Assessing Agriculture-Tourism Linkages in Senegal: A Structure Path Analysis

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Abstract

In sub-Saharan Africa (SSA), in general, and Senegal, in particular, tourism has often been proposed as a pro-poor development strategy due to its intensive use of unskilled labour. However, few studies have examined the linkage between tourism and agriculture, which is still the principal sector for employment in many SSA countries. Using a Structure Path Analysis (SPA), this paper investigates how, in structural terms, an exogenous demand shock on the tourism industry affects the Senegalese agricultural sector. The SPA results show that one of the core sub-sectors of tourism *hotels and restaurants* has relatively weak linkages with suppliers of agricultural inputs. Staple crops is identified as the agricultural sub-sector that has the most significant impact on tourism. Food and beverage processing plays an indirect but important role in the way hotels and restaurants industry impacts agriculture. Our analysis provides robust evidence that tourism has the capacity to create opportunities for the farmers and local food supply chains through generating additional demand for food products Policy interventions looking to amplify the benefits that tourism can generate for agriculture, for the case of Senegal and comparable SSA countries, should focus on measures aiming at minimising imports of manufactured food and imports reflecting and affecting food and beverage processing and investing in agritourism development initiatives, such as farm-based accommodation, agricultural festivals and farm-tours.

Key words: Tourism; Agriculture; Africa; Agritourism; Structure Path Analysis; Backward and Forward Linkages; Social Accounting Matrix.

1. Introduction

Tourism could be a key ingredient in efforts designed to support sustainable growth. In the 2030 Agenda for Sustainable Development Goals (SDGs), issued by the UN' World Tourism Organization, tourism is explicitly mentioned as key parameter in three targets (UNWTO, 2018). Tourism explicitly features as a target in Goals 8, 12 and 14. The sector's contribution to job creation, sustainable consumption and production practices and sustainable use of maritime resources is recognised in target 8.9, 12.b and 14.7, respectively.

The contribution of tourism to sustainable development depends, as with any other sector, on the linkages of the sectors with the local economy (Ashley et al.; 2005; Linden and Mahmood, 2007). Torres and Momsen (2004) argue that the recent rapid growth of tourism in developing countries has increased the interest on the linkages between tourism and the local economy as a way of sustainable development. Telfer and Wall (1996) outline that if tourism is to benefit local residents, it is important that careful consideration be given to enhancing backward linkages with the local economy. Meyer (2007) argues that tourism's nature to facilitate linkages with other sectors in the economy presents possible solutions to key challenges such as employment. Dieke (1993) argues that government development policies such as those in The Gambia explicitly state the need to increase the links between tourism and agriculture.

Driven by the rapid growth of tourism in recent years in sub-Saharan Africa (SSA) there has been a growing interest in tourism's potential to contribute to economic diversification, job creation and stimulation of small and medium sized enterprises (UNCTAD, 2005; Christie et al., 2014). Tourism in SSA has increased from a mere 6.3 million arrivals in 1990 to 34.7 million in 2014 (UNWTO Tourism Highlights, 2015). Despite the positive growth indicators and the sector's potential to develop multiple linkages with other sectors, tourism in Africa is characterised by weak inter-sectoral linkages, largely due to limited domestic productive capacities across sectors (Muthumbi et al., 2017). Muthumbi et al. (2017) argue that foreign sources of value added account for a high proportion of the final demand by hotels and restaurants in Africa (45% in South Africa). They indicate that reliance on foreign value added is especially high in agriculture and manufacturing, suggesting that linkages with

domestic entities are relatively limited to these sectors. Similarly, Belisle (1983), Taylor et al. (1991) and Telfer (2000) indicate that the failure to develop linkages between tourism and agriculture in developing countries has resulted in continuous leakages due to high food importation.

Agriculture remains the main economic activity and contributor to the development of SSA economies. Organisation for Economic Co-operation and Development OECD/Food and Agriculture Organisation FAO (2016) points out that agriculture employs more than half of the total labour force in SSA with smallholder farms constituting approximately 80% of all farms. In Senegal, most employment depends on agriculture, which employs 60% of the population and continues to dominate the Senegalese economy (Brethenoux et al., 2011). Tourism has the potential of reducing inequality (Croes and Rivera, 2017) and therefore represents an opportunity for rural poor since it requires agricultural services, which in some cases can be provided by local farmers. It has been estimated that approximately 30% of tourist expenditure is on food (Belisle, 1983; Torres, 2003). Therefore, linking local agricultural production to tourism is critical in maximising host country benefits (Torres, 2003) and supporting local farmers (Mao et al., 2014).

There is a body of literature focusing on the linkages between tourism and agriculture. Fleischer and Tchetchik (2005) argue that in many rural regions there is juxtaposition of tourism and agriculture. Many studies warn of the leakages which can occur when the tourism industry relies on imported goods (e.g. Telfer and Wall, 1996, 2000; Torres, 2003; Torres and Momsen, 2004; Rogerson, 2012; Pillay and Rogerson, 2013; Thomas-Francois et al., 2017; Anderson; 2018). Previous studies on agriculture-tourism linkages have employed a survey approach (e.g. Torres, 2003; Pillay and Rogerson, 2013); a value chain approach (e.g. Anderson, 2018, Pratt et al., 2018); or a Service Management Approach (e.g. Thomas-Francois et al., 2017) to develop an understanding of the linkages between tourism and agriculture. Few studies have applied Input-Output (IO) or Social Accounting Matrix (SAM) models to estimate the multiplier effects and the backward and forward linkages of tourism with other sectors including agriculture (e.g. Cai et al., 2005; Blake, 2008; Khanal et al., 2014). These studies have estimated linkages, following the backward and forward linkage concept developed by Hirschman (1958) and Rasmussen (1956). However, beyond measurement of linkages, IO and SAM can be used to better understand exactly how

an initial shock[1] affects the economy (Parra and Wodon, 2009). Such detailed decomposition can be achieved through Structure Path Analysis (SPA). Moreover, SPA can be used to examine along what paths an injection in a sector travels through the economy to affect other sectors, with a focus here on the impact of tourism shocks on agriculture (Parra and Wodon, 2009). Understanding the channels of transmission of shocks is a first step in designing policies and programmes to exploit agriculture-tourism linkages and promote broad-based economic growth in Senegal.

The main purpose of this paper is to enhance the understanding of the links between tourism and agriculture through the examination of how an initial shock to the tourism sector generates impacts on the agricultural sector through various paths in the Senegalese economy and to what extent these impacts are amplified while travelling through the various paths. More specifically, the objectives of the research include the following: (a) to estimate the multiplier effects of a tourism shock in Senegal; (b) to examine the economic linkages of tourism in Senegal in the areas of agriculture to gauge the potential of tourism to contribute to sustainable development in Senegal; (c) to identify ways for strengthening the linkages between tourism and agriculture in Senegal. Agriculture – tourism linkages in this paper refer to the sale of agricultural products to hotels, restaurants and cafes.

Like many African countries, Senegal has a national development plan that places considerable emphasis on tourism as a tool to accelerate economic development (World Bank, 2007). However, despite this emphasis on tourism as a key strategic element in the development of the country and the various measures launched by the government in 2015 to boost the tourism sector (e.g. decrease of airport taxes, waiving of the visa fee, new tourism national agency[2]), economic linkages in Senegalese tourism have yet to be studied. This research contributes to this body of knowledge by examining the economic linkages between the tourism and agricultural sectors, with a

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[1] Tourism shock or tourism boom is the additional FCFA (Senegalese currency) worth of exogenous spending and consumption demand for the accommodation and food service activities. Social Accounting Matrix is particularly appropriate for estimating the effects of exogenous changes or injections such as an increase in tourism spending or an increase in public expenditure.

[2] Source: https://www.hospitalitynet.org/file/152008469.pdf

specific focus on agriculture and the tourism sub-sector that refers specifically to the hotel and restaurant industry.

The remainder of the paper is organised in eight sections. Following this introduction, section two presents a brief description of the tourism sector in Senegal. This is followed by a review of the literature on the linkages between agriculture and tourism in section three and a documentation of the methodology used to investigate the linkages between agriculture and tourism in section four. Section five highlights the main features of the 2011 Social Accounting Matrix for Senegal followed by an analysis of tourism linkages with the local economy in section six. Section seven discusses the results of our SPA analysis whereas section eight discusses some final considerations regarding the research.

2. The Senegalese tourism sector

Senegal has the fourth largest economy in the West African sub-region after Nigeria, Ghana and Côte d'Ivoire, with a population of 15.4 million in 2016 (World Bank, 2016). Tourism development and promotion has been a priority sector in the development of the Senegalese economy since the early 1970s and has been supported with the help of the World Bank to diversify the economy (Lagalee, 1978, Simonet and Jobbins, 2015). Lagalee (1978) argues that tourism was first developed in coastal areas, which previously were dominated by agriculture and fisheries. At present, Dakar, Senegal's capital, is second only to Lagos, Nigeria in the West African region, in terms of air traffic size and tourist arrivals from abroad (Njoya et al., 2018).

Figure 1 presents the total contribution of travel and tourism to GDP in Senegal from 1995 to 2017 (World Bank, n.d. and WTTC, 2018). Over this period the total contribution of the travel and tourism industry to GDP has increased from 7% in 1995 to 15% in 2007 and then declined to 10.5% in 2017. This decline has been explained by the lack of investment and dynamism during the 2000's, as well as strong erosion along the Petite Côte and the recent impacts of the Ebola crisis in West Africa and the Malian conflict on tourism arrivals (Horwath HTL, 2018). The proximity of countries affected by the epidemic or in conflict discourages tourists, who tend to avoid or postpone their journey to Senegal (Simonet and Jobbins, 2015).

In 2017, the total contribution of Travel and Tourism to employment, including jobs indirectly supported by the industry was 9.1% of the total employment, which is approximately 422,000 jobs (WTTC, 2018).
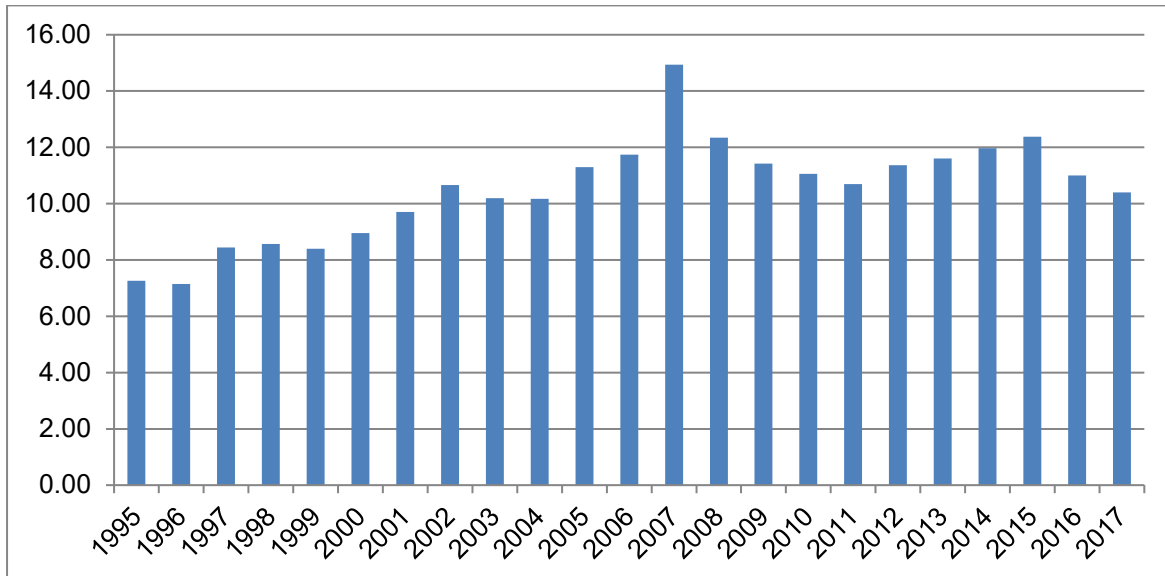

Figure 1: Total contribution of travel and tourism to GDP (in percentage) 1995-2017
Source: World Bank and WTTC

International tourist arrivals to Senegal grew from 280,000 in 1995 to 1,006,600 in 2015 (World Bank, n.d), whereas receipts from tourism increased from $168 million in 1995 to $481 million in 2014. Senegal has many diverse cultural and natural tourist attractions, ranging from beaches, vast biodiversity, national parks, nature reserves, rich cultural heritage, to entertainment and business opportunities. According to Christie (2004), Senegalese natural assets include a variety of birds, access to big game fishing and scuba diving, and some unique wildlife. Its cultural assets include its people, their music, culture and handicrafts, which all provide the potential for diversification and expansion of tourism (World Bank, 2005). The country's appeal is enhanced by its relative proximity to Europe, accounting for approximately 75% of arrivals (World Bank, 2007).

Despite the relative importance of the tourism sector in Senegal very few studies have assessed the linkages between the sector and the local economy. Previous studies have demonstrated that tourism has weak linkages with the local economy. Bilsen (1987) presents "integrated tourism" in Senegal as a possible solution to some of the problems related to tourism in developing countries. According to the author,

integrated tourism tries to create conditions necessary to increase local community's participation though small scale infrastructure managed and operated by local villagers. Diagne (2004) maintains that tourism has modified the traditional structure of the Petite Cote in Senegal and has replaced agricultural production. Tourism has also led to impacts such as environmental pollution and social exclusion. Diagne (2004) argues that locals must be better integrated into the tourism process in order to mitigate the adverse effects of tourism.

3. Agriculture-tourism linkages – a review of literature

The relationship between tourism and agriculture in developing economies have been widely studied, albeit with somewhat mixed results (e.g. Bowen et al. 1991; Meyer, 2007; Wondel and Eckhorst, 2012; FAO, 2012; Mao et al., 2014; Thomas-Francois and Francois, 2014; Anderson, 2018; Pratt et al. 2018). A key conclusion is that tourism affects agriculture in many ways. Telfer (1996) points out that the linkage between tourism and food production can be placed on a continuum from conflict through co-existence to symbiosis. Most studies found a weak backward linkage between tourism and agriculture in developing countries (Taylor et al. 1991; Freitag, 1994; Telfer and Wall, 1996; Mbaiwa, 2000; Torres, 2003; Hunt and Rogerson, 2013; UNCTAD, 2017; Pratt et al. 2018). These studies conclude that there are substantial challenges to overcome in order to increase the backward linkages between the two sectors.

By contrast, Blake (2008) investigates relationships between tourism industries and the rest of the economy with a set of SAMs for three countries of the East Africa sub-region (Kenya, Tanzania and Uganda). The results show that the hotel and restaurant industry has strong backwards linkages with the rest of the economy, but also provides below-average shares of income to poor households.

Other studies have noted the failure to develop linkages between tourism and agriculture, the challenges in building agriculture-tourism linkages (Pillar and Rogerson, 2013) and the negative impact of tourism on agriculture (Samy, 1973 and Tyrakowski, 1986). It has been argued that tourism's detrimental effects on agriculture result from competition for limited factors of production namely: land, labour and other natural resources (Tyrakowski, 1986; Samy, 1973).

Rather than creating synergies between different sectors, tourism generates increased food imports (Belisle, 1984; Wagner, 1997). Using a SAM approach, Wagner (1997) examines the economic effects of tourism in the Brazilian municipality of Guaraquecaba, arguing that the region relies heavily on imported inputs, commodities and capital. Hampton et al. (2018) claim that in Ha Long Bay, Vietnam, leakages are associated with the extended supply chains of an increasing number of national firms that bypass local suppliers in favour of national chains. Wattanakuljarus and Coxhead (2008) conclude that tourism promotion in Thailand is neither pro-poor nor pro-agriculture.

Bowen et al. (1991) argue that linkages can benefit both industries. They indicate that while traditional agriculture appears to have declined in areas where tourism has developed, production of alternative crops and product in general has increased. Thus, tourism can stimulate the development of new agriculture-based services, such as tours of agricultural production and processing facilities, and guest accommodation on farms. Studies in Tuscany (Ferrari et al., 2017) and in Turkey Yildizi (2017) show that tourism benefits food producers. Thomas-Francois et al. (2017) underline that service-dominant logic, characterised by a consumer-centric supply chain and strong and valued business relationships among stakeholders, may strengthen farmers-hotel supply chain relationships.

The impact of ownership structure of tourism infrastructure on leakages has also been studied. Telfer and Wall (2000) establish that Foreign-owned or foreign-managed hotels are able to purchase locally grown high quality produce. They find those food distribution networks are key to generating a high economic return to small local suppliers. Similarly, Anderson (2018) argues that the form of tourism business ownership and the presence of specific social networks between tourism businesses and local suppliers dictate the mode of buying and the strength of supply chains.

4. Structure Path Analysis

The SPA method presented here draws on the work by Lantner (1974) and Defourny and Thorbecke (1984). While Lantner (1974) applied SPA to an Input-Output table, Defourny and Thorbecke (1984) were among the first to apply SPA to a SAM. Total demand in each of the i-th sectors in a SAM is the sum of intermediate demand,

demand by domestic and external institutions. Based on information contained in the SAM, the values of sectoral multipliers can be obtained by computing the average expenditures propensities, denoted A_n. The average expenditures propensities can be calculated by dividing each element in the matrix by the respective column sum. If *x* is the exogenous components of demand, *I* the identity matrix and y_n the vector of endogenous income, the equation of the multiplier (M_a) can be expressed as follows[3]:

$$y_n = A_n y_n + x = (I - A_n)^{-1} x = M_a x$$

While the multiplier equation can reveal the impact of an exogenous shock on the endogenous accounts (Pyatt and Round, 1979), it cannot distinguish the paths (or flows) of these effects. Understanding the paths of economic impacts using Structural Path Analysis (SPA) enable us to discuss which economic policy is effective and identify the sectors that are bottlenecks for economic development (Defourny and Thorbecke, 1984). SPA can decompose the SAM multipliers from the account from which the external shock departs (origin) to the destination account (destination) into each sectoral connections, or the paths of economic links. For example, we can know the path from the expenditure of the hotel and restaurant (origin) to the increasing income (destination) in staple crops sector and which sector contributes to the income increase. Moreover, SPA provides a detailed method of decomposing SAM multipliers and identifying the distribution networks of an injection in a specific sector. Parra and Wodon (2009) define a path as a sequence of consecutive arcs, with the length of a path being equal to the number of its arcs. For example, arc (*i,j*) is a path with unit length, whilst path (*i,y,z,j*) has a length which equals to three (Parra and Wodon, 2009).

Defourny and Thorbecke (1984) distinguish between two types of paths: an *elementary* path and a circuit. The former refers to a path that does not pass through the same pole more than once, whereas the latter defines path that starts and ends in the same pole. Furthermore, SPA can be decomposed into three types of "influence": direct influence DI; total influence TI; and global influence GI (Defourny and Thorbecke 1984; Parra and Wodon, 2009).

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[3] Pyatt and Round (1979), Stone (1985), Lewis and Thorbecke (1992) and Breisinger et al. (2010) provide analytical details about the derivation of various SAM multipliers.

Direct influence

Direct influence, denoted $DI_{(i \to j)}$ is defined as a change in the income of j (destination) induced by a unitary injection in *i (origin),* where the incomes that are allowed to change travel through the poles in the elementary path. Direct influence can travel along a path with different lengths (for more information on SPA, see Defourny and Thorbecke, 1984).

Total influence

Total influence, denoted $TI_{(i \to j)}$ identifies the indirect effects within SPA. Induced by adjacent circuits effects, these indirect amplify the direct influence.

$$TI_{(i \to j)_p} = DI_{(i \to j)_p} \cdot M_p \ ,$$

where $DI_{(i \to j)_p}$ is the direct influence along path p and M_p the path multiplier

Global influence

Finally, global influence, $GI_{(i \to j)}$, which measures the total changes in income or production of pole of destination consequent to a unitary injection in pole of origin, is given by the sum of all total influences. The global influence from pole *i* to pole *j* is given by the accounting multiplier m_{ji} from the inverse matrix.

$$GI_{(i \to j)} = m_{ji} = \sum_{p=1}^{n} TI_{(i \to j)_p}$$

SPA has since been applied to address a number of issues such as the relationships among economic activities, pollution abatement activities and pollution emissions (Xie, 2000; Yang, et al., 2015; Yang et al., 2018; Lenzen, 2007); shocks to public spending and export (Ferri and Uriel, 2002; Ngandu et al. 2010); the role of different types of household sustaining rural economies (Roberts, 2005); substitution of traditional technologies (Khan and Thorbecke, 1989); structural analysis of the economy (Sonis et al., 1997, Lima et al., 2004); the role of urban agriculture (Kasumba and Rugiiga, 2014); the role of marine resources (Seung, 2015); sectoral growth and income distribution (Parra and Wodon, 2010); and poverty reduction (Arndt et al., 2010). This paper is among the first studies to ever apply structural path analysis to a Social Accounting Matrix to investigate the economic potential of tourism using SAM

multipliers. The structural path analysis undertaken in this study is based on the 2011 SAM for Senegal.

5. Main features of the Social Accounting Matrix for Senegal

A SAM represents an economy-wide accounting of expenditures and incomes of agents for a particular year. It differs from an Input-Output (I-O) tables[4] in that households are included (Pyatt and Round, 1979). As a result, the SAM framework can be used to model not only the inter-industry transactions, similar to I-O models, but also the the impact on other institutions. In other words, SAM helps to capture induced effects and trilateral transactions among production activities, factors, and institutions (Defourny and Thorbecke, 1984). The main data source for the SAM is the official supply-use tables (SUTs). These come in the form of matrices that record how supplies of different kinds of goods and services originate from domestic industries and imports and how those supplies are allocated between various intermediate or final uses, including exports.

The database of the model is the Senegal SAM for 2011, developed by the International Food Policy Research Institute (IFPRI). The 2011 SAM for Senegal is composed by 120 accounts including 35 industries of which five are agricultural activities. Productive factors are structured in two accounts for capital and 17 for labour, disaggregated by their level of education and training (Fofana et al., 2015). The capital account consists of the consumption of fixed capital and the net operating surplus. An important feature of the 2011 SAM is the disaggregation of households into 20 different types, based on their location (urban or rural) and their expenditure deciles (10 deciles for both rural and urban households). In addition to the main accounts in a SAM, the 2011 SAM for Senegal includes five accounts for taxes and subsidies and one account for margins, two accumulation accounts, gross fixed capital formation and changes in inventories (Fofana et al., 2015).

The relative size of a sector in total GDP is among its most important economic characteristics. The greater its share in GDP relative to other sectors, the greater is

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[4] An Input-Output table can be defined as a system of economic accounts that shows, in value terms, the supply and disposal of commodities and services produced within an economy over one year.

the impact of a shock in that sector on the rest of the economy (Burfisher, 2011). Among single Senegalese sectors, trade makes the largest contribution to GDP, 17.3%, followed by administration services (7.5%), telecommunications (7.3%), real estate (6.3%), services to enterprises (5.5%) and subsistence agriculture (5.3%) as seen in Table 1.

		GDP (factor cost)	Imports		Exports	
	Variable	Share	Share (%)	Ratio	Share (%)	Ratio
1	Staple crops	5.3	4.9	0.4	1.0	0.05
2	Cash crops	1.5	1.0	0.3	2.0	0.30
3	Livestock	4.9	0.2	0.0	0.0	0.00
4	Forestry	1.0	0.1	0.0	0.1	0.02
5	Fishing	1.9	0.6	0.1	6.3	0.53
6	Mining	2.4	10.2	1.1	8.3	0.54
7	Manufacturing of food and beverage	5.2	18.0	0.4	14.7	0.20
8	Manufacturing of tobacco products	0.2	0.1	0.0	3.0	0.74
9	Spinning, weaving, and finishing of textiles	1.1	2.4	0.4	1.3	0.13
10	Manufacturing of leather and related products	0.2	0.4	0.6	0.2	0.14
11	Manufacturing of wood and of products of wood	0.6	1.2	0.5	0.3	0.06
12	Manufacturing of paper and paper products	0.7	1.5	0.3	0.6	0.08
13	Manufacturing of coke and refined petroleum products	0.3	13.7	0.9	11.0	0.44
14	Manufacturing of chemicals and chemical products	1.6	8.3	0.9	13.5	0.88
15	Manufacturing of rubber and plastics products	0.4	1.9	0.7	0.9	0.21
16	Manufacturing of glass and ceramic products	1.4	1.3	0.1	6.6	0.43
17	Manufacturing of basic metals	0.7	7.0	2.2	4.2	0.76
18	Manufacturing of machinery	0.1	9.0	12.8	1.2	0.97
19	Manufacturing of computer, electronic, and optical products	0.0	2.4	474.4	0.3	30.47
20	Manufacturing of transport equipment	0.1	7.0	14.0	0.5	0.54
21	Other manufacturing	1.3	0.5	0.1	0.2	0.03
22	Electricity, gas, and water	2.9	0.0	0.0	0.0	0.00
23	Construction	4.5	0.0	0.0	0.0	0.00
24	Trade	17.3	0.0	0.0	0.0	0.00
25	Repair of computers and personal and household goods	1.0	0.0	0.0	0.0	0.00
26	Hotels and Restaurants	0.7	0.0	0.0	6.9	0.51
27	Transportation	4.5	2.0	0.1	2.7	0.09
28	Telecommunications	7.3	1.5	0.1	4.9	0.12
29	Financial services	3.9	0.6	0.1	0.1	0.01
30	Real estate activities	6.3	0.0	0.0	0.0	0.00
31	Activities of business services	5.5	3.2	0.2	6.0	0.22
32	Administrative and support service activities	7.5	0.0	0.0	0.0	0.00
33	Education	4.5	1.0	0.1	0.8	0.04
34	Human health and social work activities	1.5	0.1	0.0	0.1	0.01
35	Activities of membership organizations	1.9	0.1	0.0	2.7	0.27
	All industries/products	100.0	100.0	0.3	100.0	0.15

Table 1: Contribution of selected variables to GDP (at factor cost), imports and exports
Source: compilation by authors from the SAM

The low contribution of agriculture to GDP despite its importance in terms of employment implies a low productivity of the sector. Senegal primarily imports energy and food products for intermediate and final uses and exports manufactured food, chemical products, and energy products, with shares in total export value of 14.7%, 13.5%, and 11.0%, respectively (Fofana et al., 2015).

5.1. Multiplier and linkage analysis of the Senegalese tourism industry

Before applying SPA to 2011 SAM for Senegal, it is important to analyse the links between tourism and the local economy. To this end, we compute the multiplier and both forward and backward linkages in the tourism-related sectors, following the approach proposed by (Hirschman, 1958 and Rasmussen 1956)[5]. A multiplier quantifies the change in account *i's* income as a result of an exogenous change of one unit in account *j's* income. In this study, SAM multipliers indicate the total economic impacts through the direct and indirect spillover effects on other sectors by a unit (expenditure) increase on the hotel and restaurant sector. Dwyer et al. (2003) argue that the effect of an expansion of tourism on the growth prospects of local industries is dependent upon the size of local multipliers. Backward linkages measure the relative importance of a sector as a purchaser to all other sectors in the economy, whereas forward linkages measure the relative importance of the tourism sector, as a supplier, to all other sectors in the economy (Parra and Wodon, 2009). A backward linkage of sector *'i'* greater than one means that a unit change in the final demand of sector *'I'* will generate an increase above the average in the global activity of the economy. On the other hand, a forward linkage of sector *'i'* greater than one implies that a unit change in all the sectors of the final demand will generate an increment above the average of sector *'I'*. A *key sector* is defined as one with both backward and forward linkages greater than one (Parra and Wodon, 2009).

The key sectors are identified and analysed using the SimSip SAM Software. SimSIP SAM stands for Simulations for Social Indicators and Poverty through Social Accounting Matrix. The software is based on a Microsoft Excel application with

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[5] Further detail about the computation of the multiplier product matrix, backward linkages and forward linkages can be provided upon request.

MATLAB running in the background that can be used to analyse I-O tables and SAM (Parra & Wodon, 2008).

Table 2 presents a breakdown of the multipliers.

Sectors	Hotels and Restaurants	Transport	Sectors	Hotels and Restaurants	Transport
Staple crops	0.11	0.07	Manufacturing of machinery	0.00	0.00
Cash crops	0.03	0.02	Manufacturing of computer, electronic, and optical products	0.01	0.01
Livestock	0.10	0.05	Manufacturing of transport equipment	0.01	0.01
Forestry	0.02	0.02	Other manufacturing	0.03	0.03
Fishing	0.09	0.08	Electricity, gas, and water	0.10	0.07
Mining	0.02	0.04	Construction	0.00	0.00
Manufacturing of food and beverage	0.39	0.21	Trade	0.37	0.29
Manufacturing of tobacco products	0.01	0.01	Repair of computers and personal and household goods	0.07	0.07
Spinning, weaving, and finishing of textiles	0.03	0.03	Telecommunications	0.16	0.12
Manufacturing of leather and related products	0.00	0.00	Financial services	0.09	0.07
Manufacturing of wood and of products of wood	0.01	0.01	Real estate activities	0.09	0.09
Manufacturing of paper and paper products	0.03	0.02	Activities of business services	0.04	0.09
Manufacturing of coke and refined petroleum products	0.05	0.13	Administrative and support service activities	0.00	0.00
Manufacturing of chemicals and chemical products	0.05	0.03	Education	0.06	0.07
Manufacturing of rubber and plastics products	0.01	0.02	Human health and social work activities	0.02	0.03
Manufacturing of glass and ceramic products	0.00	0.00	Activities of membership organizations	0.03	0.04
Manufacturing of basic metals	0.01	0.02			

Table 2: Multiplier effects of tourism related sectors
Source: compilation by authors

As illustrated in the table, if the demand for hotels and restaurants is increased exogenously by one unit (FCFA[6] one million in this case), after all the general equilibrium effects have taken place, the income of manufacture of food and beverage increases by 0.39 unit and that of trade by 0.37 unit, indicating a relatively strong link with tourism. Agricultural sectors have a relatively weak multiplier effects from tourism. Specifically, staple crops, livestock, and fishing have weak multipliers of 0.11, 0.10 and 0.09, respectively (Table 2), implying a weak link with tourism.
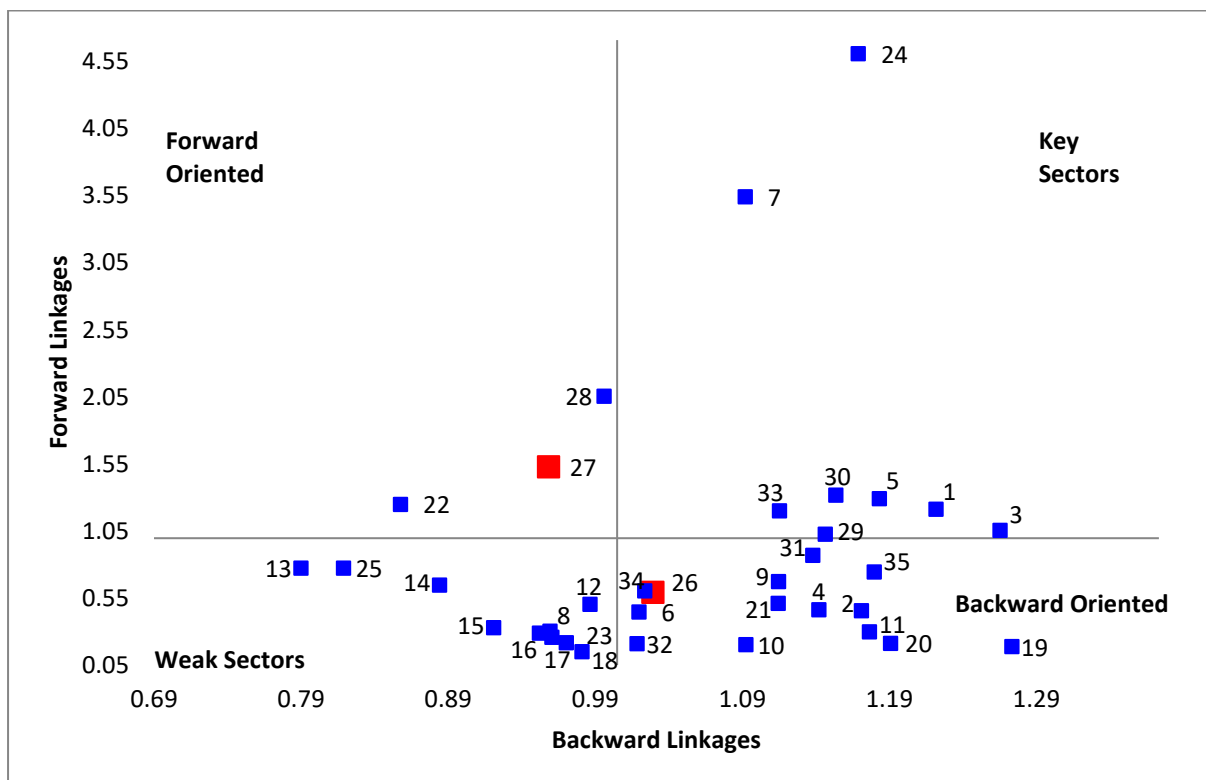

Figure 2: Backward and Forward Linkages, Senegal 2011

Source: Source: Authors' simulation results using SimSip SAM Software

The results of the backward and forward linkages are shown in Figure 2. In order not to overcrowd the graph, numbers are used instead of activities' names. The numbers correspond to the order in which the activities appear in the Input matrix sheet and in Tables 2. The results of the backward and forward linkages indicate that hotels and restaurants (sector 26 in Figure 2), a sector catering directly to tourists, is not a key sector. The hotels and restaurants sector has a very weak forward linkage coefficient

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[6] 1 FCFA is equivalent to $0.0018 (September 2018 rate).

(0.598) with the local economy and a relatively strong backward linkage (1.024). In other words, a growth of the Senegalese economy as a whole by 1% will lead to an increase in the activities of hotels and restaurants by 0.598%. Similarly, a 1% increase in the final demand of hotels and restaurants will generate an increase in the global activity of the Senegalese economy of 1.024%. This implies that the hotel and restaurant sector has a relatively strong backward and a weak forward linkage with the local economy. The hotel and restaurant sector ranks 19th in both backward linkages in forward linkages. Compared to other African countries that have relatively mature tourism sectors such as Kenya and Tanzania, the linkages between tourism and the local economy in Senegal are weak. Blake (2008) shows that the hotel and restaurant sector in Kenya, Tanzania and Uganda has high backward linkages (1.277, 1.220 and 1.216) and below average forward linkages of 0.995, 0.921 and 0.799, respectively. According to Figure 2, key sectors in Senegal include: Trade (24); Manufacture of Food and Beverage (7); Fishing (5); Real Estate Activities (30); Education (33); Staple Crops (1); Livestock (3); Financial Service (29).

A number of factors may explain the weak linkage between the hotel and restaurant sector and agriculture, including among others the location, composition and ownership of these establishments. Recent studies suggest that many upscale hotels located in the coastal region of Senegal, especially La Petite Cote where more than 60% of tourists' arrivals is concentrated, is owned by foreign companies (Dehoorne and Khadre Diagne, 2008; Diombera, 2012; GAIN Report, 2018). In 2017, the Senegalese National Statistic and Demographic Agency estimated that the vast majority of mid-scale to upscale hotels and restaurants are located in the capital city, Dakar. Upscale restaurants, which are fewer in number, are generally located in hotels. The report shows that some upscale restaurants purchase approximately two billion CFA francs ($3.6 million) of food and beverages per year. Imported foods include milk and dairy products, sauces, baking ingredients, alcoholic beverages, and seasonings, many of which originate from Europe and high quality beef, currently supplied by countries such as Brazil and Argentina.

It is encouraging to note that since the 1970s and throughout the 1990s and 2000s, with the push of community-based and sustainable tourism, several locally and community owned traditional lodges in Casamance and other regions of the country, or even residences turned into guest houses in Dakar and Saint Louis, have developed

(Diambera, 2012). Community-run village guest houses in Lower Casamance in Southern Senegal, run by the Association of the Development of Integrated Tourism, were set up in 1974 by French ethnologist Christian Saglio. The scheme has since grown from two to eleven villages all within reach of the regional capital. Bilsen (1987) suggests that this model of tourism facilitates a stronger linkage between the hospitality industry and local agriculture.

6. SPA applied to Senegal

The results of the structural path decomposition are presented in Table 3 and in Figure 3. Table 3 explores the path analysis from an exogenous increase by one unit (FCFA 1 million in this case) in the demand for hotels and restaurants to its effects on agriculture. An injection of FCFA 1 million into the hotels and restaurants yields an increase of FCFA 107,700 in the output of staple crops (see column C). The last column on the right (column H) contains the percentage of the global influence that is carried through the elementary path described in column C.

For example, by reading the fourth row it can be concluded that the path analysis shows that 32.2% (column H) of this additional production is caused directly by the demand for staple crops by the hotels and restaurants industry through the elementary path linking the two sectors without any intermediary poles. On the other hand, by reading the fifth row we conclude that 20.7% of the multiplier (0.1077) travels through the path connecting hotels and restaurants to manufacture of food and beverage to staple crops. On the other hand, FCFA 89,500 would reach the fishing sector as a result of the initial demand shock of FCFA1 million to hotels and restaurants, once all multiplier effects are taken into account. Of those FCFA 89,500, 14.2% would travel along the path connecting hotels and restaurants directly to the fishing sector (Row 14 of Table 3). Fishing is an important component of Senegal´s development policies because of its high export earnings, strong contribution to local consumption and its labour-intensive nature (Deloitte, 2017).

The other elementary paths shown in Table 3 reveal that a significant part of the global influence of hotels and restaurants on agriculture is exercised indirectly through the demand for manufacture of food and beverage. For better visibility, Figure 3 illustrates

the elementary paths (Column D of Table 3) of the simulated exogenous injection of one million FCFA in the hotels and restaurants to the agricultural sector. The agricultural sector is composed of five subsectors, namely Staple Crops (1), Cash Crops (2), Livestock (3), Forestry (4) and Fishing (5) [7].

(A) Path origin (i) $\rightarrow$	(B) Path destination (j)	(C) Global Influence $GI_{(i \rightarrow j)} = m_{ji}$	(D) Elementary Paths $(i \rightarrow j)_p$	(E) Direct Influence $DI_{(i \rightarrow j)_p}$	(F) Path Multiplier M_p	(G) Total Influence $TI_{(i \rightarrow j)_p}$	(H) Total/Global (in %) $\dfrac{TI_{(i \rightarrow j)_p}}{GI_{(i \rightarrow j)}}$
26	1	0.1077	26 -->1	0.0294	1.1790	0.0347	32.2287
			26 --> 7 --> 1	0.0138	1.6231	0.0223	20.7410
26	2	0.0333	26 --> 2	0.0103	1.1032	0.0114	34.1338
			26 --> 7 -->2	0.0050	1.5761	0.0078	23.4725
			26 -->3 --> 2	0.0004	1.2478	0.0004	1.3333
26	3	0.0971	26 -->3	0.0277	1.1629	0.0322	33.1404
			26 --> 7 -->3	0.0149	1.6117	0.0240	24.7188
26	4	0.0191	26 --> 4	0.0023	1.0583	0.0024	12.6479
			26 --> 7 --> 4	0.0001	1.5263	0.0002	1.0782
			26 --> PLAB --> U10 --> 4	0.0002	1.2869	0.0002	1.0681
26	5	0.0896	26 --> 5	0.0112	1.1368	0.0127	14.1755
			26 --> 7 --> 5	0.0039	1.5918	0.0062	6.8705
			26 --> 7 --> ECAP --> 5	0.0032	1.8733	0.0060	6.6946
			26 --> 29 --> ECAP --> 5	0.0026	1.4786	0.0038	4.2742
			26 --> 28 --> ECAP --> 5	0.0016	1.6964	0.0027	2.9767
			26 --> 30 --> ECAP --> 5	0.0017	1.4758	0.0025	2.7922
			26 --> 22 --> ECAP --> 5	0.0008	1.5062	0.0012	1.2963
			26 --> 3 --> ECAP --> 5	0.0006	1.5945	0.0010	1.1283
			26 --> 1 --> ECAP --> 5	0.0006	1.5939	0.0010	1.1182

Table 3: Structural Path Analysis: Global Influence, Direct Influence and Total Influence for Selected Paths based on 2011 SAM for Senegal
Source: compilation by authors

As illustrated in Table 3 and Figure 3, food and beverage production (activity number 7) and net operating surplus ECAP (i.e. the surplus accruing from production) play an important role in transmitting influence. Other sectors through which a shock in the hotel and restaurant and food and beverage sectors transmit to reach agriculture include electricity, gas and water (22), telecommunications (28), financial services (29) and real estate activities (30).

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[7] Numbers in parentheses refer to numbers used to indicate activities.

A not insignificant part of the influence transmitted from hotels and restaurants to agriculture goes through a path which includes the factor labour and one household group. As can be seen from Table 3 and Figure 3, 1.06% of the global influence exercised by an increase in hotel and restaurant sector output on forestry follows three elementary paths which combine the whole triangular circle from production (hotels and restaurants) to factorial income (PLAB) to household income (U10) and back to production (forestry). The 2011 Senegalese SAM distinguishes between seventeen types of labour by level of education of which PLAB represents professional workers. Furthermore, as noted above there are 20 household groups in the SAM classified by geographic location and expenditure decile. U10 refers to urban household in the 10th decile, which is the richest household.

As noted by Defourny and Thorbeke (1994), SPA is useful to the policymakers in the sense that it informs them of the distribution networks of an injection in the hotels and restaurants. Moreover, because SPA identifies the poles which play an important role in transmitting influence it can help a government identify poles which do no relay influence well which might occur in a public expenditure programme and vice-versa.

Thickness represents the strength of the linkage.
Node 26 represents the tourism sector
Nodes 1 to 5 represent agricultural sub-sectors
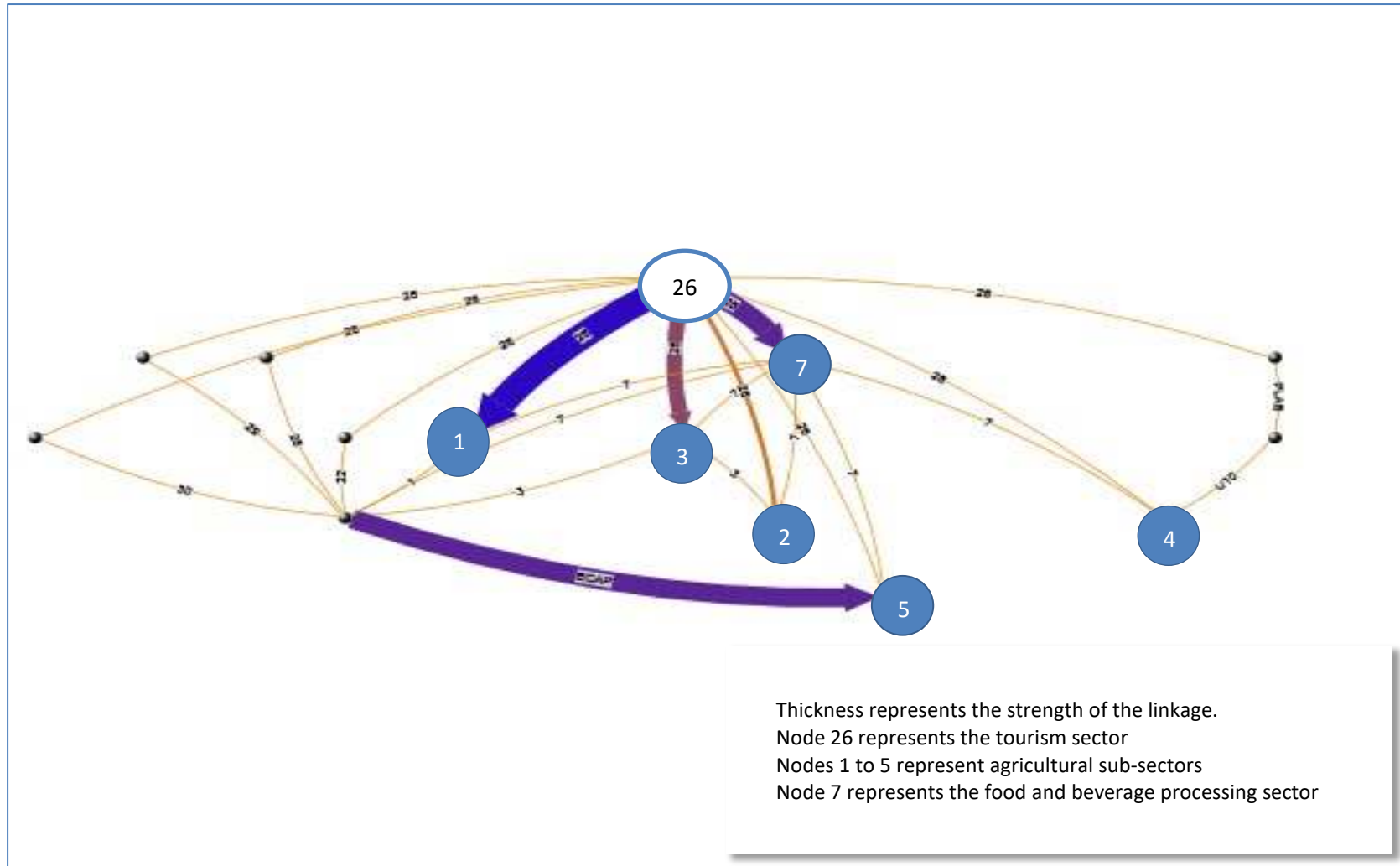Node 7 represents the food and beverage processing sector

Figure 3: SPA: Global Influence, Direct Influence and Total Influence for Selected Paths based on 2011 SAM for Senegal
Source: Authors' simulation results using SimSip SAM Software

6.1. Path Multipliers and Discussions

Column F of Table 3 suggests that the path multipliers can reach a level up to 1.1032, 1.5761 and 1.8733, depending on whether the paths are of length 1, 2 or 3 respectively.

The multiplier is particularly high in the path linking hotels and restaurants to manufacturing of food and beverage to net operating surplus to fishing (it is equal to 1.8733). Other high multipliers include the paths linking hotels and restaurants to telecommunications to net operating surplus to fishing (1.6964) and the paths linking hotels and restaurants to manufacturing of food and beverage to: (a) staple crops (1.6231); and (b) livestock (1.6117). These multipliers are all above 1.6 reflecting the amplifying action of powerful circuits. The SPA result indicates that the magnitude of the linkage with the tourism sector is greater for the capital account and capital owners than for labour. However, according to SAM, the ratio of capital to labour for the hotel and restaurant industry, in terms of earnings, is equal to 0.76, indicating that the industry is labour-intensive, with 30% of the revenue from this sector accruing to urban professional workers.

An examination of rows 4 and 5 of Table 3 reveals the path multiplier of the elementary path from hotels and restaurants to manufacturing of food and beverage to staple crops is equal 1.6231, whereas it only equals 1.1790 in the direct path from hotels and restaurants to staple crops. Moreover, an injection of FCFA 1 million into the hotels and restaurants yields an increase of FCFA 29,400 in the income accruing to staple crops through the first path as opposed to FCFA 13,800 through the second path. There is a greater total through the former as opposed to the latter necessitating a longer period of time to be fully felt. This parameter can be quite relevant in a policy context by indicating the extent to which an initial injection into a given pole will generate rapidly or only after a long period of time any increase in the production of the income of other poles in the economic structure (Defourny and Thorbecke, 1984).

Defourny and Thorbecke (1984) point out that the path multiplier can also be presented by computing its inverse i.e., the ratio of direct influence to total influence or the share of the total influence that travels along an elementary path which is accounted for by the direct influence. An examination of the first row of Table 3 shows that 84.7% of the total influence is direct. Moreover, rows 1, 3, 5, 6, 8, 10 and 11 have

a relative high percentage of the total influence being explained by direct connections, with percentages ranging from 84% to 100%. Row 9 has the lowest importance of direct connections, with direct to total ratio equal to 50%.

As shown above a high percentage of the multiplier is carried along the path associated with food and beverage processing. In other words, it is through this sector that a high proportion of the shock reaches the agricultural sector. Agro-processing is one of the most significant manufacturing activities in Senegal (World Bank, 2006). Food processing is the main manufacturing activity in Senegal accounting for 36.4% of industrial production. According to World Bank (2006), a fifth of all food and beverage processing companies are located in or around Dakar and encompass the processing of groundnuts, fish, milk, refinement of sugar, milling and the production of sodas and beer. Firms in this sector operate according to two main business models. Some companies use local inputs to produce goods for export, while others use imported inputs to produce goods for local consumption (World Bank, 2006).

Processors of horticulture for example face supply-chain constraints in terms of providing inputs, production, logistics, and marketing (Brethenoux et al., 2011). Processors express difficulties procuring sufficient products at the right quantity and price, notably due to post-harvest losses. Processors also suffer from weak logistics, notably in terms of transport of raw materials from the producers to the processors (Brethenoux et al., 2011). Deloitte (2017) indicates that value chains are also poorly structured and synergies between family farming and agribusiness are weak. Surely, reducing dependence on imported goods and improving agro-processing could strengthen the link between agriculture and tourism in Senegal and bring positive benefits for agricultural trade on both domestic and international markets. The DFID (2005) report on the link between growth and poverty reduction also discusses similar points, emphasises the need for high quality and traceable food and the interaction between food producers with market entities and changing retail models. It was shown in Table 1 that the country has a high share of food imports, with shares in total export value of 4.9% for staple crops and 18.0% for manufacturing of food and beverage. The corresponding figures for exports are 1% and 14.7%, respectively. Some other important areas of potential interaction between the two sectors include utilities, communications, financial services, real estate activities and other service provision.

The interaction between agriculture and tourism can also be strengthened through alternative tourism development, such community-based tourism and business tourism. While beach tourism, cultural heritage and nature and adventure tourism are the primary tourism products for Senegal, the country has been positioning itself in recent years as a key destination in business tourism. Business tourism is an important and growing area for sub-Saharan Africa, one that is less seasonal than leisure tourism and more resilient to political change. While European Business tourists tend to use high-end hotels and restaurants, the clients of small hotels are more likely to be nationals or other African visitors on business (English, 2016).

As highlighted above, community-based and rural tourism have been developing in Senegal since the early 1970s in response to a growing recognition that benefits accruing from conventional tourism are not necessary shared by all layers of the population Sène-Harper and Séye, 2019). Similarly, Saglio (1979), Bilsen (1989) and Schlechten (1989) identify Casamance as one of the cradles of rural tourism in West Africa. Despite the potential of community-based tourism to improve rural livelihoods, comprehensive government policies to support the sector have not been fully realised. Government institutions in sub-Saharan Africa need a major shift in attitude in favour of alternative forms of tourism especially in light of the push of tourism as a catalyst for sustainable development. Government policies should give more priorities to investment in infrastructure and research to promote institutional linkages between farmers and tourism facilities. Examples of such investments include good transport linkages, budget allocation for agritourism research, capacity building enabling farmers to improve post-harvest and marketing skills.

Organic agriculture could also be considered an opportunity for local farmers to participate into tourism and contribute to SDGs 12.b (sustainable consumption and production practices). The market demand for organic products has grown rapidly in recent years, driven by growing health concerns among consumers and increasing awareness regarding the benefits of organic food. Anderson (2018) argues that in Lushoto, the hoteliers, restaurateurs and consumers in Lushoto generally perceive that locally and organically grown fruit and vegetables are of very high quality. The author highlights that this fact plays an important role in making tourism sustainable as it appeals to visitors' desire to experience authenticity while on holiday at the same time the quality of the locally supplied products meets requirements of the industry.

Tropical fruits such as papaya, mangoes and vegetables offer an opportunity to develop agritourism for European tourists, but also African tourists and city dwellers. Africa's domestic (by resident visitors) and intra-African tourism are expected to increase. Four out of 10 international tourists in Africa come from the continent itself, according to UNCTAD (2017). In sub-Saharan Africa, this number increases to two out of every three tourists whose travels originate in the continent. Data backing this key finding show that, contrary to perception, Africans themselves are increasingly driving tourism demand in Africa. That also adds a dimension reflecting and affecting the need that local agricultural production should be also associated with the rise of intra-African tourism.

7. Conclusions and Policy Recommendations

Tourism as a vehicle for socio-economic development and poverty alleviation in developing countries has been a research focus for decades (Davidson and Sahli, 2015; Njoya and Seetaram, 2018) but how, in structural terms, tourism is associated with the agricultural sector is a topic severely understudied. The purpose of the current study is to examine the link between the tourism and agriculture in Senegal using a SPA. The link between agriculture and tourism is one of the means through which leakages can be avoided and the benefits of tourism can be dispersed to local communities. Yet, global experience reveals that tourism expansion can both benefit and harm the agricultural sector. Thus, the benefits of tourism may accrue to people and factors outside the host country if hotels and other tourism establishments hire non-local labour and use other inputs, including agricultural products, which originate outside the country. Tourism may also draw agricultural workers from the land, leading to a reduction of the output of traditional agriculture.

Tourism in Senegal has long been a significant source of export revenues and an important source of employment. On the other hand, agriculture in Senegal constitutes the main source of income for a very large segment of the population. Therefore, when deciding on a tourism development strategy, policymakers should give consideration to the linkages that benefit both the tourism and the agricultural sectors. Tourism's economic benefits depend to a large extent on the structure of tourism economy (i.e. how far backward and forward linkages extend into the economy). The results of this

investigation show that the Senegalese hotel and restaurant sector has a very weak forward linkage coefficient with the local economy and a relatively high backward linkage. These findings suggest that unless backward linkages between tourism and the local economy are strengthened, the benefits of tourism flowing to locals would be marginal.

The results of the SPA show that tourism has the capacity to create opportunities for the farmers through additional demand for food products. The magnitude of the linkage between tourism and agriculture is considerably great for staple crops, livestock, food and beverage processing and net operating surplus. More specifically, compare to the other sectors, the path between hotels and restaurants and the above sectors has a high expenditure propensity. The food and beverage processing plays an important role as transmitter of the impacts of the hotel and restaurant sub-sector to the agricultural sector.

It can be concluded that complementary strategies aiming at minimising leakages (mainly via reduction of imports of manufactured food and other inputs of food and beverage processing), and strengthening both backward and forward linkages would amplify the benefit of tourism on the economy. Such measures may include the development of agritourism, such as farm-based accommodation, agricultural festivals, attractions and farm-tours; and the implementation of policies, such as physical planning, protection of agriculture and fishing areas to integrate agriculture. In line with this, there is evidence to suggest that agritourism has the capacity to transform and diversify the local farming to a new and dynamic rural industry (Wu, 2018) generating additional income through touristic on-farm activities to help balance the continuously decreasing income from agricultural activities (Streifeneder, 2016). Also community-based farming initiatives can effectively support sustainable tourism growth (Knowd, 2006); community involvement and participation could create challenges, according to Imbaya et al. (2019), but investments on labour skill development and better information access could help alleviating them. The 'bigger picture' lesson is that developing niche tourism products for the context of Africa at least, according to a country's specific environment, human capital and natural resources, in line with what Amalu et al. (2018) suggested, may be a decisive mechanism for provision of jobs, business opportunities, improved family income and patronage of local products.

Although this research is country-specific, the methods used and the many insights gained are relevant and to an extent generalisable for other sub-Saharan African countries with similar economic and policy environments. The traditional agriculture has often diversified by adding various tourism business functions and operations to become a multi-functional agriculture establishment, that nurtures a new style of rural industries, and is called agritourism (agro-tourism), farm-based tourism, rural tourism (countryside tourism), or leisure farms.

The approach adopted in the current research is demand-driven and does not account for supply constraints or substitution effects and therefore is inappropriate for capturing the economic impacts of policy changes. Moreover, the expansion of tourism can be expected to raise the costs and, therefore, prices of other products. Computable general equilibrium models make it possible to account for resource constraints and price changes when analysing the economic impacts of tourism shocks. Thus, more research is needed to better understand the economic impact of tourism expansion in Senegal. An interesting future research project is to decompose the hotel and restaurants category and examine the contribution of different tourism models in Senegal, namely conventional coastal tourism owned by internationals, and locally owned hospitality services.

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