization should the farmer join, how information can be acquired and shared, which product will be transported and how the product will be transported.

5.1 Organization

"Cooperatives are private oriented enterprises and self-reliant business entities for significant contribution to the national socio-economic transformation through creation of productive jobs and wealth" – Vision of the National Policy on Cooperative in Rwanda[94].

First, a possible organization will be sourced. For having a stronger position in trade it is advisable for the farmers to join together. One common organization for farmers is the cooperative. According to Oxford Dictionary a cooperative is: "*A farm, business, or other organization which is owned and run jointly by its members, who share the profits or benefits*"[95]. For the farmers in Rwanda that means they join their farms under the um-

88 ibid., p. 15.

89 ibid., p. 12.

90 ibid., p. 13.

91 ibid., p. 16.

92 ibid., p. 16.

93 Own figure.

94 *MINICOM,* National Policy on Cooperatives in Rwanda (2018), p. 22.

95 *Stevenson, A.,* Oxford dictionary of English (2011), https://www.lexico.com/en/definition/cooperative, accessed 15 October 2019.

brella of the cooperative together and hold as well as conduct it collectively. The cooperative can build up trust because the farmers run it by themselves and pay the farmers directly. The central role that cooperatives have in sustainable development and economic transformation is recognized by the government of Rwanda.[96]

The cooperative is regulated in Law no. 50/2007 of 18/09/2007 "determining the establishment, organization and functioning of cooperative organizations in Rwanda". In article 4 no. 3 and 4 it is described that a cooperative has (3) "*the power to enter into contracts*" and (4) "*the capacity to hold movable and immovable properties of every description*". It has the principles of a voluntary membership, democratic control in form of one member one vote, educated and informed members and concerned for development of the community where the organization is located according to article 3. For establishing a cooperative there needs to be at least seven persons not belonging to the same family or to another cooperative with the similar activities, article 10. A person can join a cooperative when he or she is at least 16 years old, article 29. As the average age of farmers is 55 years[97] in Rwanda there will not be any problems with complying the age limit. There are three organs in the cooperative: the General Assembly, the Board of Directors and the Supervisory Board, article 48. According to article 63, the Board of Directors exists of at least five (5) and not more than nine (9) members and is the "*management authority*". The Supervisory Board consists of at least two (2) and not more than five (5) members. Generally, every member of the cooperative can be part of an organ and participate in decisions-making. This is an important advantage over for example a limited company with private shares where the number of votes depends on the number of shares, article 75 number 1 of Law no. 07/2009 of 27/04/2009 relating to companies. But for working organs the farmers have to be educated and trained so that they can perform their duties accordingly. In article 76 of Law no. 50/2007 it is stated that "*where possible, every Co-operative Organization shall establish education and training, credit and finance [and] personnel committees […]*", which can be a support for younger people who have problems to receive financial aid for accessing farm business. Further, the cooperative shall form an education and training fund, article 85. Thus, the knowledge gap between people living in the city and those living in rural areas can be closed. Farmers can be taught how to meet the challenge of problems due to climate change like soil erosion, how to trade and which agro-products are favoured in the cities. If wanted, the cooperative can also be transformed into another organization, article 107.

The Ministry of Trade and Industry of Rwanda has established a National Policy on Cooperatives in Rwanda for evaluating and transforming the current situation of cooperatives in Rwanda. There they emphasize that cooperatives can be a kind of a self-help group and is able to pool members' resources to receive economies of scope and scale as well as serving a platform for policy dialogue.[98] Farmers can gain economies of scale through their increasing size of production (here: cultivating agro-products) which strengthens trade. Economies of scale are also referred to as increasing returns. When doubling the inputs the industry will more than double its production.[99] With economies of scale occur different effects, two of them are the learning curve effect and the decrease of fixed costs. The learning curve effect is the accumulation of knowledge. The farmers

96 *MINICOM,* National Policy on Cooperatives in Rwanda (2018), p. 1.

97 *MINAGRI,* Annual Report FY 2016-2017 (2017), p. 33.

98 *MINICOM,* National Policy on Cooperatives in Rwanda (2018), p. 1.

99 *Krugman, P./Obstfeld, M./Melitz, M.,* International economics (2018), p. 180.

can exchange their knowledge and therefore reduce their costs.[100] Through the regulation in article 76 of Law no. 50/2007 to educate and train the members of the cooperative this effect is enhanced by law. With production, the farmers can learn how to cultivate in the best way together. If the cooperative is successful the farmers can maybe even make experiments like testing new kind of cultivation in the future and spread the risks over all farmers, which leads to the decrease of fix costs. On the other hand, the decrease of fix costs appears when they can be allocated on an increasing number of outputs, e.g. living costs.[101] Furthermore, they can buy in larger numbers their raw materials like seeds and can get a discount. By producing on a large scale the cooperative can offer their products for lower prices which makes them more competitive. Moreover, cooperatives can gain economies of scope. Companies who achieve economies of scope "*produce their several products together at less cost than could a group of single-product*" companies.[102] This means that the cooperative can have lower costs when they cultivate more than just one fruit or vegetable. For example they can buy for all products fertilizer and at the same time they are prepared for fluctuating prices and demands for agro-products. Due to those advantages of cooperatives the policy has the target to modernize and increase productivity of agriculture by enhancing the total land consolidated into larger blocks as well as promoting agricultural investment through Public Private Partnership models.[103] However, investments will be needed. Despite all advantages of cooperatives there are also challenges e.g. the low interest of financial institutions to finance rural agricultural investments[104]. Solutions for limited financial resources will be discussed in chapter *7 Financing*.

The Ministry of Agriculture and Animal Resources (MINAGRI) emphasizes that cooperatives are key to increasing food security as well.[105] Several programmes were already implemented by the government to support farmers' cooperatives.[106] Therefore there are already farmers organized in cooperatives but these cooperatives do not provide support in activities such as marketing, sorting, grading and have only limited bargaining power[107] and are mainly clustered along the national routes.[108] Cooperatives need assistance so that they can support their members also in these activities. The Rwanda Cooperative Agency (RCA) offers training in legal assistance, internal audit, financial management and cooperative leadership, e.g. in a project of MINAGRI for Climate Resilient Post-harvest and Agribusiness Support Project in FY 2016/17.[109] But still, cooperatives need to be trained on how to transport their products to the market by their own and how to bargain. Here is probably support of the private industry or of other Non-Governmental Organizations (NGO) needed.

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100 ibid., p. 191.

101 ibid., p. 201.

102 *Milgrom, P. R./Roberts, J.,* Economics, organization and management (1992), p. 107.

103 *MINICOM,* National Policy on Cooperatives in Rwanda (2018), p. 8.

104 *MINAGRI,* Annual Report FY 2016-2017 (2017), p. 81.

105 ibid., p. 34.

106 ibid., p. 34.

107 *Dijk, N. van/Dijkxhoorn, Y./Merrienboer, S. van,* SMART Tomato Supply Chain analysis for Rwanda (2015), p. 12.

108 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 36.

109 *MINAGRI,* Annual Report FY 2016-2017 (2017), p. 79.

5.2 Information

For a successful supply chain an exchange of information is essential. Lack of information causes losses for logistics and supply chain operations.[110] The farmers need to know, when the busses drive, how expensive the transport is and which product can be profitably sold on the market. According to a survey from the EU about horticulture in Rwanda from 2014, farmers mainly receive information due person-to-person contact. Nearly 80 % of horticulture organisations obtain information from other members, friends/family, other producers, product sales agents, extension agents and projects/NGOs.[111] A secondary source are technologies like radios, mobile phones/SMS, televisions and the internet. Whereas telephones are mainly used for person-to-person interaction too.[112] Nevertheless, Rwanda does a lot to promote Information and Communication Technology. *"When you are not endowed with oil and all these other natural resources, you can use technology and innovation together to achieve economic goals. We are determined to become a service economy."* said former Foreign Affairs Minister Mushikiwabo. President Paul Kagame emphasized: *"We have to focus on our own major resource, which is our people."*[113]

In Africa digitalization begins with mobile phones. Technology has to be cheap for the consumers and smartphones can be bought for USD 20. Moreover, for the infrastructure no cables are needed.[114] In Rwanda, mobile phones are on their way. *"Along a rural road, a woman with a basket on her head or a man balancing bunches of bananas on the back of a bicycle he is pushing up a steep hill are probably also toting cell phones."*[115] From the FY 2005/06 to 2016/17, the percentage of mobile phone owners increased from 6.2 % to 66.9 %.[116] Additionally, Rwanda is nearly 100 % covered with mobile data network.[117] With smartphones and apps people can gain access to countless information. Through Apps the agriculture sector has better access to markets and banks.[118] For example a weather forecast can be send to the mobile phones of local farmers with information when to seed or to harvest and farmers can be connected to local and regional markets[119] to check prices. This is called Smart Farming, "*where just the right amounts of the right inputs are used for each parcel based on information*"[120]. Technology can increase the productivity in the agriculture sector and makes it more attractive to the youth.[121] Therefore the government of Rwanda has established different Apps to

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110 *Bvepfepfe, B. S.* in: *Adewole, A./Struther, J.* (Editors), Logistics and Global Value Chains in Africa (2019), p. 53.

111 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 44.

112 ibid., p. 44.

113 *Crisafulli, P./Redmond, A.,* Rwanda Inc (2014), p. 24f.

114 *Der Kontext,* Digitalisierung in Afrika, https://www.derkontext.com/thema/digitalisierung-afrika#m=6/1349.03081/211.43881,p=25, accessed 15 October 2019.

115 *Crisafulli, P./Redmond, A.,* Rwanda Inc (2014), p. 10.

116 *NISR,* Rwanda Statistical YearBook 201 (2018), p. 3.

117 *INROS LACKNER SE,* Market Analysis of the Digitalization in the Transport/Logistics Sector in Rwanda (2019), p. 34.

118 *Der Kontext,* Digitalisierung in Afrika, https://www.derkontext.com/thema/digitalisierung-afrika#m=6/1349.03081/211.43881,p=25, accessed 15 Ocotber 2019.

119 ibid.

120 *RWANDA; GOVERNEMNT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), S. 42.

121 *Der Kontext,* Digitalisierung in Afrika, https://www.derkontext.com/thema/digitalisierung-afrika#m=6/1349.03081/211.43881,p=25, accessed 15 October 2019.

support farmers. One of them is e-Soko. In the report “Future Driver of Growth in Rwanda” the World Bank explains e-Soko as "*an electronic platform that gives farmers, consumers, and traders up-to-date market price information by short message service [...] enabling farmers to market their agricultural produce better and to get premium prices"*[122]. The prices can be obtained via mobile phone and are updated every 2-3 days for markets across the country. With this app farmer can ponder when it is profitable to sell their products at the market. Maybe this platform can also help gaining information about the market, such as supply and demand. Generally, there is higher demand for agro-products when there is no harvest time for the specific product. On the other hand, there can be lack of supply when there is harvest time. For knowing when a product is needed the platform could also indicate roughly the offered amount of horticulture on the market. After a while a pattern could be visible and the farmers know when to offer the product that would sell the best. Moreover, through mobile phone farmers can receive information when busses drive. Currently this information is not available via internet but with a phone call.

Furthermore, technology can support banking e.g. M-Pesa[123]. In the long run this could be used by cooperatives to receive money from the market. For the government in Rwanda this has the advantage that corruption decreases as everything is monitored electronically.

On the other hand, consumers in the city need information about the quality of the agro-products. This can be checked through looking at the goods, feeling it and maybe even having a taste of it. However, the last option would result in a certain loss for retailers. In order to guarantee an impeccable quality, a certificate could be introduced. Moreover, with a certificate the products would seem to be special and convince customers of their quality. In a lot of sectors, companies produce goods that are differentiated from one another. In some cases the differences are small (like bottle size) and in others much more significant (like cars).[124] In the agriculture sector, products do not differentiate at first sight. Papayas are papayas and mangos are mangos. Nevertheless there can be a difference in quality and this quality must be trustworthy. With the strategy "Made in Rwanda" promoted by the Rwandan government Rwandan creditability of the products can be enhanced and consumer awareness and preference in public procurement increased.[125] Rwanda has already authentic certifications incl. ISO 22000 certification for food safety and Fair Trade standards under the Rwanda Standards Board[126] which gives Rwanda a comparative advantage over other countries.

5.3 Product

Before the farmer can sell their agro-products at the market they have to consider which products are in demand, specifically the demand of people in Rwandan cities. Therefore the cultural affinity in form of eating habits has to be analysed. The OECD-FAO Agricultural Outlook 2019 anticipates that the demand for agricultural products in the world will

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122 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 13.

123 *Safaricom*, M-Pesa Global, https://www.safaricom.co.ke/personal/m-pesa/do-more-with-m-pesa/m-pesa-global, accessed 15 October 2019.

124 *Krugman, P./Obstfeld, M./Melitz, M.,* International economics (2018), p. 198.

125 *MINICOM,* National Policy on Cooperatives in Rwanda (2018), p. 11.

126 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 41.

grow by 15 % over the coming decade also due to increasing population.[127] Whereas urbanisation is accompanied by shifts in dietary patterns. Higher value food is being consumed, while the consumption of cereals and pulses is decreasing. Half of the total food expenditure are fruits, vegetables, meat and fish by urban households.[128] For example the OECD-FAO Agricultural Outlook 2016 predicted that the papaya consumption will probably increase by more than 3 % p.a. in Africa's developing regions, while pineapple and mango consumption will raise by 4.5 % p.a. and 4.1 % p.a.[129] Therefore, farmers should specialise on fruits and vegetables, so-called horticulture. For fruits the dominant crops are pineapples (12.8 %), passion fruits (3.5 %) and tamarillos (2.6 %) in Rwanda (cited in 2014). They constitute nearly 95 % of all fruit sales.[130] Vegetables sales are dominated by tomatoes (28.4 %), onions (14.2 %) and cabbages (12.8 %).[131] Currently farmers mainly produce vegetables (77.3%) compared to fruits (20.3%).[132] Vegetables are less perishable and susceptible to rot and other damages in storage and transportation. On a price per kilo basis, they are more affordable, especially in local destination markets.[133] On the other hand, only few fruits on the market means a market niche which could be filled by the farmers. But not only the demand matters, it is also important to consider what can be grown in which area. Rwanda has three agricultural seasons covering season A. approximately from September to the end of February in the following year, season B. starting in March and ending in June in the same year and season C. from July to September.[134] In 2017/2018 the agriculture seasons were from 10th December 2017 to 30th January 2018 (season A), from 29th April to 19th July 2018 (season B) and from 4th to 24th September 2018 (season C).[135] Fruits are grown on the hillsides (94.4 %) and only rarely in the lowland areas.[136] They are often perennials and heartier and deep rooted hence, only minimal irrigation is needed. Vegetables are seasonal and need significant amount of water for proper growth. [137] Thus, in valleys crops such as maize, beans and vegetables are cultivated.[138] Comparing the provinces in Rwanda, the provinces Kigali and the South have more valleys and produce no fruits whereas the eastern province has hillsides and produces quite a lot of fruits.[139]

Moreover, the weather conditions have to be considered. According to figure 5 the ideal weather condition for tropical fruits is in the East province which corresponds to the assumption that the main fruit production is in the East. In the South, West and North the weather is ideal for vegetables.

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127 *OECD,* OECD-FAO Agricultural Outlook 2019-2028 (2019), p. 3.

128 *OECD,* OECD-FAO agricultural outlook 2016-2025 2016 (2016), p. 65.

129 ibid., p. 90.

130 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 17.

131 ibid.

132 Ibid., p. 16.

133 ibid.

134 *NISR,* Seasonal Agricultural Survey 2018 annual report (2018), p. 1.

135 ibid., p. ix.

136 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 40.

137 ibid., p. 33.

138 ibid., p. 40.

139 ibid., p. 41.

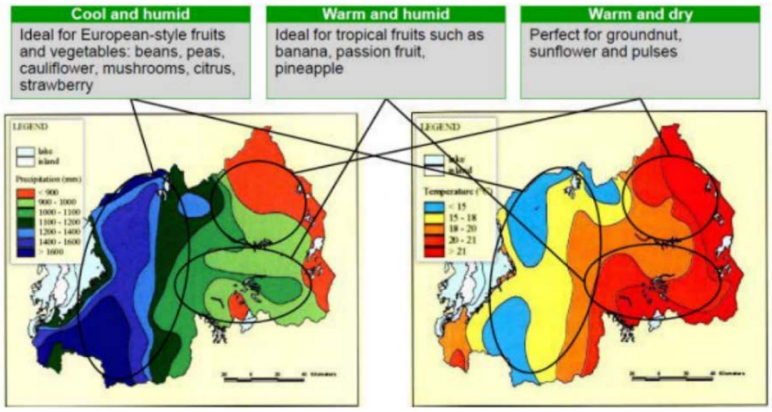

Figure 6: Climate zones of Rwanda[140]

Organisations that produce fruits and vegetables are in all of the country's 30 districts.[141]

Lastly, the prices of the products must be considered. At the end farmers must be able to live from their profits. As prices for fruits and vegetables fluctuate frequently[142] a calculation about costs and revenues needs to be done in regular terms. Especially, in the dry season the supply of vegetables is very low and particular hotels are willing to pay higher prices for high quality.[143] As already mentioned fruits can be a market niche and bring high revenues. Therefore, it will be concentrated on selected fruits but as well vegetables, which in turn ensures a diversified supply.

5.4 Transportation

To transport the products safely an appropriate transport possibility is needed. Assuming that the products are carried to the market by bus the farmers need a kind of box where post-harvest losses are avoided. Post-harvest losses can occur during harvesting itself when horticultures are picked during high temperature and then stored in the heat. Moreover, it is problematical to repack the product for transportation, when it can be squashed depending on sensibility of the product and exposed to the sun during transport.

Van Dyke et al. describes that the tomatoes are exposed to heat directly after harvesting and loose quality[144]. Additionally, tomatoes are stored in baskets which are easily broken as they are made out of natural materials, often overloaded and difficult to clean so that there is a high risk of infection.[145] As a solution the authors suggest to use plastic crates or euro norm trays which have lower height so that the tomatoes cannot be easily smashed. Crates can be cleaned easier, last longer and can be stacked over one an-

140 *Kerkhoven, P. et al.,* Floriculture for the Republic of Rwanda (2013), p. 26.

141 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 24.

142 ibid., p. 26.

143 *Dijk, N. van/Dijkxhoorn, Y./Merrienboer, S. van,* SMART Tomato Supply Chain analysis for Rwanda (2015), p. 14.

144 ibid., p. 17.

145 ibid., p. 22.

other. The authors recommend crates from Kenya like the company Kenpoly for an average price of USD 6.[146] To eliminate the heat an isolation material like reflectix for covering the crates could be used.[147]

To avoid at least one repackaging the used baskets for harvesting could be utilized for transportation in the bus. The retailer at the market could pick up the horticulture, repack the crates in their own baskets and the bus driver brings them back to the farmers. In this way the repackaging of the wholesaler could be prevented. However, one problem will be that someone has to take care of the farmers' baskets at the market. Maybe this could be done by the bus driver for money depending on the schedule of the bus driver and how trustworthy the driver is. Another option could be that someone from the cooperative travels with the baskets to and from the city, but this would mean a missing person on the field. During harvesting time everyone will be needed. The cooperative would have to organize somehow a compensation for the missing worker e.g. farmers schedule on which farm they work together or someone in the city (a person who organized the market etc.) could do this job for money. Still, here the person has to be trustworthy as well.

In addition, for cooling van Dyke et al. suggest to build a special cooling chamber with regular addition of water which uses the system of evaporative cooling, it is called ZECC (Zero Emission Cold Chamber). There are two chambers within each other built from bricks and sand. Between the walls is wet sand, the sand will be wetted regularly with water. On the top a roof will be built to provide shade. In the inner chamber, the vegetables and fruits can be stored. The ZECC costs around USD 250.[148] It could be used to keep fruits and vegetables longer fresh. Then the farmer has the opportunity to wait a little bit longer with selling to achieve better prices. It gives them room to manoeuvre. Of course this can only be used for some days but it can give them advantage over other suppliers. In average the shelf life can be extended to 4-5 days.[149]

During transportation different conditions between rural areas and cities need to be considered as well. At local markets the product requirements are relaxed. As long as the product meets the right size and colour expectations as well as it is sold in the right volume the buyers are satisfied. In more distant markets larger volumes are needed and in Kigali or other cities the prices are higher.[150] Hence, the supply chain must be able to transport the agro-products without damaging them and at the same time enough horticultures must arrive at the market. Moreover, the transportation must take place early in the morning because the fruits and vegetables have to be at the market punctually. Thus, the bus transport concept depends on bus times. However, the agro-products can be transported to the market later if the market has a lack of supply. After mentioning possible barriers and solutions a calculation will be made on the basis of them.

6 Economic Aspects

For receiving an impression about the concept a rough calculation will be made in the following. The theory of J. H. von Thünen will serve as a basis to compare the different

146 ibid., p. 22.

147 ibid., p. 23.

148 ibid., p. 24f.

149 ibid., p. 25.

150 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 34.

agro-products. The so-called “land rent” will be redefined as profit to examine if the transport will be economically profitable.

Additionally, to have a comparison of the different supply chain the surcharge of the wholesaler will be calculated and compared with the costs for bus transport. According to van Dijk et al. the farmers receive for their tomatoes 150-200 RWF per kg whereas the wholesaler sells them for 300-400 RWF[151]. The average price of tomatoes at the Kimironko market is 615 RWF/kg in 2019.[152] Hence, the farmers only receive 29% of the market prices. The market retailer will keep 35 % of the market price as revenue for occurring costs or as profit or the other way around the farmer receives 65 % of the market price.

6.1 Restrictions

The calculation will contain some restrictions. Firstly, the selection of products are limited to the available prices of products on the website e-Soko.[153] It will be concentrated on horticulture which grows in specific regions in Rwanda. For a calculation as correctly as possible, an average price will be used. The calculation mainly concentrates on the year 2019 however, when only some data from 2019 were available the price range was extended to 2018. Secondly, costs for additional water supply will not be considered as there are no data available when a water supply is needed and when not. In Rwanda rainfall patterns are becoming more irregular and unpredictable with shorter rainy seasons.[154] Moreover, there is no information available how much it would cost to add water or if the farmers would have an own well or would receive it from the state. Thirdly, there is no cost calculated for fertilizer because a calculation of the fertilizer would go beyond the scope of this thesis. Furthermore, no costs for seeds will be considered because there is only limited information about accessible seed prices[155]. Additionally water, fertilizer and seed consumption occur if the farmers transport their products by bus as well as when they sell them to wholesaler and a comparison is not necessary. Therefore the costs for these three aspects are excluded. It will also be assumed that the cultivated land is the property of the farmer and no rent must be paid. This is quite likely as 60 % of people working in the agricultural sector cultivate their own land in Africa.[156] To validate if farmers could live from the possible profit of selling agro-products the average living wage for families in Rwanda is considered. The living wage for families was 219,000.00 RWF/Month in the year 2018.[157] As a cooperative consists of minimum seven people the profit has to be high enough for seven families, 1,533,000.00 RWF/Month. In the following it will be calculated with the living costs for a whole year 18,396,000 RWF/year. Lastly, the capacity of the bus must be considered. Like Thünen explained in his Theory, the transport costs are proportional to the weight of the agro-products. In Rwanda different busses are used. The transport company Ritco Ltd uses coaches with

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151 *Dijk, N. van/Dijkxhoorn, Y./Merrienboer, S. van,* SMART Tomato Supply Chain analysis for Rwanda (2015), p. 13.

152 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

153 ibid.

154 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 17.

155 Only seed prices for onions were available.

156 *Der Kontext,* Digitalisierung in Afrika, https://www.derkontext.com/thema/digitalisierung-afrika#m=6/1349.03081/211.43881,p=25, accessed 15 October 2019.

157 *Trading Economics,* Rwanda Living Wage Family, https://tradingeconomics.com/rwanda/living-wage-family (effective: 2018), accessed 15 October 2019.

57-seats.[158] Those busses have a capacity of 12 m³. A part of this will be used by other passengers for their luggage. It can be said that ¼ or 3 m³ can be packed with fruits and vegetables.[159] Other used busses are so-called midi-busses often from Toyota[160] with a capacity of 2-3 m³. For the calculation a capacity of 3 m³ will be assumed. For an easier comparison of the weight of agro-products with the capacity of busses the m³ will be convert into kg. 1 m³ is the same as 1,000 litre, 1,000 litre is similar to 1,000 kg therefore 3 m³ is 3,000 kg. A bus can transport 3,000 kg.

After pondering the fruits and vegetable offered at e-Soko and the available information about cultivation possibilities the following fruits and vegetables will be used for the calculation: peas, beans, onions, strawberries, papayas, pineapples and mangoes. In the North, West and South region onions and strawberries are mainly growing. In the East part of the country papayas, pineapples and mangoes are cultivated. Beans and peas are cultivated and harvested in every region.[161] Tomatoes were not included because some bus transport companies do not transport tomatoes.[162] The transport costs base on tariffs from RURA which published prices for public transport prices in 2018. RURA has the power to set up tariffs according to Law No. 09/2013 of 01/03/2013 article 7, considering the interest of consumers and investors and the costs of producing the special product and service. The aim is to promote competitive tariffs and to attract more customers without distorting market growth and profitability. Considering those directives it can be assumed that the tariffs were calculated in cooperation with the bus transport companies to cover their costs and that the prices comply with the income of the rural population. Per route the tariff in RWF were divided by the kilometres needed for the route, researched with google maps (created by bus-planted.org)[163]. Afterwards an average price of every route were calculated. The average RWF/km is 23 km. No numbers after the comma were considered because the calculation with google maps is not accurate enough and there are sometimes outliers. There are no specific price differences between the provinces of Rwanda and between the road conditions (paved or unpaved, national or district road).

The selected markets are in bigger cities in every province of Rwanda: Butare (South) with 20,001 inhabitants, Byumba (North) with 36,997 inhabitants, Kibungo (East) with 28,688 inhabitants, Kibuye (West) with 15,519 inhabitants and the market Kimironko in Kigali with 59,312 inhabitants in 2012[164]. The position of the farm will be selected with the help of figure 8 and the available bus transport data. The production place for pineapple will guide the place for papayas and mangoes as they have the same prerequisites for harvesting. Strawberries are cultivated at the same place as onions. The farm where

158 *Veerkamp, J./Buses World Wide,* Rwanda Regional Bus Services, http://www.bus-planet.com/aworldofbuses/buses-in-africa-nw/rwanda/rw-regional/ (effective: mid-2016), accessed 15 October 2019.

159 *Memo with Mr. Ralf Behrens*, Wagener & Herbst Consultants GmbH, 16 September 2019.

160 *Veerkamp, J./Buses World Wide,* Rwanda Regional Bus Services, http://www.bus-planet.com/aworldofbuses/buses-in-africa-nw/rwanda/rw-regional/ (effective: mid-2016), accessed 15 October 2019.

161 *NISR,* Seasonal Agricultural Survey 2018 annual report (2018), p. 60ff.

162 *Ritco*, Luggage, https://www.ritco.rw/services/asset-recovery-2/ (effective: 2018), last accessed 15 September 2019.

163 *Google Maps/Veerkamp, J./Buses World Wide*, Rwanda regional bus transport, https://www.google.com/maps/d/viewer?mid=1RjEPyPVqdDvtq_t2yh--J_rgWdY&ll=-1.3635281999999808%2C30.36516879999992&z=8 (effective 2016), last accessed 15 September 2019.

164 *NISR,* ProvisionalResuts_Sector, http://www.statistics.gov.rw/search/google/butare (2012), accessed 15 October 2019.

peas and beans will be cultivated will be in a province where no already selected farms are located and connected with the route at google maps.

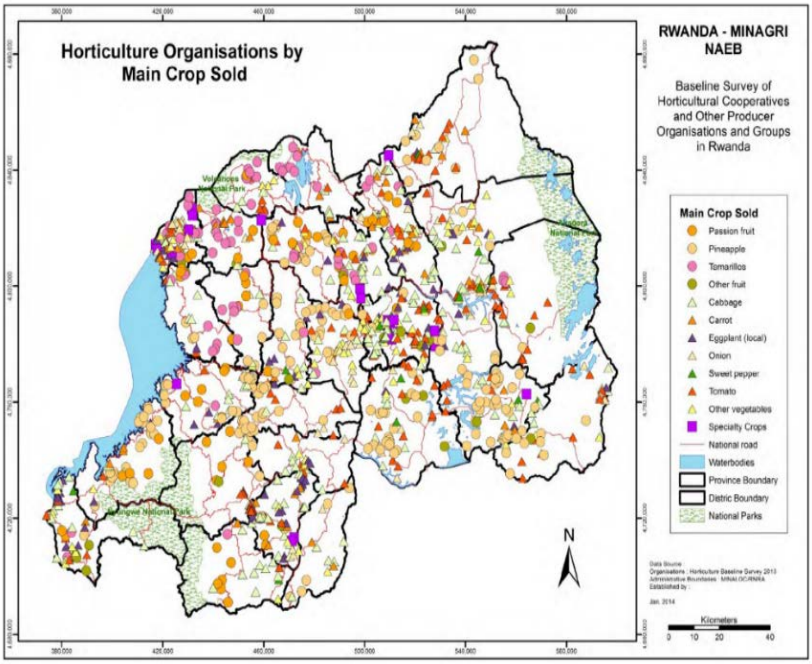

Figure 7: Horticulture Organisations by Main Crop Sold[165]

Onions and strawberries grow in Kamembe and pineapples, mangoes and papayas in Gatore. Beans and peas grow in Gisagara.

6.2 Calculation by the example of the market Kimironko

In the following part the calculation of the market Kimironko and a valuation of the demand of each product will be explained.

It starts with mangoes. According to Google Maps the distance from Gatore to Kimironko is 121 km multiplied with 23 RWF/km yields a value of 2783 RWF as transport costs. The average price of mangoes is 1,105 RWF/kg[166] in 2019 whereof the farmer receive 719 RWF/kg. This price is a little bit higher than usually because there is currently a lack of mango supply.[167] As there is no indication that the prices will decrease soon the price from 2019 will be used. The wholesaler pays for one mango 320 RWF/kg (1,105 * 29% = 320). For making no losses with the transport by bus at least 3.9 kg mangoes have to be sold at the market (figure 10). If the price with the wholesaler is compared to the incomes with the bus transport the transport by bus is more profitable after 7 kg of mangoes. A mango has an average weight of 500g[168] which means that for one bus journey the farmers need to transport at least 14 mangoes (7 * 2 = 14).

165 *Clay, D./Turatsinze, J.,* Baseline report on the Rwanda Horticulture Organization Survey (RHOS) (2014), p. 79.

166 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

167 *Dieu Nsabimana, J. de*, Declining mango production worries local fruit vendors, https://www.newtimes.co.rw/business/declining-mango-production-worries-local-fruit-vendors (effective 8 September 2019), 15 October 2019.

168 ibid.

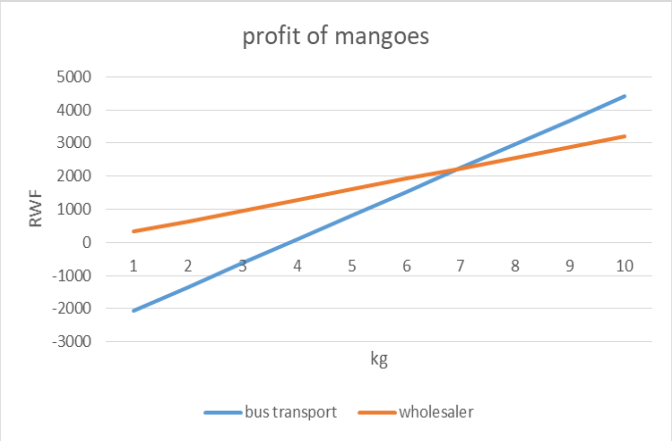

Figure 8: profit of mangoes[169]

To gain a profit as high as the living costs of 18,396,000 RWF/year the farmer needs to sell 25,586 kg mangoes (719 RWF/kg * 25,586 kg = 18,396,000 RWF). 25,586 kg multiplied with 2 (one mango = 500 g) yields to 51,172 mangoes per year. One bus can transport 3,000 kg this means that for 25,586 kg mangoes there has to be 6 bus journeys (25,586 / 3,000 = 9). This bus transport has to be paid as well. To pay 9 journeys with costs of 2,783 RWF each, 35 kg mangoes has to be sold (9 * 2,783 = 35 * 719). These extra mangoes need to be transported as well which means that now 25,621 kg mangoes have to be transported (25,586 + 35 = 25,621). 25,621 kg divided through 3,000 yields again to 9 journeys. Applying the theory of Thünen, there is a market price of 1,105 RWF/kg minus 35 % multiplied with 25,621 kg mangoes minus the distance of 121 km multiplied with 6 and the costs of 23 km/h yields to a profit of 18,396,000 RWF. However, it is questionable if the farmers harvest 2,775 mangoes per day (25,621 / 9 = 2,847) or at least 14 mangoes to pay the bus transport. Farmers in Rwanda report that they harvest tonnes of mangoes if they have trees resistant against diseases. For example the mango farmer Marie-Claire Ntabana "*from the Nyagatare District in the Eastern province […] has 1,415 active mango trees on 10 hectares where she harvests around 150,200 tonnes per season*".[170] Considering such reports there will be probably no problems to harvest enough mangoes from the trees to cover more than 6 journeys. The distance between farm and market could even be higher. Furthermore, a mango tree can help to reduce soil erosion[171]. Questionable is if the transportation of mangoes by bus has an advantage over the transport with wholesaler. The farmers would receive 320 RWF/kg from the wholesaler. Thus, the farmers would get 8,198,720 RWF for 25,621 mangoes (320 * 25,621 = 8,198,720) which is far less than the 18,396,000 RWF that the farmers have as a surplus with the other transportation.

In the following, the transport of pineapples will be examined. The average price of pineapples is 681 RWF/kg in 2019[172] whereof the farmers receive 443 RWF/kg (681 – 35% = 443). The price of the wholesaler for pineapples is 197 RWF/kg (681 * 29% = 197). Not to make losses with the bus transport the farmers have to sell at least 6.3 kg. In comparison with the wholesaler the bus transport is more profitable when the farmers

169 Own figure.

170 *Dieu Nsabimana, J. de*, Declining mango production worries local fruit vendors, https://www.new-times.co.rw/business/declining-mango-production-worries-local-fruit-vendors (effective 8 September 2019), 15 October 2019.

171 A lot of farmers have problems with soil erosion in Rwanda.

172 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

sell at least 11.4 kg which is 5 pineapples. One pineapple weighs 1 - 4.5 kg[173], it will be calculated with 2.5 kg.

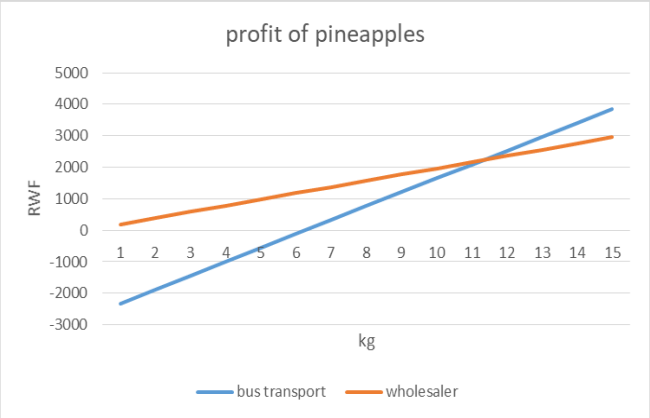

Figure 9: profit of pineapples[174]

The living costs of 18,396,000 RWF divided by 443 RWF/kg yields to 41,526 kg. 41,526 kg are 16,611 pineapples (41,526 / 2.5 = 16,611), one pineapple is one plant. For 41,526 kg the farmers need 14 bus journeys (41,526 / 3,000) and to pay the 14 bus journeys 88 kg of pineapples must be sold additionally (14* 2,783 = 443 * 88). Hence, 41,614 kg (16,646 pineapples) needed to be sold. Applying the theory of Thünen there is a market price of 681 RWF/kg minus 35% multiplied with 41,614 kg pineapples minus the distance of 121 km multiplied with 14 and the costs of 23 km/h yields to a profit of 18,396,000 RWF. It is to be analysed if that many pineapples plants would have enough space on the farms. A farm has an average size of 0.6 hectare[175] which means 77 x 77 m assumed that the farm is a square. The pineapples need a distance of 3 feet[176] or 1.5 m. 16,646 pineapples multiplied with 1.5 m yields to 24,969 m². The seven farms altogether have 41,503 m² (77 * 7 * 77 = 41,503) which is enough space for the 16,646 pineapples, e.g. as a fence around the field. A problem of pineapples are that they need more space than mangoes and that the demand for fresh pineapples is low[177]. Thus, it is questionable if the farmers can sell their pineapples. Perhaps pineapples should only be cultivated at farms near the market. Nevertheless, compared to the current situation the farmers will make more money with the bus transport as with the wholesaler. 197 RWF/kg multiplied with 41,614 kg yields to 8,197,958 RWF which is again far less than the 18,396,000 RWF.

The last fruit to be transported from Gatore is papaya. The price for papayas is 514 RWF/kg[178] whereof the farmer receives 334 RWF/kg (514 * 35% = 334), the wholesaler pays 149 RWF/kg (514 * 29% = 149). The farmers have to sell 8.4 kg papayas to make profits with the bus transport. Comparing the bus transport and the sale to wholesaler

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173 *Biologie-Schule.de,* Ananas, http://www.biologie-schule.de/ananas.php (effective: 2018), accessed 15 October 2019.

174 Own figure.

175 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 224.

176 *Palomo, E.,* How far apart should pineapples be planted?, https://homeguides.sfgate.com/far-apart-should-pineapples-planted-74122.html (2018), accessed 15 October 2019.

177 *Fortune of Africa,* Pineapples, https://fortuneofafrica.com/rwanda/pineapple/ (effective: 2016), accessed 15 October 2018.

178 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

the bus transport is more profitable when the farmers can sell 15.1 kg papayas which is 8 papayas. One papaya has a weigh of around 2 kg depending on the variety.[179]

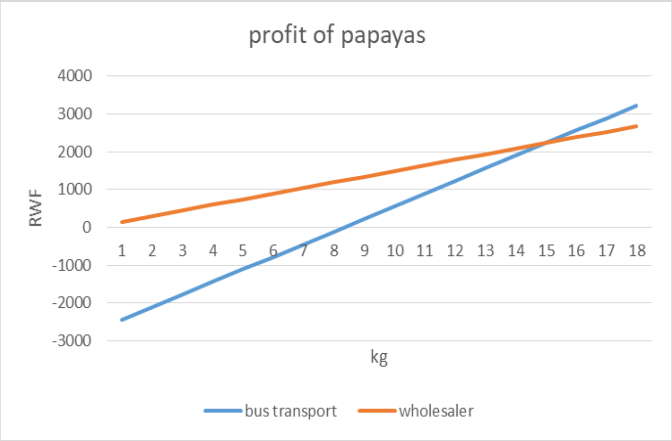

Figure 10: profit of papayas[180]

According to the calculations above the farmers has to sell 55,078 kg papayas to gain the living costs (334 * 55,078 = 18,396,000). 55,078 kg are 27,539 papayas. It needs 19 bus journeys to transport 55,078 kg (55,078 / 3,000 = 19). To pay the 19 bus journeys the farmers have to sell additionally 159 kg (19 * 2,783 = 334 * 159) which can be transported within the 19 bus journeys (55,078 + 159 = 55,237 / 3,000 = 19). Applying the formula of Thünen, a market price of 514 RWF/kg minus 35 % multiplied with 55,078 kg papayas minus the distance of 121 km multiplied with 19 journeys and the costs of 23 RWF/km yields to a profit of 18,396,000 RWF. There is no accurate calculation about how much papayas grow on one tree available. However, to transport at least 8 papayas on one bus journey should be possible. Comparing the bus transport with the transport of the wholesaler the farmers will make more money with the bus transport. 149 RWF/kg multiplied with 55,237 kg yields to a value of 8,230,313 RWF which is less than 18,396,000 RWF.

The agro-products onions and strawberries will to be transported from Kamembe in West-Rwanda. The distance from Kamembe to Kimironko amount to 246 km multiplied with 23 RWF/km yields to 5,658 RWF. The average price of onions in Kimironko is 626 RWF/kg[181] whereof the farmers receive 407 RWF/kg (626 * 35 % = 407), from the wholesaler the price is 181 RWF/kg (626 * 29 % = 181). The farmers have to sell at least 14 kg onions to evade losses. In comparison with the transport of wholesaler the bus transport is more profitable when the farmers sell at least 25.1 kg which means 122 onions. A medium sized onion with the size of 7.6 cm has a weight of 206 g.[182]

179 *National Horticulture Board,* Papaya, http://nhb.gov.in/pdf/fruits/papaya/pap012.pdf, accessed 15 October 2019.

180 Own figure.

181 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

182 *National Onion Association,* Cutting, Preparation Tips and More, https://www.onions-usa.org/foodservice/cutting-preparation-tips-and-more (effective: 2011), accessed 15 October 2019.

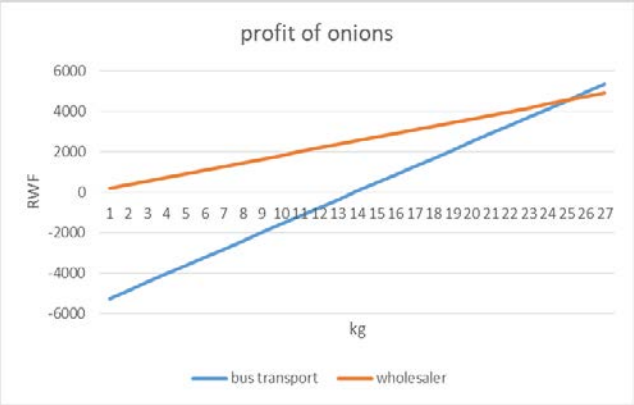

Figure 11: profit of onions[183]

To gain the living of costs of 18,396,00 RWF, 45,120 kg (219,030 onions) have to be sold (407 * 45,120 = 18,396,000). To transport the onions the bus has to drive 16 times (45,120 / 3,000 = 16). Additionally 223 kg has to be sold to be able to pay the bus transport (16 * 5,658 = 407 * 223) which can be transported as well within 16 bus journeys (45,120 + 223 = 45,343 / 3,000 = 16). Applying the formula of Thünen, a market price of 626 RWF/kg minus 35 % multiplied with 45,343 kg onions minus the distance of 246 km multiplied with 16 journeys and the costs of 23 RWF/km yields to a profit of 18,396,000 RWF. From the wholesaler the farmers would receive for the 45,343 kg 8,207,083 RWF which is less compared to which can be received with the bus transport. Onions are often essential in every dish and therefore a demand for onions will probably not end. Onions have to be planted around 12.7 cm apart[184] which means that enough space is available at the farms (219,030 onions * 12.7 cm = 2,781,681 cm = 27,816.81 m < 41,503 m available at one farm).

Strawberries are the second fruit to transport from Kamembe to Kimironko. It has a price of 1,974 RWF/kg[185] whereof the farmers receive 1,283 RWF/kg. The wholesaler pays 572 RWF/kg (1,974 * 29% = 572). To make no losses with the bus transport the farmers have to sell at least 4.5 kg of strawberries. The wholesaler is less profitable than the bus transport when the farmers can sell 8 kg (667 strawberries). A medium strawberry has a weight of 12 gram.[186]

At least 14,339 kg strawberries have to be sold to gain the living costs of 18,396,000 RWF. This amount of strawberries can be transported in 5 bus journeys (14,339 / 3,000 = 5). The 5 bus journeys are paid when 23 kg strawberries are sold on the market (5 * 5,658 = 1,283 * 23). The 23 kg can be transported in the 5 bus journeys as well (14,339 + 23 = 14,362 / 3,000 = 5). Applying the formula of Thünen, a market price of 1,974 RWF/kg minus 35 % multiplied with 14,362 kg strawberries minus the distance of 246 km multiplied with 5 journeys and the costs of 23 RWF/km yields to a profit of 18,396,000 RWF. The wholesaler would pay 8,215,064 RWF for the 14,362 kg. Based on the high

183 Own figure.

184 *The old Farmer's Almanac,* Growing onions, https://www.almanac.com/plant/onions (effective: 2017), accessed 15 October 2019.

185 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

186 *Strawberry Plants.org,* Strawberry Serving, https://strawberryplants.org/strawberry-serving/ (effective: 2019), accessed 15 October 2019.

price it can be assumed that strawberries are quite popular and/or the supply is insufficient. Strawberries are especially requested for processed food[187]. However, the cultivation of strawberries is elaborate.

Figure 12: profit of strawberries[188]

The last two agro-products beans and peas will be transported from Gisagara in the Southern part of Rwanda. From Gisagara to Kimironko is a distance of 158 km multiplied with 23 RWF/km yields to 3,634 RWF. The price of beans amounts to 607 RWF/kg[189] whereof the farmers receive 395 RWF/kg (607 * 35 % = 395). The wholesaler pays 176 RWF/kg (607 * 29% = 176). The farmers have to sell at least 9.2 kg beans to make no losses. In comparison with the sale to wholesaler the transport by bus is more profitable when the farmers sell at least 16.6 kg.

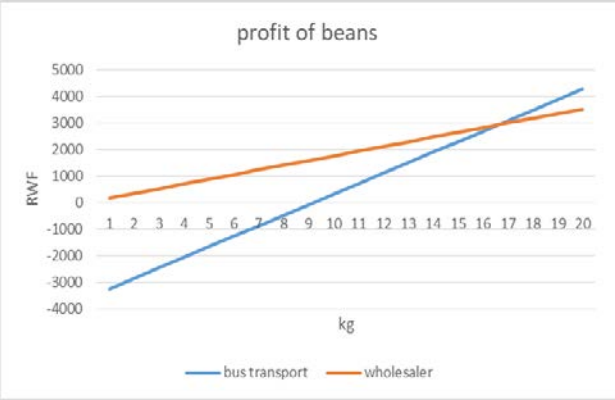

Figure 13: profit of beans[190]

To gain the living costs 46,573 kg beans have to be sold (395 * 46,573 = 18,396,000) and transported in 16 bus journeys (46,573 / 3,000 = 16). To pay the 16 bus journeys 148 kg beans have to be sold additionally (16 * 3,634 = 395 * 148) which can be transported within the 16 bus journeys (46,573 + 148 = 46,721 / 3,000 = 16). Applying the formula of Thünen, the market price of 607 RWF/kg minus 35 % multiplied with 46,721 kg beans minus the distance of 158 km multiplied with 16 journeys and the costs of 23

187 *Ntirenganya, E.*, Audit reveals gaps in fruit and vegetable processing, https://www.newtimes.co.rw/news/audit-reveals-gaps-fruit-and-vegetable-processing (effective: 21.07.2019), accessed 15 October 2019.

188 Own figure.

189 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

190 Own figure.

RWF/km yields to a profit of 18,396,000 RWF. The wholesaler would only pay 8,222,896 RWF. Beans are staple food, especially with climbing beans the farmers can improve their life as they are fertile.[191]

The price for peas is 1,172 RWF/kg[192] whereof the farmers receive 762 RWF/kg and the wholesaler pays 339 RWF/kg (1,172 * 29% = 339). To avoid losses the farmers have to sell at least 4.8 kg peas. In comparison with the price of the wholesaler the bus transport is more profitable when 8.6 kg peas are sold.

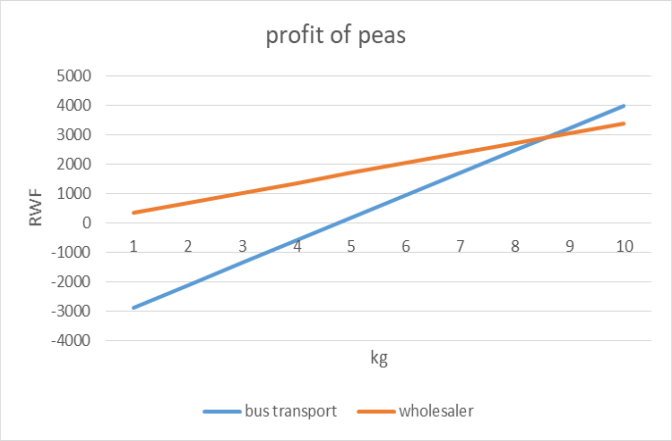

Figure 14: profit of peas[193]

24,142 kg peas have to be sold to gain the living costs of 18,396,000 RWF (762 * 24,142 = 18,396,000). Those peas can be transported in 9 bus journeys (24,142 / 3,000 = 6). The 9 bus journeys are paid when 43 kg peas are sold at the market (9 * 3,634 = 762 * 43). The 19 kg can be transported within the 6 bus journeys (24,142 + 43 = 24,185 / 3,000 = 9). Applying the formula of Thünen, the market price of 1,172 RWF/kg minus 35 % multiplied with 24,185 kg peas minus the distance of 158 km multiplied with 9 journeys and the costs of 23 RWF/km yields to a profit of 18,396,000 RWF. The wholesaler would pay for the 24,185 kg 8,198,715 RWF. Peas also belong to the staple food and especially green peas are eaten by Rwandans as they are quite healthy[194].

6.3 Evaluation

After calculating all five markets with each agro-product the results will be compared and conspicuously explained in the following. However, it should be kept in mind that this evaluation is only a ‘snapshot’ with prices of 2019/2018. Trends and developments were considered but there can be unexpected changes in the future. As expected most market prices increase when the transport distance increases as well. The best examples are the prices for pineapples. The lowest prices can be found at the market Kibungo in the east part of Rwanda where pineapples grow. Papayas have the same situation. On the other hand, onions are most expensive in Kibungo located in eastern Rwanda, where the conditions for onions are not the best and the transport distance is the highest one.

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191 *The Guardian*, Climbing beans improve life for Rwandan farmers - in pictures, https://www.theguardian.com/global-development/gallery/2012/apr/27/climbing-beans-rwanda-in-pictures (effective: 27 April 2012), accessed 15 October 2019.

192 *MINAGRI,* esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

193 Own figure.

194 *Atiendo, L.*, The fascinating health benefits of green peas, https://www.newtimes.co.rw/health-fitness/fascinating-health-benefits-green-peas (effective: 21 May 2018), accessed 15 October 2019.

There the trade is probably not so distinct because the distance is too high. As the gravity model explained: high distance means less trade. Moreover, beans, which grow everywhere have more or less the same price level at all markets. At all markets, except Kimironko the impact of the transport costs can take full effect. Kimironko has in general higher prices than other markets. In the south, where the beans come from in this calculation is the lowest price and the lowest break-even point[195] where the bus transport is profitable. In general every product has the lowest break-even point where the distance is shortest one. In that case a transport to markets further afar is not reasonable. Interesting is the market Butare where papayas have the second highest price and the highest break-even point (16.5 kg). This indicates that the demand for papayas is not that high or the supply is too high. The highest break-even point have pineapples at the market Kibuye (18.48 kg). Regarding mangoes it should also be mentioned that the high price of mangoes due to a lack of supply at the market Kimironko did not reach every market in Rwanda yet. Currently, the price at Kimironko is the highest one. Assumingly the price at other markets will increase in the future as well. Therefore a specialization on mangoes seems profitable. Strawberries are quite expensive too with 800 RWF/kg in Butare, 3,137 RWF/kg in Byumba and 1,974 RWF/kg in Kimironko. This encourages the assumption that strawberries are popular and/or the supply is rare in Rwanda. The popularity and insufficient supply could also be a reason why the price for peas at the market Kibungo is so high. With 1,213 RWF/kg is this price an outlier. Another interesting point is that with a short distance and a low market price the farmers have to sell more kilograms of their agro-products as when they would sell the products at markets with a longer distance. For example the farmers have to sell 63,264 kg pineapples at the market Kibungo with a distance of 27 km and only 28,859 kg at the market Butare with a distance of 194 km. The price at the markets with higher distances have such high prices that it compensates the transport costs. In that case a sale at markets further afar would be profitable.

In summary it can be said that the concept to transport the agro-products by bus is faster more profitable than the current concept with the wholesaler. Especially, as the farmers are freer to change their prices to be more competitive with agro-products from neighbouring countries. They gain bargaining power with the retailer at the market where they can sell their agro-products cheaper to them if the competition is too high. In this calculation the agro-products were evaluated separately because for a mixed calculation the exact demand for the agro-products would be needed. In this case only a rough assumption about demand could be made. The farmers should offer a mix of different products to be secure against price or demand fluctuation. But as it is often enough to transport some kilograms that the bus transport is profitable there should be no problem to transport profitably a mix of the products. However, somehow this concept has to be financed.

7 Financing

As already mentioned one important problem is still the lack of agricultural finance.[196] Whereas especially young people have inadequate access to financial services.[197] There

195 In the following the break-even point is always the amount when the bus transport is profitable.

196 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 227.

197 *MINAGRI,* Annual Report FY 2016-2017 (2017), p. 32f.

are different options to receive financial aid. For some options the farmers can help themselves by receiving micro-loans, for others the project as a whole can be supported. The first financial aid can come from Umurenge Savings and Credit Co-operatives (SACCOs). It was established in 2008 and should help to boost up rural savings and provides loans to their members.[198] An Umurenge is an administrative sector.[199] Umurenge SACCOs offer basic microfinance services to its members. Those products and services differ from one SACCO to another but in general there are deposit products like current account and time deposit as well as retail loans for transportation (motorbike/bicycle) or commerce.[200] If the farmers of the cooperative are members of a SACCO this microfinance could help them to purchase transport boxes or cooling storages and received money could be stored at those bank accounts. According to RCA there are 484 SACCOs in all provinces in Rwanda.[201] The agriculture cooperative could also form a Savings and Credit Co-operative. However, both cooperatives should be strictly separated and an auditing organ must be formed so that no corruption could occur. An advantage could be that over the time the agriculture cooperative could pay the farmers money on the current account from the SACCO and the saved money on the SACCO could be used for investments of the agriculture cooperative. The SACCO can also borrow money from the Business Development Fund (BDF). The BDF offers SACCOs a loan with the aim to increase SACCOs' capacity in lending money to as many Rwandan as possible.[202] This loan could be used as a start capital. However, the RCA has to teach the farmers how to form a SACCO.

Secondly, the BDF promotes small and medium-sized enterprises to gain financial access, particularly those without sufficient collateral to obtain credit from traditional financial institutions at reasonable rates.[203] This institution offers a program to promote investments in growing horticulture in special districts: Musnaze, Gatsibo, Kayonza, Ngoma, Nyagatare, Kirehe, Nyabihu, Rubavu, Muhanga, Ruhango, Nyanza and Kamonyi. The program supports among other things transportation and packaging materials.[204]

One possible non-governmental organisation (NGO) could be the International Fund for Agricultural Development (IFAD). This NGO is already working in Rwanda through several projects. The IFAD helps to reduce poverty by empowering poor rural men and woman to participate in transforming the agriculture sector and in rural development and by reducing their vulnerability to climate change.[205] Although the NGO is not working directly together with cooperatives the cooperative can contact IFAD-funded projects under MINAGRI. The head of the cooperative could also contact Mr. Emmanuel Gisagara.[206]

198 *RCA,* UMURENGE SACCOS, http://www.rca.gov.rw/about-sacco/umurenge-sacco/#.XWELMW5uLD4 (effective: 2018), accessed 15 October 2019.

199 ibid.

200 *RCA*, Products & Services, http://www.rca.gov.rw/about-sacco/products-services/#.XaW7JG5uLD4 (effective: 2018), accessed 15 October 2019.

201 *RCA*, Documents, http://www.rca.gov.rw/publications/list-of-cooperatives-registered-so-far/#.XaW76G5uLD4 (effective: 2018), accessed 15 October 2019.

202 *BDF*, Background, https://www.bdf.rw/bdf-profile/ (effective: 2017), accessed 15 October 2019.

203 *BDF*, Grants, https://www.bdf.rw/grants/n (effective: 2017), accessed 15 October 2019.

204 ibid.

205 *IFAD*, Rwanda, https://www.ifad.org/en/web/operations/country/id/rwanda (effective: 2019), accessed 15 October 2019.

206 Memo with Mr. Ntukanyagwe, Country Programme Officer, IFAD, 28 August 2019.

Another option could be the Global Agriculture and Food Security Program (GAFSP). GAFSP is a global partnership formed to fight hunger, malnutrition and poverty by supporting resilient and sustainable agriculture in developing countries among them Rwanda.[207] Donors are Bill & Melinda Gates Foundation, Canada, the Republic of Korea, Spain, the United States, Australia, Germany, Ireland, Japan, the Netherlands and the United Kingdom.[208] Furthermore, they cooperate with the International Finance Corporation (IFC).[209] The organization has different funds for government support and in cooperation with private companies. The last one is the Private Sector Window which supports projects that are aimed to improve the livelihood of smallholder farmers through blended finance solutions and concessional funding. Blended finance solutions crowd in private sector to finance projects with high development impact that otherwise would not be possible - typically from development partners alongside with commercial funding.[210] The organisation partners with companies who include smallholder farmers in their value chain, providing access to markets, financing, storage and increasing production and incomes for those living and working in the world's lowest income countries. Additionally, they offer advice and technical support in agriculture.[211]

Another NGO which is already working in Rwanda is the One Acre Fund. Next to improved seed on credit they also offer training in agriculture and bargaining.[212]

With the financial support of these associations the cooperative can pay the farmers directly and bridge the time until they receive the money from the market.

8 Conclusion

In principle the concept to transport agro-products by bus is profitable for the farmers and can be realized quickly. Therefore, the life of farmers in Rwanda can be improved with this concept and young people attracted. Even single farms could gain an advantage with the bus transport as only a small amount of agro-products have to be transported not to make losses.

But the bus transportation will be a rearrangement for the farmers. They are stronger if they join together which means a new form of coordination for the farmers. They need to learn how to work together. The RCA should be contacted to educate the farmers. Moreover, the farmers need a solution how to secure the transport of the agro-products. Furthermore the knowledge of farmers about market trade should be improved that they can better bargain with the market trader. There the farmers could receive help from e.g. the NGO “One Acre Fund”. In addition farmers need improved seeds and fertilizer. Without them the farmers will not be able to cultivate competitively. Then the farmers need to buy a transportation box e.g. from the loan of a SACCO and contact the bus company (the companies have telephones numbers on their websites).

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207 *GAFSP,* Private Sector Window, https://www.gafspfund.org/private-sector-window (effective: 2018), accessed 15 October 2019.

208 *GAFSP*, Work with us, https://www.gafspfund.org/work-with-us (effective: 2018), accessed 15 October 2019.

209 ibid.

210 *GAFSP*, Private Sector Window, https://www.gafspfund.org/private-sector-window (effective: 2018), accessed 15 October 2019.

211 ibid.

212 *One Acre Fund,* Our Mission, https://oneacrefund.org/what-we-do/our-model/ (effective: 2019), accessed 15 October 2019.

Difficulties could arise due to the middle man (wholesale trader) who currently picks up the agro-products. It will be a risk for the farmers to loose contact with the middle man also depending on the market power of him. As a hedge farmers could sell the middle man a little bit of the agro-products while the rest is transported by bus. Hence, a trust in the new concept can be build up without demanding that the farmers will have to give up their original supply chain immediately. Furthermore, the option to transport the agro-products by bus could help farmers when the middle man has no space left for further products or the middle man is not coming to the farm at all.

Important is that the road network will be improved. For farms near the main corridors of the bus network it will be easy to use the busses but for distant farms it can be difficult with unpaved roads. Additionally, the roads have to be weatherproofed and not unused by the next raining season.

Moreover, due to increased purchasing power of farmers, the demand for local goods and services increases and reduce unemployment in the area.[213]

In the long run farmers can even participate in international trade. The requirements are good for the farmers. Rwanda has already a comparative advantage in the sale of vegetables and food production in comparison to its neighbouring countries in the East African Community.[214] Then the farmers could use the existing country connecting bus services and expand their trade.

Lastly, the transportation of agro-products bus can be a realistic solution to connect farmers with markets. Nevertheless, further surveys and field test in Rwanda will be necessary to be able to make a last assessment.

References

Adewole, Adebisi/Struthers, John J. (editor), Logistics and global value chains in Africa, The impact on trade and development, Palgrave studies of sustainable business in Africa, Cham, Switzerland 2019.

Arvis, Jean-Francois/Ojala, Lauri/Wiederer, Christina/Shepherd, Ben/Raj, Anasuya/Dairabayeva, Karlygash/Kiiski, Tuomas, Connecting to Compete 2018, Trade Logistics in the Global Economy, The World Bank, Washington 2018, https://lpi.worldbank.org/report, accessed 15 October 2019.

Atiendo, Lydia, The fascinating health benefits of green peas, The NewTimes 2018, https://www.newtimes.co.rw/health-fitness/fascinating-health-benefits-green-peas, accessed 15 October 2019.

Bathelt, Harald/Glückler, Johannes, Wirtschaftsgeographie, Ökonomische Beziehungen in räumlicher Perspektive, 4th edition, UTB 8217, Stuttgart 2018.

Biologie-Schule.de, Ananas, Steckbrief 2018, http://www.biologie-schule.de/ananas.php, accessed 15 October 2019.

Business Development Fund (BDF), Background, 2017 https://www.bdf.rw/bdf-profile/, accessed 15 October 2019.

Business Development Fund (BDF), Grants, 2017, https://www.bdf.rw/grants/, accessed 15 October 2019

213 *RWANDA, GOVERNMENT OF/WORLD BANK GROUP,* FUTURE DRIVERS OF GROWTH IN RWANDA (2018), p. 39.

214 ibid., p. 102.

Central Corridor Transit Transport Facilitation Agency, Performance Monitoring Report, January - December 2018, 10 May 2019, http://centralcorridor-ttfa.org/e-resources/, accessed 15 October 2019.

Clay, Daniel/Turatsinze, Juvénal, Baseline report on the Rwanda Horticulture Organization Survey (RHOS), AGRER Consortium, March 2014, https://www.canr.msu.edu/csus/uploads/458/49149/Baseline_Report.EU.RwandaHortSurvey.v15.with_Annexes.FINAL.pdf, accessed 15 October 2019.

Climbing beans improve life for Rwandan farmers - in pictures, The Guardian 27 April 2012, https://www.theguardian.com/global-development/gallery/2012/apr/27/ climbing-beans-rwanda-in-pictures, accessed 15 October 2019.

Crisafulli, Patricia/Redmond, Andrea, Rwanda Inc, How a devastated nation became an economic model for the developing world, Basingstoke, Hampshire 2014.

Der Kontext, Digitalisierung in Afrika, https://www.derkontext.com/thema/digitalisierung-afrika#m=6/1349.03081/211.43881,p=25, accessed 15 October 2019.

Dieu Nsabimana, Jean de, Declining mango production worries local fruit vendors, The NewTimes 8 September 2019, https://www.newtimes.co.rw/business/declining-mango-production-worries-local-fruit-vendors, accessed 15 October 2019.

Dijk, Niek van/Dijkxhoorn, Youri/Merrienboer, Siem van, SMART Tomato Supply Chain analysis for Rwanda, identifying opportunities for minimizing food losses, BoP Innovation Center; Wageningen University; TNO, 2015, http://www.bopinc.org/sites/www.bopinc.org/files/updates/smart_report_0.pdf, accessed 15 October 2019.

Economic Regulation Unit, Statistics in Transport Sector as of March of the Year 2019, Rwanda Utilities Regulatory Authority (RURA), https://rura.rw/fileadmin/Documents/transport/statistics/Transport_Statistics_Report_as_of_June_2019.pdf., accessed 15 October 2019

Fortune of Africa, Pineapples, 2016, https://fortuneofafrica.com/rwanda/pineapple/, accessed 15 October 2019.

Global Agriculture and Food Security Program (GAFSP), Private Sector Window, Private Sector Solutions for Helping Small Farmers, 2018, https://www.gafspfund.org/private-sector-window, accessed 15 October 2019.

Global Agriculture and Food Security Program (GAFSP), Work with us, 2018, https://www.gafspfund.org/work-with-us, accessed 15 October 2019.

Head, Keith, Gravity for Beginners, United Nation Conference of Trade and Development 2003, https://vi.unctad.org/tda/background/Introduction%20to%20Gravity%20Models/gravity.pdf, accessed 15 October 2019.

INROS LACKNER SE, Market Analysis of the Digitalization in the Transport/Logistics Sector in Rwanda, 2019, Project No. 81229591.

International Fund for Agricultural Development (IFAD), 2019, https://www.ifad.org/en/web/operations/country/id/rwanda, accessed 15 October 2019.

Kerkhoven, Peter Marrten/Hagman, Hans/Baarveld, Henk R./Elings, Anne/Hamel, Egbert, Floriculture for the Republic of Rwanda, Tierra B.V; Wagening UR Greenhouse Horticulture; SHER Ingénieurs-Conseil s.a., 2013, https://core.ac.uk/download/pdf/29209546.pdf, accessed 15 October 2019.

König, Dieter, Erosionsschutz in Agroforstsystemen, Möglichkeiten zur Begrenzung der Bodenerosion in der kleinbäuerlichen Landwirtschaft Rwandas im Rahmen standortgerechter Landnutzungssysteme, Mainzer geographische Studien H. 37, Mainz 1992.

Krugman, Paul R./Obstfeld, Maurice/Melitz, Marc J., International economics, Theory & policy, 11th edition, Harlow, England 2018.

Kuo, Lily, Rwanda is a landlocked country with few natural resources. So why is China investing so heavily in it?, Quartz 22 November 2016, https://qz.com/africa/827935/ rwanda-is-a-landlocked-country-with-few-natural-resources-so-why-is-china-investing-so-heavily-in-it/, accessed 15 October 2019.

Liefner, Ingo/Schätzl, Ludwig, Theorien der Wirtschaftsgeographie, 11th edition, Wirtschaftswissenschaften, Geographie 782, Paderborn u.a. 2017.

Milgrom, P. R./Roberts, J., Economics, organization and management, Upper Saddle River, N.J., London 1992.

Ministry of Agriculture and Animal Resources (MINAGRI), Annual Report FY 2016-2017, Republic of Rwanda, 2017, https://www.minagri.gov.rw/fileadmin/user_upload/documents/AnnualReports/Annual_Report_FY_2016-2017.pdf, accessed 15 October 2019.

Ministry of Agriculture and Animal Resources (MINAGRI), esoko, http://www.esoko.gov.rw/, accessed 15 October 2019.

Ministry of Infrastructure (MININFRA), Transport Sector Strategic Plan for EDPRS2, Kigali June 2013, http://www.minecofin.gov.rw/fileadmin/templates/documents/sector_strategic_plan/Transport__SSP_June_2013.pdf, accessed 15 October 2019.

Ministry of Trade and Industry (MINICOM), National Policy on Cooperatives in Rwanda, Toward Private Cooperative Enterprises and Business Entities for Socio-Economic Transformation, August 2018, http://www.rca.gov.rw/uploads/media/2019_03_20_Cooperative_Policy__ENGLISH.___5_.pdf, accessed 15 October 2019.

National Horticulture Board, Papaya, Varities, Ministry of Agriculture & Farmers Welfare, Government of India, http://nhb.gov.in/pdf/fruits/papaya/pap012.pdf, accessed 15 October 2019.

National Institute of Statistics of Rwanda (NISR), Labour Force Survey, Annual Report, December 2018, http://www.statistics.gov.rw/publication/labour-force-survey-report-december-2018, accessed 15 October 2019.

National Institute of Statistics of Rwanda (NISR), ProvisionalResuts_Sector 2012, http://www.statistics.gov.rw/search/google/butare, accessed 15 October 2019.

National Institute of Statistics of Rwanda (NISR), Rwanda Statistical YearBook 2018, December 2018, http://www.statistics.gov.rw/publication/statistical-yearbook-2018, accessed 15 October 2019.

National Institute of Statistics of Rwanda (NISR), Seasonal Agricultural Survey 2018 annual report, Republic of Rwanda, December 2018, http://statistics.gov.rw/publication/seasonal-agricultural-survey-2018annual-report, accessed 15 October 2019.

National Onion Association, Cutting, Preparation Tips and More, Yields & Conversions 2011, https://www.onions-usa.org/foodservice/cutting-preparation-tips-and-more, accessed 15 October 2019.

Ntirenganya, Emmanuel, Audit reveals gaps in fruit and vegetable processing, The NewTimes 21 July 2019, https://www.newtimes.co.rw/news/audit-reveals-gaps-fruit-and-vegetable-processing, accessed 15 October 2019.

Organisation for Economic Co-operation and Development (OECD), OECD-FAO agricultural outlook 2016-2025 2016, OECD-FAO Agricultural Outlook 2016, Paris [France] 2016, http://www.fao.org/3/a-i5778e.pdf, accessed 15 October 2019.

Organisation for Economic Co-operation and Development (OECD), OECD-FAO Agricultural Outlook 2019-2028, OECD-FAO Agricultural Outlook, Paris 08 July 2019, http://www.fao.org/3/ca4076en/ca4076en.pdf, accessed 15 October 2019.

One Acre Fund, Our Mission, Market-based strategies to fight rural poverty, https://oneacrefund.org/what-we-do/our-model/, accessed 15 October 2019.

Palme, Gerhard/Musil, Robert, Wirtschaftsgeographie, Das geographische Seminar, Braunschweig 2012.

Palomo, Eulalia, How far apart should pineapples be planted?, SFGate 2018, https://homeguides.sfgate.com/far-apart-should-pineapples-planted-74122.html, accessed 15 October 2019.

Perry, Alex, The Rift, A new Africa breaks free, London 2015.

Republic of Rwanda/Swedish International Development Cooperation Agency (Sida), Country profile - Rwanda 11 October 2017, http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/FEI_Country_profile_Rwanda.pdf, accessed 15 October 2019.

Rwanda Cooperative Agency (RCA), Documents, 2018, http://www.rca.gov.rw/publications/list-of-cooperatives-registered-so-far/#.XaW76G5uLD4, accessed 15 October 2019.

Rwanda Cooperative Agency (RCA), Products & Services, 2018, http://www.rca.gov.rw/about-sacco/products-services/#.XaW7JG5uLD4, accessed 15 October 2019.

Rwanda Cooperative Agency (RCA), UMURENGE SACCOS 2018, 2018, http://www.rca.gov.rw/about-sacco/umurenge-sacco/#.XWELMW5uLD4, accessed 15 October 2019.

Rwanda Interlink Transport Company Limited (Ritco), https://www.ritco.rw/, accessed 15 October 2019.

Rwanda Transport Development Agency (RTDA), Annual Report Fiscal Year 2017/2018, December 2018, https://www.rtda.gov.rw/fileadmin/templates/documents/Annual_Report_2017_2018_FINAL.pdf, accessed 15 October 2019.

Rwanda Utilities Regulatory Authority (RURA), RURA's Reponsibilities in road transport Regulation, 1. Road transport 2019, https://rura.rw/index.php?id=81, accessed 15 October 2019.

RWANDA, GOVERNMENT O. F./WORLD BANK GROUP, FUTURE DRIVERS OF GROWTH IN RWANDA, Innovation, integration, agglomeration, and competition, 2018.

Safaricom, M-Pesa Global, https://www.safaricom.co.ke/personal/m-pesa/do-more-with-m-pesa/m-pesa-global, accessed 15 October 2019.

Secretariat, Trade Policy Review, East African Community (EAC) WT/TPR/S/384, 13 February 2019, https://www.wto.org/english/tratop_e/tpr_e/tp484_e.htm, accessed 15 October 2019.

Stevenson, Angus, Oxford dictionary of English, Oxford reference online, [Oxford] 2011, https://www.lexico.com/en/definition/cooperative, accessed 15 October 2019.

Strawberry Plants.org, Strawberry Serving, 2019, https://strawberryplants.org/strawberry-serving/, accessed 15 October 2019.

The old Farmer's Almanac, Growing onions, Planting, Growing, and Harvesting Onions, How To Plant Onions, https://www.almanac.com/plant/onions, accessed 15 October 2019.

The Republic of Rwanda, 7 Years Government Programme: National Strategy for Transformation (NST 1), 2017-2024, http://www.minecofin.gov.rw/fileadmin/user_upload/NST1_7YGP_Final.pdf, accessed 15 October 2019.

The World Bank, International LPI 2018, https://lpi.worldbank.org/international/global, accessed 15 October 2019.

Thünen, Johann Heinrich von, Der isolierte Staat, in Beziehung auf Landwirtschaft und Nationalökonomie, 2nd Edition, Sammlung sozialwissenschaftlicher Meister XIII, Jena 1910.

Trading Economics, Rwanda Living Wage Family 2018, https://tradingeconomics.com/rwanda/living-wage-family, accessed 15 October 2019.

Transport Observatory Reliable Northern Corridor Performance Data, Northern Corridor Transport Observatory report, Enhanced Transport Efficiency of the Northern Corridor, 13th edition, 27 May 2019, file:///C:/Users/admin/Documents/Studium/Bachelorarbeit/Rwanda/Quellen%20Behrens/Central%20Corridor%20Transport%20Observatory%20Annual%20Report%202018%20.pdf, accessed 15 October 2019.

Veerkamp, John/Buses World Wide, Rwanda Regional Bus Services, bus-planet mid-2016, http://www.bus-planet.com/aworldofbuses/buses-in-africa-nw/rwanda/rw-regional/, accessed 15 October 2019.

world-statistics.org, total natural resources rents (% of GDP), https://world-statistics.org/index-res.php?code=NY.GDP.TOTL.RT.ZS?name=Total%20natural%20resources%20rents%20(%%20of%20GDP), accessed 15 October 2019.

Abgeschlossen Oktober 2019
www.logos-verlag.de unter ‚Zeitschriften'
www.w-hs.de/ReWir

Impressum: Westfälische Hochschule, Fachbereich Wirtschaftsrecht, August-Schmidt-Ring 10, D - 45665 Recklinghausen, www.w-hs.de/wirtschaftsrecht

Vertrieb: Logos Verlag Berlin GmbH
Comeniushof, Gubener Straße 47
10243 Berlin
http://www.logos-verlag.de