



Asia-Pacific  
Economic Cooperation

## Services and the Food System

By Gloria O. Pasadilla and Crystal Jiquan Liu

Technology is revolutionizing the food system. Innovative solutions like digital financial instruments have allowed farmers and food companies access to credit and insurance by just a click of a button and made payments convenient. Information such as agriculture techniques, market trends and real-time weather forecasts can reach farmers' hands instantaneously through mobile phones. Simplification and digitalization of customs procedures have allowed commodities to enter some economies' borders more quickly. Internet and e-commerce connect buyers and sellers in every corner of the world.<sup>1</sup> Cold chain logistics make it possible to transport worldwide perishables like fish and seafood without losing freshness.

Finance, transport, logistics, internet and telecommunications are all important features of food production, delivery and sales. The food system is not only about producing food. Various kinds of services are involved in supporting the production process and other stages of the food value chain and facilitating the smooth functioning of the entire system. Leveraging new technologies, the services sector is playing a more crucial role than ever before and has brought unprecedented opportunities to transform the food system and deliver food worldwide. As manufacturing experienced 'servicification', or the increased role of services in the value chain (from design to maintenance and repairs), the food system, too, is increasingly being 'servicified'.

This policy brief first provides a quick overview of the role that services play in the food system. The next section looks at three examples of food value chains and identifies the stages where services come in. Then, using input-output matrix, it analyses the backward linkages of food and agriculture industries on service sectors and identifies key services in the food system. It also measures the value added contribution of services in food exports.

<sup>1</sup> Alibaba Research Institute reports that the Canadian Cold Water Lobster Association sold more than 50,000 lobsters on China's online e-commerce website, Tmall, in just one day during China's largest online shopping festival, with the fastest delivery made in 33 hours. Source: Alibaba Research Institute

### Services in Food Value Chains

The food system covers all activities that are involved in the food value chain such as research and development, agricultural production, processing, storage, transportation, distribution, sales, as well as the legal, social and economic environment under which all these activities occur. It is an ecosystem which encompasses farmers, enterprises, business associations, governments and many other actors in the agriculture, manufacturing and services industries.

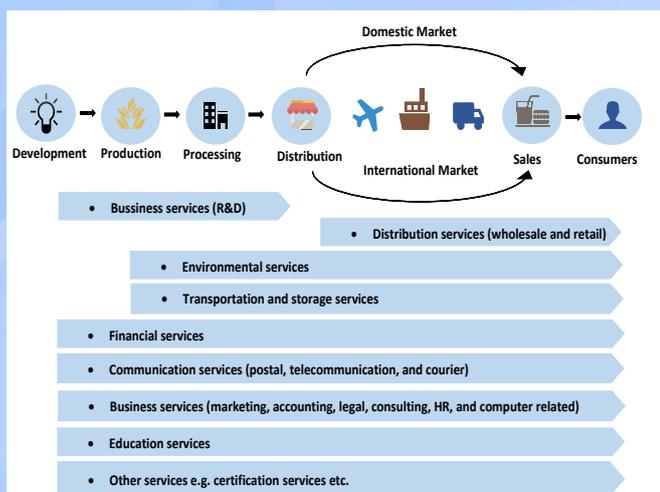
Services are a critical component of the food system. They function as vital stages (development, distribution, sales services) in the value chain as well as linkages (transport, storage services) between the different stages. Moreover, they are key inputs (telecommunications, financial services) in the food producing and manufacturing process. Services providers are also major actors in the system, working closely with farmers and food manufacturing companies. By providing innovative solutions and professional advice to farmers and food companies, services providers can assist them in building resilience towards external and internal shocks. Constructing a healthy environment for the development of services and improving access to services by all players are vital towards ensuring a better functioning and productive food system.

Figure 1 depicts a generic food value chain. The value chain begins from the development stage, moving on to the production, then the processing, distribution to domestic or international market, and sales, ending at the consumers. The figure also illustrates a standard combination of services involved in this generic food value chain and the stages those services are associated with. Research and development services are usually involved in the first few stages before the products

(2016). Alibaba's eCommerce Practice & Opportunities for SMEs. Accessed from [https://www.wto.org/english/tratop\\_e/ecom\\_e/s2chengouyanga/libaba.pdf](https://www.wto.org/english/tratop_e/ecom_e/s2chengouyanga/libaba.pdf).

are ready to enter the market, while distribution services (i.e. retail and wholesale) come in after the production and processing stages. Environmental services and transportation and storage services start from the production stage. Besides those services attached to specific stages, there are plenty of other services which support the whole value chain, such as financial services, communications services, business services and education services. Together, these services complete the whole value chain and deliver all kinds of food onto the consumers' hands.

**Figure 1: Services in a Generic Food Value Chain**



Source: Authors

In reality, value chains are generally more complex than what is depicted in the figure as the value chain of a particular product is entwined with the chains of others. On the other hand, for some products, the actual value chain might be simpler as one or two stages can be skipped. For example, the processing stage may not be required in a fresh fish or seafood chain. Moreover, the order of different stages in the chain is not fixed. For example, coffee beans can be exported straightaway after being produced, and then processed in the foreign market before they are sold in the market. The range and combination of services involved in each value chain also vary across different types of food and their production modes.

**Case #1. Services in the Fisheries Value Chain**

Figure 2 shows a general and simplified fisheries value chain from which we can understand the main services involved. The chain begins with resources management, where technical support and R&D are vital. Wild capture, aquaculture and aquaponics are the three major modes of fisheries

<sup>2</sup> European Commission (2017). Boosting Business along the Fisheries Value Chain. Accessed from [https://webgate.ec.europa.eu/fpfis/cms/farnet2/sites/farnet/files/publication/en\\_farnetguide12.pdf](https://webgate.ec.europa.eu/fpfis/cms/farnet2/sites/farnet/files/publication/en_farnetguide12.pdf).

production where satellite-based technology, telecommunications, renting of machinery and equipment, and environment services together ensure the productivity and quality of the fish, and safety of the fishermen especially in the case of wild capture. The fish produced or captured are then either collected by an aggregator or directly sold to factories, restaurants or consumers through contract or direct sale. During this stage, distribution services, sales and cold chain logistics would have already come into play before most of the fishes go into the next processing stage. After being processed, the final products are packaged and transported to either the domestic or international market where they are sold to retail outlets or restaurants, or to wholesale buyers who subsequently sell them to small buyers or retailers. However, many services are invisible in this figure, such as financial services and business services, which are also indispensable parts of the chain.

**Figure 2: A General Fisheries Value Chain**



Source: European Commission (2017)<sup>2</sup>

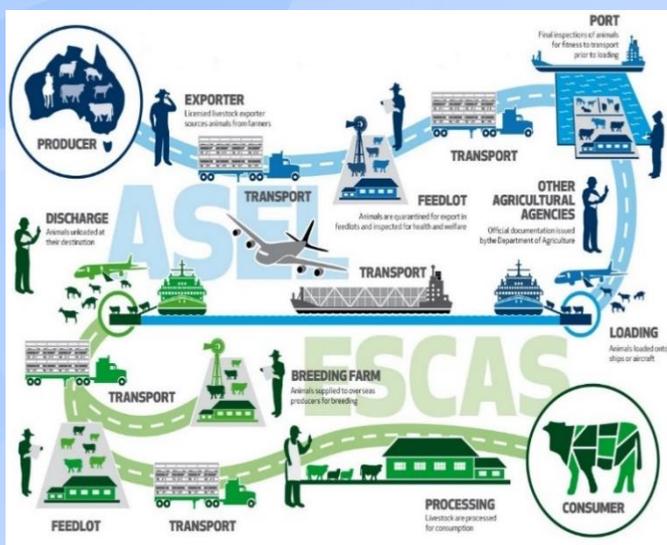
**Case #2: Services in an Australian Livestock Export Roadmap**

Figure 3 depicts a picture of the export roadmap of a typical livestock from Australia. The journey begins when licensed exporters transport the animals from producers to a feedlot for quarantine where the animals' health and welfare will be examined. After that, the livestock is transported to the port where a final examination of the animals will be conducted before loading. Animals that pass this stage will then be sent through ship or plane to their destination markets. After being discharged at the foreign port, some will be sent to farms for breeding purposes, while others will be sent to feedlot for another round of quarantine services and consequently transported to processing factories.<sup>3</sup>

<sup>3</sup> Australian Livestock Export Corporation (LiveCorp). An Overview: Industry Information. Accessed 10 April 2018 from <http://www.livecorp.com.au/industry-information/an-overview>.

Two major regulatory systems are highlighted in the figure. The Australian Standards for the Export of Livestock (ASEL) stipulates the animal health and welfare requirements for the livestock from farm to the point of discharge at the overseas ports, while the Exporter Supply Chain Assurance System (ESCAS) regulates that Australian exporters must have control over the entire value chain to the point of slaughter in the foreign markets to make sure each stage meets international standards. The two systems require great amount of certification and inspection services, which are important in ensuring the smooth movement of animals along the export chain.<sup>4</sup>

Figure 3: Australian Livestock Export Map



Source: Australian Livestock Export Corporation (LiveCorp)

### Case #3 Services in Chilean Fresh Cherry Industry

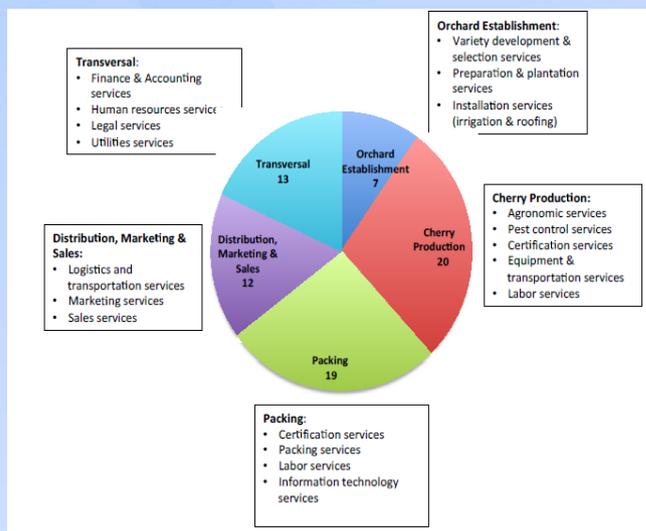
Figure 4 shows the key stages and services involved in the fresh cherry industry in Chile, one of the major cherry exporters in the world. The value chain starts with the preparation and farm establishment where R&D and plantation and construction services such as roofing and irrigation happen. During the production stage, technical assistance and supervision are required to ensure high quality of the cherry fruit. Major services required include agronomic, pest control and certification services. Moving to the packing stage, packing and selection, testing and certification, and information technology services are key inputs. After fresh cherries are selected and packaged, they move on to the last stage where logistics, transportation, marketing and sales services become vital and enable the realization of profit and completion of the whole chain. Besides the

<sup>4</sup> Ibid.

<sup>5</sup> Bamber, P., & K. Fernandez-Stark (2015). Fresh Cherry Industry in Chile. P. Low & G.O. Pasadilla (Eds). Services in

services directly related to a specific stage of the cherry value chain, there are many transversal services that support the whole value chain, such as finance and accounting, human resources, legal services and information system management. In total, 88 separate services were identified by the study in the Chilean fresh cherry industry.<sup>5</sup>

Figure 4: Key Services in Chilean Cherry Industry



Source: Bamber & Fernandez-Stark (2015)

The above three cases show that a wide range of services are involved in each food chain and each service plays its own unique role in the system. **Financial services**, particularly credit and payment, allow all actors in the value chain, not only farmers and food companies, to be able to obtain working capital and invest in technology, talents and management resources. Moreover, financial services, specifically insurance, can help farmers and companies manage risks and recover quickly after natural disasters. **Information and communications technology (ICT) services** enable the flow of information among everyone in the food system through phone, internet, satellite system, remote sensor and others. Many mobile apps and software have provided innovative solutions to connect food producers with one another, with weather or price information sources, and with the outside market. **Transportation and storage services** account for the movement of food from production to storage to sales. The rapid development of cold chain logistics for the past decade has greatly facilitated the long-distance trade of perishable food such as seafood and fruits and decreased food losses and waste. **Distribution services** include wholesale and retail services, which connect the food producers with the end market. An efficient distribution system is

Global Value Chains: Manufacturing-Related Services (pp. 701-741).

undoubtedly critical to avoid food shortage or waste and link products to the right customers. **Business services** such as R&D, human resource, legal, marketing and accounting services improve the farmers' and companies' core competitiveness by providing professional knowledge and individually tailored advice. In addition, other services such as **environmental services, educational services and certification services** complete the food value chain and help it function effectively and efficiently.

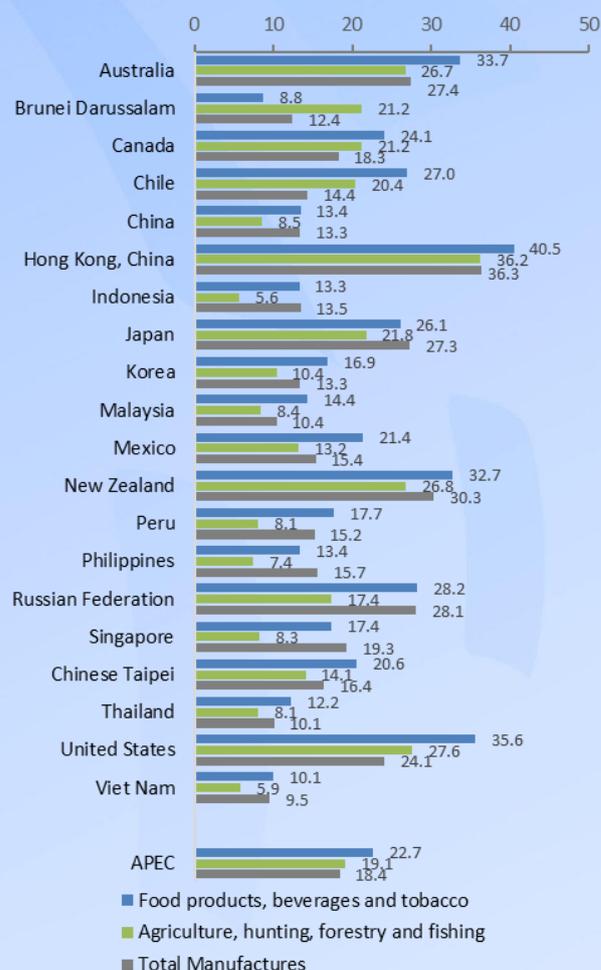
### ... But Not All Services are Equal

Some services have greater contribution in the food system than others. This section tries to provide some insights on which services are critical in the food system. It analyses statistics on APEC economies' domestic services value added share of gross exports as well as backward linkages of food and agriculture industries on services using the Leontief input-output inverse matrix from the OECD.

Figure 5 shows the domestic services value added share of gross exports in food products, beverages and tobacco industry, and similarly, in agriculture, hunting, forestry and fishing industry.<sup>6</sup> In the food products, beverages and tobacco industry, the domestic services value added share of gross exports in 2011 ranges from 8.8% (Brunei Darussalam) to 40.5% (Hong Kong, China), with an APEC average of 22.7%. For the agriculture, hunting, forestry and fishing industry, the share ranges from 5.6% (Indonesia) to 36.2% (Hong Kong, China), with an APEC average of 19.1%. A pattern can be observed from the figure, that is the share of services in food and agriculture industries is higher in the industrialised APEC economies (Australia; Japan; New Zealand; and the United States) than in developing APEC economies (such as China; Indonesia; Malaysia; the Philippines; Thailand; and Viet Nam).<sup>7</sup>

For comparison, the figure also shows the share of domestic services value added in total manufacturing exports. The numbers range from 9.5% (Viet Nam) to 36.3% (Hong Kong, China), with an APEC average of 18.4%. Aside from a few exceptions, the services value added contribution in the food products, beverages and tobacco industry is generally higher than in manufacturing in APEC economies.

**Figure 5: Domestic Services Value Added Share (%) of Gross Exports in Agriculture and Food industry, 2011**



Source: Authors' calculation based on OECD Trade in Value Added (TiVa) Statistics<sup>8</sup>  
Note: Data on Papua New Guinea is not available.

### So what are the key services in the food system?

The OECD Leontief input-output inverse matrix provides backward linkages of industries which indicate the number of units of goods or services needed from each sector in order to produce an additional unit of production of one specific industry.<sup>9</sup> For the purpose of our study, we look at a unit change in both the food products, beverages and tobacco industry, and the agriculture, hunting, forestry and fishing industry; and for each industry classification, we examine the services inputs that are required for its production.<sup>10</sup>

<sup>6</sup> This is based on two different industry classifications used in the OECD trade-in-value added tables.

<sup>7</sup> Industrialised APEC economies are Australia; Canada; Japan; New Zealand; and the United States. Developing APEC economies are Brunei Darussalam; Chile; China; Hong Kong, China; Indonesia; Korea; Malaysia; Mexico; Papua New Guinea; Peru; the Philippines; Russia; Singapore; Chinese Taipei; Thailand; and Viet Nam.

<sup>8</sup> OECD Trade in Value Added (TiVa) Statistics, accessed 3 May 2018 from

[http://stats.oecd.org/Index.aspx?DataSetCode=TIVA\\_2016\\_C1](http://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2016_C1)

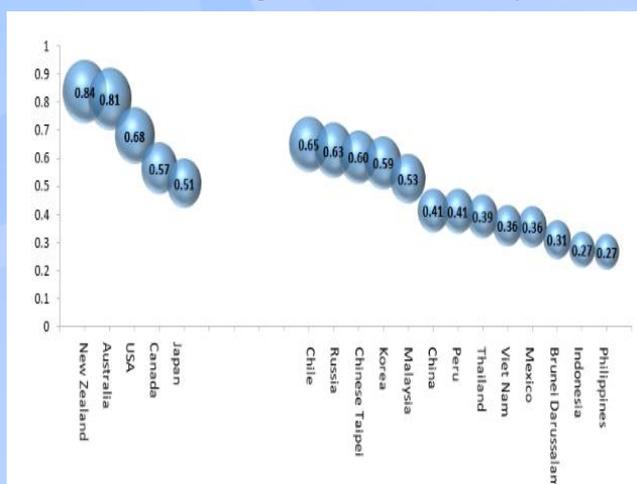
<sup>9</sup> For details of OECD Leontief input-output inverse matrix, see <http://stats.oecd.org/Index.aspx?DataSetCode=IOTS>.

<sup>10</sup> For the purpose of this paper, we focus only on services backward linkage and exclude linkage from non-services sectors.

### Food products, beverages and tobacco industry

Figure 6 shows the total services backward linkage of the food products, beverages and tobacco industry in APEC economies from the OECD Leontief inverse matrix. Both the y-axis and bubble size measure the number of input required from the services sectors to produce one additional unit in the food industry. For example, 0.84 unit input from all services sectors is required for one unit production in the food, beverages and tobacco industry in New Zealand in 2011.

**Figure 6: Total (Services) Backward Linkage of Food Products, Beverages, and Tobacco Industry, 2011**



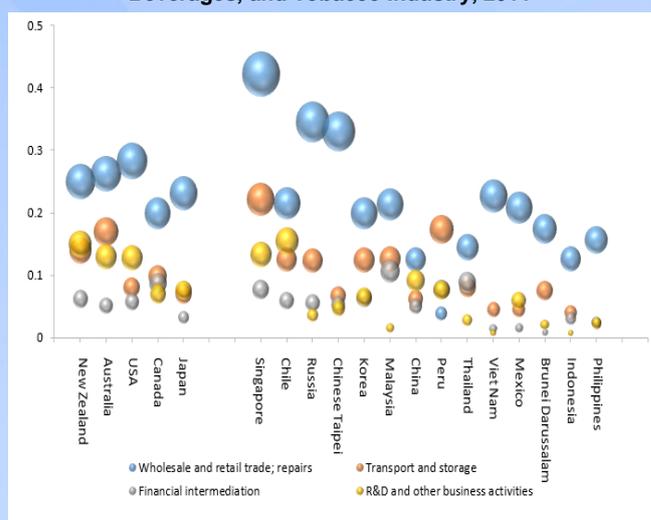
Source: Authors' calculation based on OECD Leontief Inverse Matrix 2011<sup>11</sup>

Note: Hong Kong, China; and Singapore are not included in the figure since the services input for both exceed the scale in y-axis (1.20 and 1.06 for Hong Kong, China; and Singapore, respectively). This can be attributed to the highly services-reliant structure of these economies. Data on Papua New Guinea is not available.

As shown in Figure 6, more than 0.5 unit is required from the services sectors in all developed APEC economies, while the services input is lower in the developing APEC economies.

The top four key services are identified when looking at the backward linkages on the individual services sector. As shown in Figure 7, wholesale and retail services, transportation and storage, financial intermediation, and R&D and other business activities<sup>12</sup> are the four major services inputs in the food products, beverages and tobacco industry. Wholesale and retail services take up a good amount in total services input for the food industry in almost all economies, followed by transport and storage services and business services such as R&D.

**Figure 7: Major Services Input in Food Products, Beverages, and Tobacco Industry, 2011**



Source: Authors' calculation based on OECD Leontief Inverse Matrix 2011

Note: Hong Kong, China is not included in the figure since total services input exceeds the scale in y-axis. For Hong Kong, China, wholesale and retail is 0.719, transport and storage 0.094, financial intermediation 0.075, and R&D and other business activities 0.111. Data on Papua New Guinea is not available.

### Agriculture, hunting, forestry and fishing industry

A similar pattern is observed from the Leontief inverse matrix with respect to the agriculture, hunting, forestry and fishing industry. Figure 8 presents the total services backward linkages of this industry in 2011 for APEC economies. The figure shows that developed APEC economies likewise have higher services input than most developing APEC economies. Compared with the food industry in the previous discussion, less services input is required across all APEC economies (except for Brunei Darussalam) in the agriculture, hunting, forestry and fishing industry.

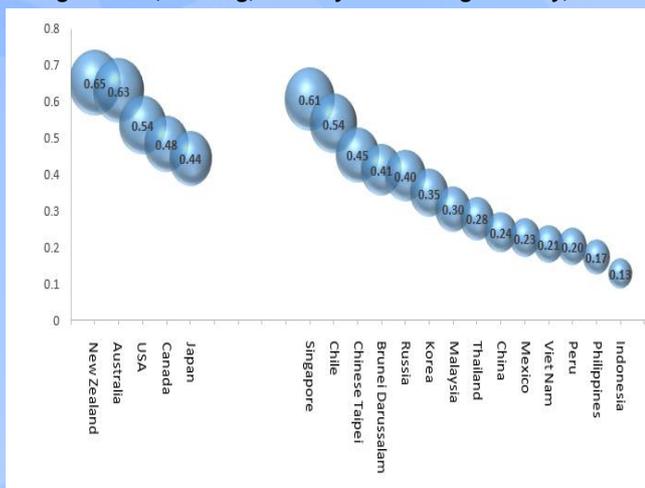
Wholesale and retail services remain the highest services input sector for the majority of APEC economies as shown in Figure 9. Transport and storage, financial services, and business services are the other major services sectors that contribute to the agriculture, hunting, forestry and fishing industry.

<sup>11</sup> OECD Leontief Inverse Matrix 2011, accessed 20 April 2018 from <http://www.oecd.org/trade/input-outputtables.htm>.

<sup>12</sup> Based on the International Standard Industrial Classification of All Economic Activities (ISIC) Rev. 3 classification used for

this table, other business activities here include legal, accounting, market research, business and management consultancy and advertising. For details, see <https://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=2>.

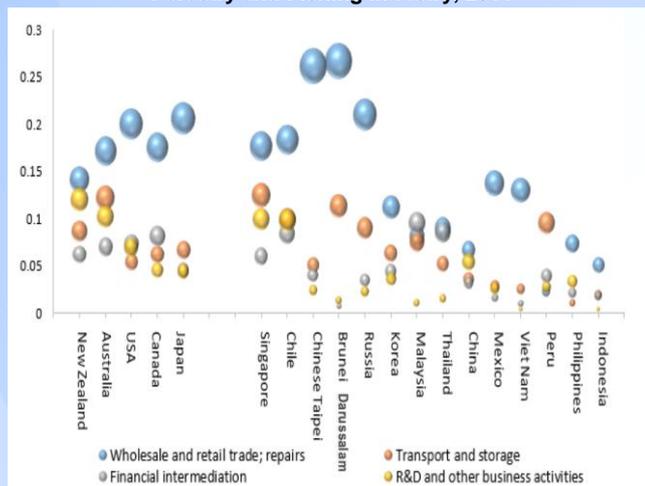
**Figure 8: Total (Services) Backward Linkage of Agriculture, Hunting, Forestry and Fishing Industry, 2011**



Source: Authors' calculation based on OECD Leontief Inverse Matrix 2011

Note: Hong Kong, China is not included in the figure since the services input exceeds the y-axis scale (at 1.08). Data on Papua New Guinea is not available.

**Figure 9: Major Services Input in Agriculture, Hunting, Forestry and Fishing Industry, 2011**



Source: Authors' calculation based on OECD Leontief Inverse Matrix 2011

Note: Hong Kong, China is not included in the figure since total services input exceeds the scale in y-axis. For Hong Kong, China, wholesale and retail is 0.637, transport and storage 0.087, financial intermediation 0.086, and R&D and other business activities 0.088. Data on Papua New Guinea is not available.

However, it is recognized that the Leontief inverse matrix from the OECD input-output table has certain limitations when identifying key services in the food value chain. For example, communications and computer services do not stand out in the calculation, possibly because at the time the data was collected in 2011, the transformation of ICT was not as deep and widespread as it is now.

<sup>13</sup> OECD Services Trade Restrictiveness Index (STRI). Accessed 17 April 2018 from <http://www.oecd.org/tad/services-trade/services-trade-restrictiveness-index.htm>.

## Summary and What Next

Wholesale and retail, transport and storage, financial services, and business services are the major services sectors in the food system identified by the Leontief inverse matrix. Together with ICT services, these five sectors can be discussed in detail in a future study. For example, for the financial services sector, the study can tackle different financing activities along the food value chain, various types of insurance services, barriers faced by players in accessing the service, as well as identify some innovative financial modes and cases in the APEC region.

Moreover, strict regulations on services hinder the development of the services sector and place barriers on trade in services. Considering the importance of these sectors, it is worthwhile to look at some of the regulatory impediments in services sectors based on the OECD Services Trade Restrictiveness Index. Restrictions on foreign entry, barriers to competition and regulatory transparency are the major contributors to the overall restrictiveness.<sup>13</sup> More discussion on the regulatory environment of the food-related services sectors can form part of a subsequent study.

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