



# Agriculture and Economic Development

# 3

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## Abstract

The evolution of agriculture from the days of the Lewisian two-sector model to today's context has involved many changes and developments, but the backwardness of the agriculture sector has persisted. Low-income countries have experimented with different policy orientations for agriculture. The modern linkage connecting agriculture to the rest of the economy is best described as a series of innovations in value addition through different types of processing and by linking the supply chains to niche markets. However, the occasional successes in value addition hardly match up to the systemic inefficiencies in low-income agriculture. For instance, there is evidence of countries where more than 34 per cent of the population is undernourished, while agriculture represents 30 per cent of GDP. Agriculture also faces significant environmental and climate challenges. While using 85 per cent of the developing world's freshwater withdrawals and 40 per cent of land, the sector accounts for up to 30 per cent of greenhouse gas emissions. The solutions to these challenges lie in multiple places: appropriate technologies, informed policy, transparent institutions, and, above all, efficient markets.

## Keywords

Growth models · Role of agriculture · Sectoral impacts · Macroeconomic impacts

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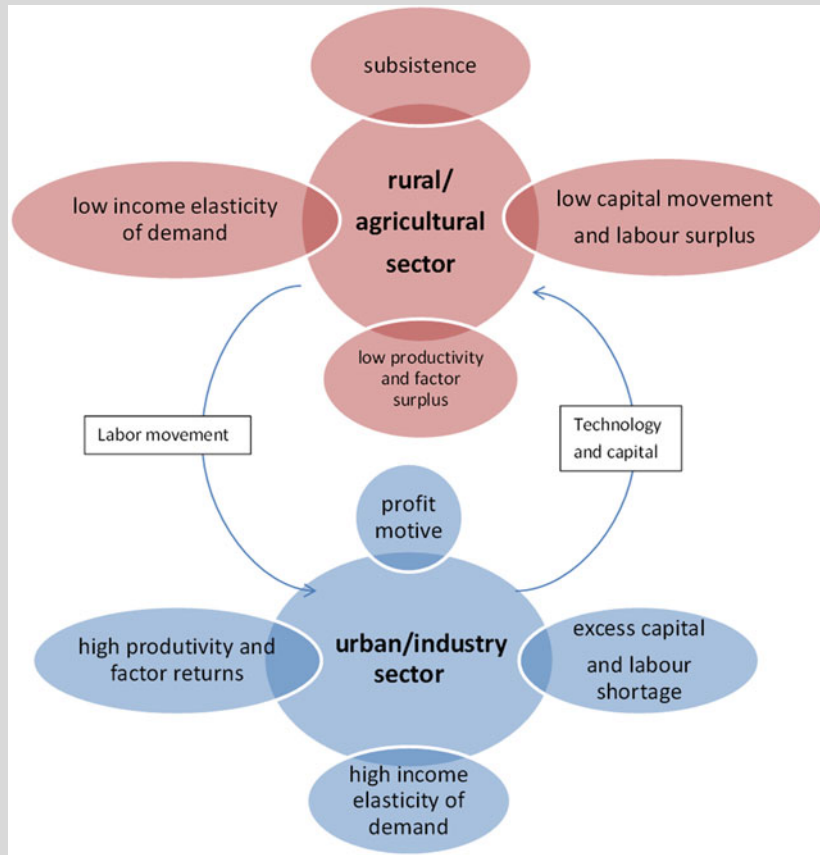
## **3.1 Role of Agriculture in Economic Development**

### **3.1.1 Linking Agricultural Transformation to Economic Growth**

Agriculture's contribution to economic development forms an integral component of the literature on development policy. Among the many contributors to the literature on agriculture and economic development, Arthur Lewis, Yujiro Hayami, Vernon Ruttan, John Mellor, Theodore Schultz, and Gustav Ranis stand out for making enduring contributions highlighting the agriculture sector's relations to economic growth. This genre of literature was essentially a response to the Malthusian warning that population growth would surpass the rate of increase in food supply. It also attempts to explain the economic and social transformations conditioned by global events, such as the industrial revolution, colonisation and imperialism, and the world wars of the twentieth century. Each of the aforesaid global events had its own element of shock and transformation to the global food supply. At the same time, episodes such as the Green Revolution marked a technology-driven process of gradual intensification of agriculture, necessitating a holistic understanding of agriculture's role.

The postcolonial world contained a multitude of low-income economies ideally suited for experimenting with economic restructuring. A pervasive traditional sector and tiny pockets of industrialisation were characteristics of many countries emerging from colonialism. In the context of two sector models (see Box 3.1), the role of agriculture was unambiguously outlined by many theorists as a facilitator to a future era of industrialisation.

**Box 3.1 Two-Sector Model of Economic Growth. Lewis Model, 1954 (as visualised by the author)**



In general, the structure of western economies was the model to be emulated. Mellor (1968) articulates the fivefold role of agriculture as follows: (a) meet a rapidly growing demand for agricultural products associated with economic development; (b) increase foreign exchange earnings by expanding agricultural exports; (c) supply labour to the non-agricultural sector; (d) supply capital, particularly for its own growth, for overheads and for secondary industry; and, (e) serve as a market for industrial output. The role of agriculture, as conceived above, is necessarily a subordinate role, a precondition to industrial transition, and the basis of prioritisation of self-sufficiency in staples and exports of agricultural raw materials. Thus, one could argue that the two-sector model was the origin of backwardness that many agricultural economies still grapple with.

A third strategy of agricultural growth was in making large investments in rural infrastructure. This complements the export-driven model by making local supply chains logistically efficient. Thus, public investments in agriculture form a historically important and still relevant component in the growth equation. The development literature provides much evidence of high and significant values of social rate of returns to large investments in irrigation, dams, and land consolidation projects, to name a few.

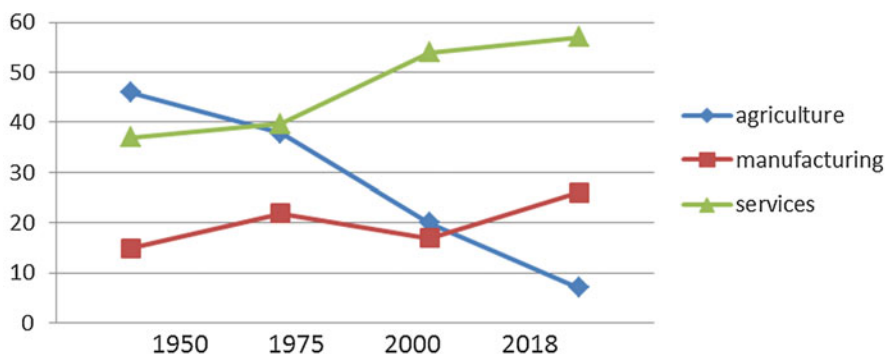
The evolution of agriculture from the days of Lewisian two-sector model to today's context has involved many changes and developments, but the backwardness of the agriculture sector has persisted. Such developments delivered hope but fell short of tangible outcomes. For instance, the high-yielding varieties in staples made self-sufficiency possible but failed to generate adequate profit margins to the cultivator. Export agriculture initiatives opened agricultural economies to the world but delivered neither stable prices nor sustainable business linkages. Marketing boards made supply chains stable but failed to coordinate production to avoid seasonal gluts and shortages. Farm subsidies helped continuity of staples but made farming systems less diverse. Technology helped farmers to be efficient but not optimal.

The modern linkage extending from agriculture to the rest of the economy is best described as a series of innovations in value addition through different types of processing of the raw product and matching the supply chains to niche markets. This process necessitates higher standards and quality to enable agricultural produce to be positioned in the mind of the consumer as products with respectability similar to industrial products. In other words, agriculture is transforming into an industry. As value addition and productivity increases, the excess labour is shed and production channels are streamlined in terms of efficiency and reliability.

Formulation of the agricultural sector's role in broader economic growth will vary based on the nature of development trajectories that a country faces. As a country undergoes a process of structural transformation, there are four broad responsibilities for the agriculture sector (Myint 1977). These include (1) food security, associated with annual per capita production of food (rice and other field crops); (2) labour mobility, releasing agricultural labour force to other sectors (manufacturing and services); (3) capital formation, through domestic savings from this sector; and, (4) agricultural trade, foreign exchange by exporting agricultural products. Each of the above has direct contributions to the national output.

### **3.1.1.1 Sri Lanka's Experience of Agricultural Transformation and Growth**

Economic growth during the postcolonial period in Sri Lanka has been driven almost entirely by agricultural production and processing. The statistics reveal that, in addition to the dominant agricultural sector that accounted for nearly 50 per cent of national output, the agricultural processing sector constituted nearly 7 per cent of the manufacturing sector in the early post-independence years. The classical two-sector basis was observable even within the agricultural sector in the form of a subsistence sector and a plantation sector.

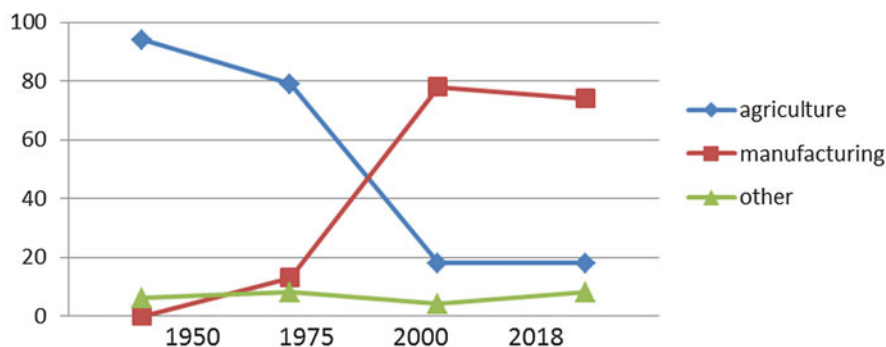


**Fig. 3.1** Declining contribution (%) from agriculture to national output. Source: Department of Census and Statistics and Central Bank of Sri Lanka, 1975–2019

However, Sri Lanka's growth story deviates from a textbook two-sector model. According to Jogaratnam (1964), the local peasant agriculture sector failed to release surplus labour to the more productive sectors (namely, the plantation sector) due to a host of structural reasons. Thus, a classic two-sector model, as visualised by Arthur Lewis (1954), did not materialise. On the other hand, the plantation labour did not seem to have benefited in any way from the rapid expansion and rising levels of productivity within the plantation industry. Thus, both sectors failed to generate welfare to the respective local participants.

After independence from British rule, the subsistence sector received a boost in the form of irrigation, land reallocation, and colonisation programmes. Staples were locally grown under state patronage. The Green Revolution had a significant impact on local staples in terms of factor productivity. These rural sector transformations helped release excess labour from the subsistence agricultural sector. The rise in factor productivities resulted in wage growth, but real prices of agricultural produce continued to decline under global supply conditions. The net result was a drastic decline of the agricultural sector's contribution to national output (see Fig. 3.1).

In the 1970s and afterwards, after realising the shortfalls of Lewisian-style growth, low-income countries adopted a regime of economic expansion in the form of export-led growth. The agriculture sector was given the promise of niche markets for efforts in diversification and partial value addition. Classically, agricultural exports carried the dual benefit of increasing farmer incomes and foreign exchange earnings of the country simultaneously. However, an individual country that caters to a small fraction of world exports of an agricultural product faces an elastic demand at the world market. In order to reduce the overexposure of exports to price shocks and to make export revenues less sensitive to price variations, the efforts to increase exports either within the product category or through diversification made sense. The downside of simultaneous efforts to expand exports of an agricultural commodity by a number of countries is the risk of substantial price declines, especially when the relevant price and income elasticities are low. The Sri Lankan experience in agricultural exports was similar to many other countries of



**Fig. 3.2** Agricultural exports as a percentage of total exports. Source: Department of Census and Statistics and Central Bank of Sri Lanka, 1975–2019

similar development status. While many programmes were carried out to diversify agriculture beyond plantation crops into spices, horticultural products, growth media, etc., substantive evidence of agricultural export-led growth was not observed (see Fig. 3.2).

Sri Lanka's agriculture sector today is a mix of several strategies that were discussed earlier. For instance, it is largely export-oriented in horticultural produce, spices, and tea but pursues import substitution in staples, and other field crops. The livestock sector remains underutilised overall with a growing poultry sector that meets the domestic demand. While the elements of export-led growth and import substitution are both observed in isolated pockets, the overall agriculture sector does not display an exclusive growth orientation today.

### 3.1.2 Poverty Alleviation

There is substantial cross-country evidence to support the argument that agriculture sector growth is important in reducing poverty. Wiggins (2003) outlines three channels of impact of agricultural growth on poverty alleviation. First, there is the direct impact of agricultural growth on farm incomes which accounts for a large share of total income in poor economies. Second, there are numerous rural economy linkages. Growth in the incomes of farmers and farm labourers creates demand for non-farm products and services in rural areas. These are often provided locally using local labour. Third, agricultural growth leads to reduced prices for food and raw materials and thus raises the real incomes of the urban poor. Agricultural growth may also generate savings that lead to greater farm and non-farm investments. In addition, large public investment projects in agriculture, such as irrigation, reservoir, and river basin development, bestow high payoffs to growth and poverty reduction. In particular, returns to agricultural research and extension (Alston et al. 2002) have been highlighted for having direct impacts on rural poverty reduction. Datt and Ravallion (1998) report that the price and wage effects of agriculture are more important in

reducing rural poverty in the long run than short-run direct effects on farm income. For example, during the Green Revolution in Asia, total factor productivity rose faster resulting in rising agriculture sector wages. This change took place more rapidly than the rate of decline in food prices (Lipton 2005), generating net welfare gains in the agricultural sector.

Food price volatility is a key poverty implication of agriculture. Given the relatively high share of household expenditure on food in low-income households, price shocks can aggravate poverty statistics at short notice. For instance, the 2008 food price spike is estimated to have moved approximately 130–155 million of the global population into poverty (World Bank 2007).

### **3.1.2.1 Sri Lanka's Experience of the Agriculture-Poverty Nexus**

While the incidence of poverty nationwide has been reduced over the last 20 years, pockets of poverty persist. In 2016, with the official poverty line at LKR 4166 per person per month, the poverty headcount was 1.9 per cent in urban areas; 4.3 per cent in rural areas; and, 8.8 per cent in the estate sector (Department of Census and Statistics 2017a). In 2018, the mean household monthly income for urban areas was reported to be LKR 88,692, while the values for the rural and estate sectors were LKR 58,137 and LKR 34,804, respectively (Department of Census and Statistics 2018). The global Multidimensional Poverty Index (MPI) incorporates other dimensions of poverty into the headcount indices and ranks countries based on 10 indicators, namely, nutrition, child mortality, years of education, school attendance, electricity, sanitation, drinking water, cooking fuel, floor, and assets. The MPI for Sri Lanka (reported for 2016) indicates that 37.5 per cent of people are deprived when the weighted average of all indicators is considered (Department of Census and Statistics 2019).

A blind spot in Sri Lanka's achievements in poverty alleviation is the area of gender parity. National poverty statistics, while displaying significant improvement, mask the gender wage gaps that are ingrained in the traditional economic units in the rural agricultural and estate sectors. For instance, the estimated earned income per capita per month for women is LKR 5379, and the estimated earned income per capita per month for men is LKR 17,275 (Food and Agriculture Organisation 2018), a disparity indicative of both unequal compensation and unequal opportunity.

Poverty in the agricultural sector in general (and particularly in the plantation sector) is due to a number of direct and indirect factors rooted in historic economic structures. Income poverty in agriculture can be explained in terms of falling real prices for agricultural goods and falling productivity in the rural sector. The presence of a vicious cycle of poverty is especially evident in the agriculture sector where incomes are seasonal and credit-bound relationships create pressure on farm incomes even after a good harvest. On the other hand, poverty strengthens out-migration of skilled workers, intensifying the deprivation within the sector. Statistics in 2017 show that, except for the professionals, the agriculture sector carries the highest percentage of workers in the age cohort of 45–60 years in Sri Lanka (Department of Census and Statistics 2017b).

### 3.1.3 Food Security and Livelihood Development

Food security is framed conventionally as a collective of four aspects: availability, access, utilisation, and stability. Food availability is ensured through local production and imports. Access is assured through affordable relative prices of foods and lower transaction costs along the food supply chain. Food processing, storage, and marketing are key aspects of utilisation. Stability of food supply is ensured via long-term planning that will determine both quantity and prices. Food security and quality of livelihoods within the sector are closely interlinked. A dominant rural sector having access to cultivable land and other inputs ensures a steady flow of food to the rest of the economy. Given the large land footprint of agriculture, land and resource policies directly affect the supply side of food. Factors such as drought, floods, pests, and diseases cause volatility in food production. In addition, high production costs, low profitability, post-harvest losses, inappropriate land use, shortage of water in some parts of the world, and declining soil productivity also have detrimental impacts on food security.

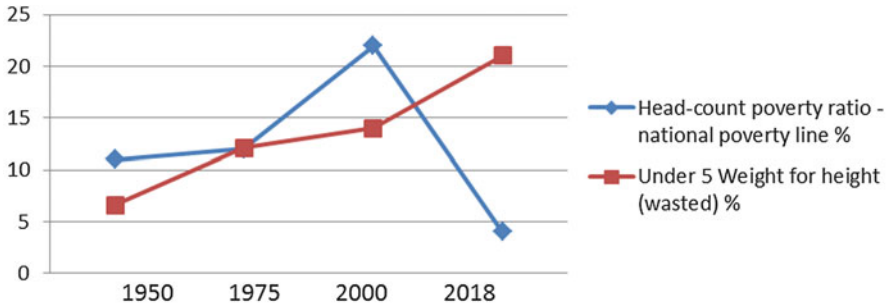
A host of factors determines food supply but food demand is easily conceptualised. The annual rate of increase in demand for food is a function of the rate of growth of population and that of per capita income. The access to food depends on the income elasticity of demand and, therefore, has a dampening effect on the demand expansion due to per capita income growth. Food access, on the other hand, is a function of mainly the per capita income. The level of value addition and reduction of waste, both of which are factors influenced by consumer education and technologies of food supply and processing, directly influence food utilisation.

Statistics show that undernourishment has fallen when food production has risen, at least in the early stages of growth. Per capita food production grew by only 1.4 per cent per annum in countries where the number of undernourished increased substantially (Food and Agriculture Organisation 2003). But it grew by 3.3 per cent per annum in countries where there was a significant fall in the number of undernourished people (Food and Agriculture Organisation 2003). In general, throughout low-income countries, agriculture accounts for around 9 per cent of GDP and more than half of total employment. Paradoxically, in countries where more than 34 per cent of the population is undernourished, agriculture represents 30 per cent of GDP, and nearly 70 per cent of the people rely on agriculture for their livelihoods (Food and Agriculture Organisation 2003).

#### 3.1.3.1 Sri Lanka's Experience in Food and Livelihood Security

Sri Lanka focused the greater part of her agricultural policy on food security during the post-colonial period. Thus, large-scale irrigation plans with concurrent colonisation programmes were scaled out into major river basins. State land was parcelled and allocated to the landless in the form of long-term user deeds in order to expand the cultivation of staple foods. Reservoirs and irrigation canals were restored to ensure a continuous supply of water. These efforts did meet with considerable success as observed in food availability in the island. While food access and food usage remain important concerns, Sri Lanka recorded a very high Household Food





**Fig. 3.3** Are poverty and nutrition statistics diverging? Source: Department of Census and Statistics, 1975–2019

Insecurity Access Scale Score (HFIAS), implying 90 per cent food secure households, placing Sri Lanka as the most food-secure nation in South Asia (Department of Census and Statistics 2017a). However, severe food insecurity is observed for 3 per cent of the households in the same measure.

In contrast to the above food security statistics, the Global Hunger Index indicates that the average level of calorie deficit in Sri Lanka in 2014–2016 was the highest in South Asia. The evidence suggests that access to food does not correlate with nutritional security in Sri Lanka. For instance, the Medical Research Institute of the Ministry of Health reports that almost one in three (31.8 per cent) pregnant women is anaemic. Stunting in children under 5 years increased during the period 2007–2016 in seven districts (see Fig. 3.3).

### 3.1.4 Natural Resource Conservation

Pressure on natural resources arising from the agricultural sector is threefold. First, it is agriculture’s direct dependence on natural resources. For example, water use in agriculture may create pressure on the alternative uses of water resources. Similar impacts may be observable on fertile land. Open access grasslands, forests, and fisheries typify the “tragedy of the commons”. Second, there is the pollution element and the depletion of the quality of the resource due to use. For instance, water is polluted by agrochemicals and soil by heavy metals found in fertilisers. Carbon emissions also fall under pollution. Thirdly, there are indirect impacts, such as the destruction of habitats of flora and fauna and reduction of biodiversity due to monocultures.

Such impacts emerging from agriculture pose serious unresolved problems to the quality of the environment and farming ecosystems. Indirectly, habitat destruction and ecological transformations such as monocultures have brought about pest and disease outbreaks, wild animal intrusion to farmlands, and reductions of biodiversity. Nevertheless, given the key role of providing sustenance in terms of provision

of food and feed, agriculture has a custodial role to the earth's natural resources, especially with regard to the natural resources in human habitats.

Ecology-friendly agriculture remains an ideal that is paid lip service in mainstream farming models. This, however, should not underestimate the role of alternative agricultural practices such as organic farming that are increasingly being promoted in response to consumer demand for environment-friendly produce.

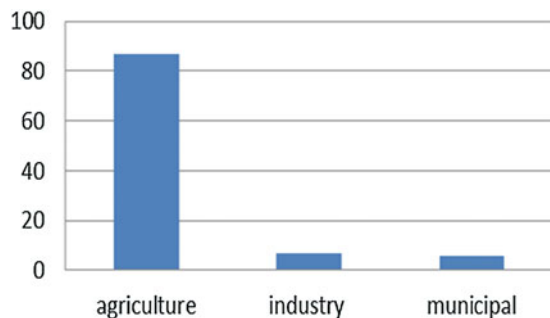
Statistically, agriculture is a major user of scarce natural resources. Approximately, 85 per cent of the developing world's fresh water withdrawal and 40 per cent of land are in agriculture. It is also a leading contributing factor to underground water depletion, agrochemical pollution, loss of biodiversity through deforestation, and to global climate change, accounting for up to 30 per cent of greenhouse gas emissions (United Nations Framework Convention on Climate Change 2015).

The gravity of the sector's impact on the environment and natural resources has long been a part of human knowledge and widely addressed in literature since the famed work of Rachael Carson. In response, academic and policy interest has focused on ecosystem-based approaches to agriculture. But widespread adoption of more sustainable approaches has often been hindered by inappropriate policies that encourage overexploitation and misuse of resources. Strengthening property rights and providing long-term incentives for natural resources management with off-farm benefits are necessary in both intensive and extensive farming areas to manage externalities. For instance, there is growing interest in payments for ecosystem services to help overcome market failures in managing environmental externalities (Food and Agriculture Organisation 2007). Among other corrective measures, environmental certification of products and farms enables consumers to pay for sustainable environmental management. Carbon trading schemes, especially if they provide finance for avoided deforestation and soil carbon sequestration, offer significant potential to reduce emissions from agricultural land uses.

#### 3.1.4.1 Agriculture's Impact on Sri Lanka's Environment

While research has been carried out into elements of pollution of water, air, and soils, the environmental footprint of agriculture in Sri Lanka has not been studied extensively. Numerous studies have highlighted the overuse of water in agriculture: Fig. 3.4 shows the relative size of agriculture in water withdrawals. The fate of

**Fig. 3.4** Water footprint of agriculture (percentage water withdrawals). Source: Food and Agriculture Organisation (Aquastat database)



water quality under agriculture has been a serious concern. Soil application of fertilisers beyond the recommended levels has affected the water quality (Rajakaruna et al. 2005). According to Henegama et al. (2013), in key vegetable cultivation areas, the fertiliser application rates exceeded the recommended rates by large margins. Amounts of potassium, phosphorus, and nitrogen were reported to be higher by at least 217 per cent, 12 per cent, and 55 per cent, respectively. The soil carbon content and microbial habitats have been depleted by the intensive use of agrochemicals. Cultivation on sloping terrain has led to removal of the topsoils. Soil erosion and surface runoff from agricultural lands have resulted in siltation of tanks and reservoirs (Dayawansa 2006).

Over a period of 70 years, land-use maps indicate the expansion of agricultural land. While land productivity has increased in several crops such as tea and rice over the same period, land productivity has declined overall indicating that there may be land abandonment from agriculture due to declining soil fertility. Conservative estimates indicate that nearly 44 per cent of agricultural lands in Sri Lanka have been subject to land degradation. This value is higher in sloping terrain where tea is cultivated.

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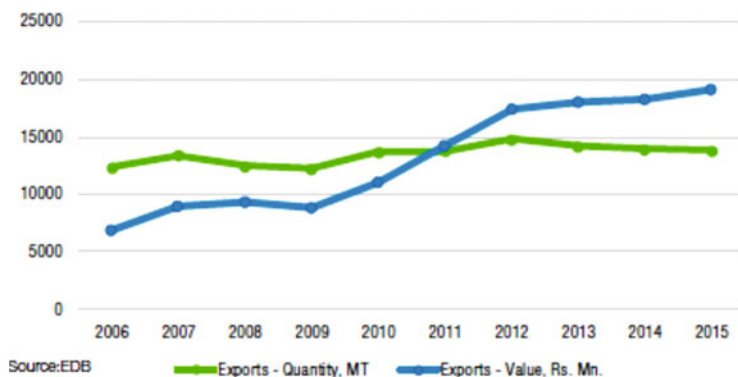
## 3.2 Drivers of Agriculture Development

The push factors and pull factors affecting agriculture are numerous and dynamic in nature. Analytical clarity is best served in treating the supply side and demand side differently. The supply side is predominantly driven by the policy framework, material input availability, and cost structure, and labour availability. The demand side is much simpler to understand but varied in composition. The consumer demand for food, feed, and fibre both locally and globally is coordinated by a market price mechanism.

### 3.2.1 Global Trends

The agricultural sector in every country adjusts to global trends and shocks. Global food value chains have integrated vertically to minimise transaction costs. While such developments ensure efficiency in the value chain, smallholders must adjust significantly to fit into these novel economic structures. With global supply chains integrated, diversification from primary exports to processed exports is necessary to maintain local competitiveness. The global trends of market integration can pose challenges to local agricultural value addition in the absence of frontier technologies. This vacuum is partially filled through the introduction of forward contract models and public-private partnerships which have introduced modern technologies into the agricultural value chain.

Among the less wholesome global trends, a recent threat to food sector stability is high fuel prices which have prompted many countries to look for alternatives, such as ethanol made from carbohydrates. Thus, crops such as maize, cassava, sorghum,



**Fig. 3.5** Cinnamon exports: quantities and values. Source: Export Development Board and Institute of Policy Studies, 2016

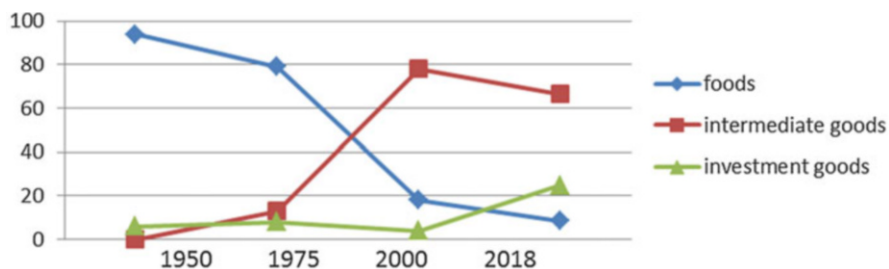
etc. are now cultivated for the purpose of fuel. While this is a significant driver of agricultural expansion, the obvious pressures on food and feed have not been resolved.

Thirdly, the world food demand is moving to nature-based, herbal, and locally procured produce. Global initiatives of standardising food supply chains free of heavy metal traces and emission-reducing production processes have restructured agricultural supply chains significantly. In mainstream agriculture also, it is possible to introduce green or organic variants (e.g. organic spices in Matale District and pesticide-free rice in Badulla District). Globalisation of specialised export crops with comparative advantage, such as cinnamon, pepper, and cardamom, appear to consolidate the local value chains. Area cultivated under such crops has risen under global preferences for Sri Lankan cultivars of these products and the careful matching of supply to niche markets. Real prices of these niche commodities have risen in world markets, resulting in significant value gains (see Fig. 3.5).

The changing global retail food marketplace is also an important driver of local agricultural development. Supermarkets and electronic markets have replaced conventional platforms for retailing. Reardon et al. (2012) claim that in emerging Asia at least 37 per cent of the market share is captured by supermarkets. The statistics for countries such as Hong Kong and Singapore report that nearly 60 per cent of the share of fresh fruits and vegetable sales are with supermarkets and other modern retailers (Reardon et al. 2012). Evidence from Sri Lanka also highlights the penetration of supermarket chains in fresh fruit and vegetable supply.

### 3.2.2 Macroeconomic Drivers

Macro sector shocks affect the agricultural sector through traded produce. Agricultural goods are traded through different channels and different institutional linkages. Starting from bilateral trade agreements to open market trading, agricultural output



**Fig. 3.6** Food imports percentage of total imports. Source: Central Bank of Sri Lanka, 1975–2019

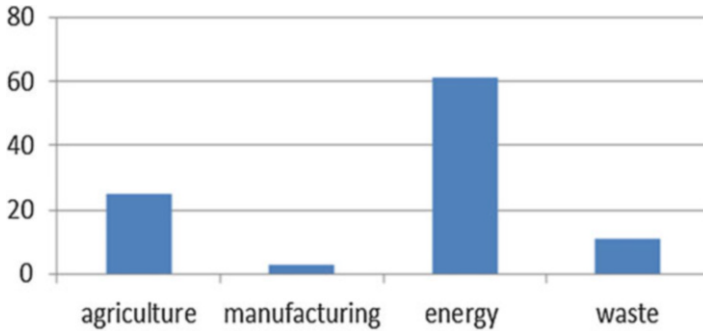
crosses borders every day and becomes important determinants of agricultural price level domestically.

Trade liberalisation is the single most important macroeconomic driver of local agricultural sector transformation in the modern era. Essentially, Sri Lanka moved from a high nominal rate of assistance to agriculture to a more liberal trade regime over the years. With a significant trade dependence, the agricultural and food sectors were directly affected by exchange rate shocks. For the greater part of the last 50 years, Sri Lanka operated a fixed exchange rate regime with currency overvaluations. However, Yamaguchi and Sarma (2006) conclude that this regime helped to reduce the real food imports and increase the agricultural exports, implying that the export depressing impact of an overvalued local currency did not materialise in the agricultural sector. Trade-dependent subsidies, such as for fertilisers, create pressure on the balance of payments under a fixed exchange rate regime. With the General Agreement on Tariffs and Trade (GATT) commitments on reducing tariff protections and floating regime, the vulnerability of local production increased significantly in the area of spices and plantation crops. Empirical studies do not find large-magnitude benefits to agricultural exports under a regime of floating exchange rates and lowered nominal rates of assistance. Statistics indicate that the imports of food have declined drastically in relation to non-food imports (see Fig. 3.6).

The third macroeconomic driver of agricultural sector development is inflation. The inflationary impact of a given percentage increase in food prices is much more severe in a low-income country than in a high-income economy. This is a simple consequence of the dominant position of food as a wage good in lower-income countries, where 50 to 60 per cent of total consumption expenditure is devoted to food compared with 20 per cent in developed economies.

### 3.2.3 Environment Pressures

Climate change impacts loom large in future projections of changes in the food supply. While technology provides solutions to mitigate and adapt to climate shocks on agriculture output at a given production setting, the impact of climate change on heterogeneous farmlands remains unaddressed. For instance, in the Sri Lankan agro-



**Fig. 3.7** Percentage contribution of agriculture to GHG emissions in Sri Lanka. Source: United Nations Framework Convention on Climate Change 2015

climatology, with the wet zone becoming drier and dry zone becoming wetter, there will be challenges of altering the farming systems in order to match the topology and soil environment to climate variations.

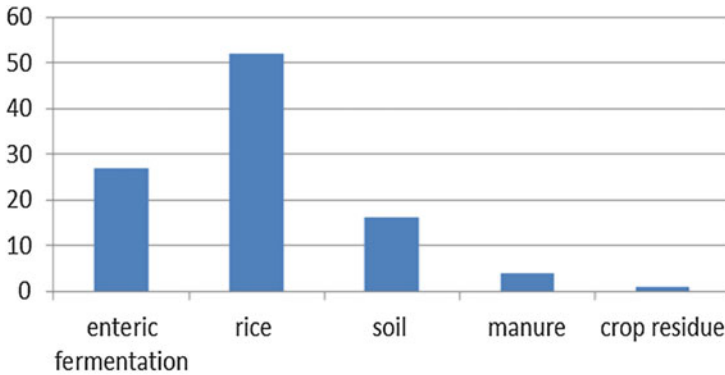
The paradigm of carbon trading also places pressures on agriculture as the opportunity cost of allocating land for cropping and livestock may be high in the presence of better prices of carbon stocks. While the valuation of ecosystem services and carbon will make the use of natural resources efficient at the global level, the local impacts may not be unambiguous. Shrestha et al. (2013) estimate that by introducing a carbon tax starting at USD 15 per metric ton, Sri Lanka's cumulative Greenhouse gas (GHG) emissions may drop by nearly 22 per cent by the year 2030. While agriculture is just one sector contributing to GHG emissions, such stylistic calculations will have impacts on land-use decisions in agriculture.

Agriculture is a dominant contributor to GHG emissions in the Sri Lankan context. Figure 3.7 shows the relative sectoral contribution to GHG emissions in Sri Lanka. Within the agriculture sector the relative burden of emissions is shared by the rice sub-sector and dairy sub-sector (Fig. 3.8). With stringent international commitments on carbon emission reduction, there is pressure to modify the conventional agricultural production practices into more sustainable ones.

Sri Lanka's agriculture currently records a contribution below the average value (i.e. 35 per cent) for a "non-annex 1" country under the United Nations Framework Convention on Climate Change classification. As the Food and Agriculture Organisation (2017) points out, the potential for reducing emissions from the agriculture sector is available, especially in the livestock sector. Greenhouse gas emissions and the resulting climate change impacts will be a key driver of the agricultural sector of Sri Lanka in the years to come.

### 3.2.4 Technology

Agricultural intensification is taken seriously in land-locked and resource-poor countries. The supply chains are directed towards input factor productivity and

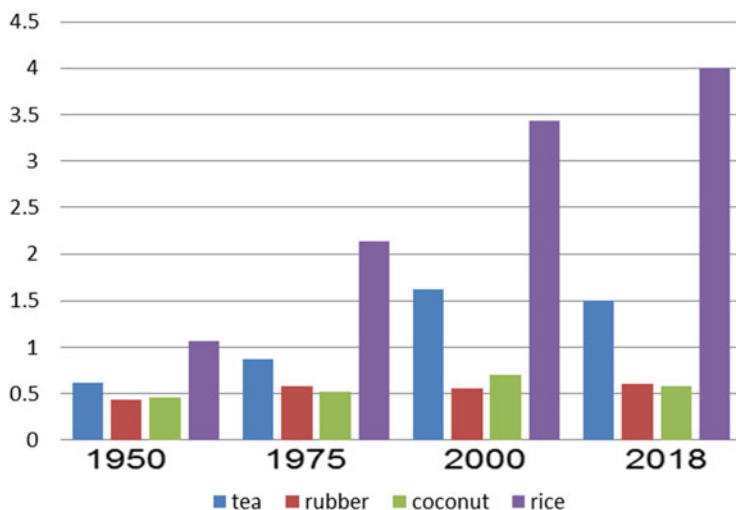


**Fig. 3.8** Percentage breakdown of relative contribution of activities within agriculture to GHG emissions. Source: United Nations Framework Convention on Climate Change 2015

reduction of transaction costs. At the national scale in Sri Lanka, the impact of technology in agriculture shows mixed outcomes. While the increased private sector participation in protected agriculture and niche product developments has benefited from external know-how and technology, the para-statal and smallholder sector have not shown significant adoption of new technology. The only clear adoptions have been at land preparation and harvesting of staples (which remain at nearly 100 per cent locally). New policy developments such as public-private partnerships are necessary to introduce capital-intensive technologies at other stages of the agricultural supply chain. The historical evidence is symptomatic of a rise of input productivities in some sub-sectors while clear lags are visible in others. In general, tea and rice cultivations show increasing returns to land while coconut and rubber do not (Fig. 3.9).

The level of penetration of technology is varied even in cases where there are substantive increases in land productivity. For instance, in local rice production, the land preparation, harvesting, and threshing stages use mechanisation to a level above 98 per cent of the farmers (Gamlath et al. 2018). But, the rate of mechanisation of seedbed preparation is at 29.73 per cent, rice transplanting at 3 per cent, weeding at 3 per cent, and power spraying at 9 per cent. The time trade-offs for manual implementation of tasks such as transplanting are more than 10 times the labour hours used with mechanisation.

Other technological drivers of agriculture include Information and Communication Technologies (ICT), especially as part of agricultural extension provision. This development is a result of near 100 per cent penetration of mobile telephony into the rural sector. A recent study finds that mobile agricultural extension users are 2.2 times more likely to decrease fertiliser and pesticide use than non-users (Palmer and Darabian 2017). Users of mobile phone-based agricultural extension were also significantly more likely to report changes to their planting habits (3.3 times) and their harvesting and storage practices (2.2 times) than a matched group of non-users (Palmer and Darabian 2017).



**Fig. 3.9** Evidence of land productivity changes in plantation crops and rice. Note: Comparison across crops per given year is not intended due to difference in units. Display of changes across years by crop is the intended purpose of the figure. Source: Central Bank of Sri Lanka and Department of Census and Statistics, 1975–2019

### 3.2.5 Institutions and Policies

Institutions and policies are a key aspect of agriculture in almost all countries. In many low-income and middle-income countries with a significant rural sector, agricultural institutions and policies are politically impactful. As the economies of these developing countries gradually open to world trade, the frictions arise mainly in agricultural institutions and policy structures. The classic development question for many decades and perhaps still to date is why agricultural policy is still so difficult to reform. Is it due to inefficiency in policy structures that are politically appealing? Is it inability to coordinate across vast numbers of rural-smallholder producers? Is it the issue of inadequate land title ownership among smallholders? Or is it the essential perishability of agricultural produce, making harmonising agricultural value chains difficult? There may be other possibilities.

Local experience with respect to agricultural sector policies starting from the colonial period is worth revisiting for the lessons one can draw from history. According to Jogaratnam (1972), the development strategy for Sri Lanka in the early twentieth century was concerned with the provision of credit which was considered to be the critical factor that limits sustained increases in agricultural production. Thus, agricultural policy was mainly concerned with the establishment of rural cooperative credit societies. After failing to reap the expected outcomes, the policy interest shifted to irrigation, land development, and settlement in the 1940s. It was recognised that the farm units were too small to be economically viable and that new land had to be opened up or existing land consolidated. The focus on



agricultural expansion was accompanied by a scheme of incentive prices which guaranteed the farmer a price for rice and input subsidies (particularly for fertilisers). A third era of policy materialised in the 1960s with rural development programmes, influenced mainly by Arthur Mosher's work. The logic was to adopt an integrated approach to agricultural development focusing on five essential elements (markets, technology, local input supplies, production incentives, and transportation) and five accelerators (education, production credit, group action by farmers, land improvement, and national planning). The integrated development focus temporally overlapped with the introduction of Green Revolution technologies. The domestic rice sector saw rising productivity of inputs and livelihood conditions. Perhaps, at this point, in the later 1970s to 1980s, the labour releasing role of agriculture actually occurred. Adoption of an open economy structure to the country helped pull labour out of agriculture into urban vocations in manufacturing.

Even though investing in agricultural research and development has generated very high internal rates of returns historically, most recent agricultural policy commitments have taken the form of channelling funds toward subsidising private goods (like fertiliser and credit). Researchers have argued that spending on private goods provision, such as through subsidies, is less productive than investments in public goods (López and Galinato 2006).

Many countries display a policy bias favouring the agricultural sector *viz-à-viz* other sectors of the economy. Literature reports the impact of subsidies as a 30 per cent decline in the relative price of agricultural products with respect to a non-agricultural price (Krueger et al. 1991). This policy bias is worsened by overvalued exchange rates, high tariffs, and taxes on agricultural exports (Anderson 2008). Macroeconomic restructuring is usually recommended as a measure to correct such historical biases towards agriculture. However, the outcomes are mixed. There is evidence to suggest that while macroeconomic initiatives have increased the competitiveness of agriculture, these gains may be offset by trade policies (of high-income countries) which reduce world market prices for agricultural produce (World Bank 2007).

Looking at the multinational agricultural development agenda, one observes that the share of agriculture in official development assistance has declined sharply in the period up to the 2008 food price crisis: the share varies from 18 per cent in 1980 to around 3 per cent in 2005 (World Bank 2007). However, the food price crisis refocused attention on newer problems of agricultural development, such as price volatility and the fungibility of cash subsidies. This renewed attention resulted in drawing capital in the form of private-public partnerships, and the novel institutional structures promised a greater likelihood of returns to public spending globally.

Modern agriculture policy has moved away from the classic material subsidies and land tenure restrictions even within South Asia. Key examples in this regard include water markets in Bangladesh, electronic (online) vending platforms in India, and electronic finance in Pakistan, all acting to widen the policy frontier in agriculture. Simultaneously, the organisational structures of agriculture are fast evolving to capture the benefits of global capital stocks and private venture capital. For instance, in all South Asian countries, private-public partnerships are promoted actively by the

state as a solution to the capital shortage in agriculture. Sri Lanka has actively adopted a Public-Private-Producer model of agricultural investments since 2015, in ventures ranging from standard crop and animal production to peripheral areas such as seaweed culture and apiculture (Prasada 2019).

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### 3.3 Assignments

1. Agriculture's contribution to growth rate diminishes in the long term, but there may be short-term contributions that surpass the other sectors. Using cross-country data from 1950 onwards, test if the above claim holds. Use World Bank open data for data series extraction.
2. Using time series data on agricultural GDP and an agricultural price index, test if the following major policy episodes had any impacts on output or prices. Use World Bank open data and CBSL annual reports for data series extraction.
  - Accelerated Mahaweli project (1978–1984)
  - Fertiliser subsidy removal (1990–1994)
  - Land reform (1972–1975)
  - Trade liberalisation (1978 onwards)

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