

Agricultural Value Chains in Developing Economies: A Theoretical Framework



Robert N. Truelove, Stephen C. Lellyett, Abukari Ibrahim Issaka,
and Samsul Huda

1 Introduction

The aim of this chapter is to provide a conceptual framework for understanding value chains and to inform our understanding of complex systems, such as the food supply system, which is critically important to human life on this planet.

Essentially, a value chain represents the flow of goods, services and processes leading to final consumption. A given value chain may span the full range of processes involved from supply of raw inputs, production and manufacturing, distribution, marketing, to the sales and final disposal of associated waste, or any subset thereof. Agricultural value chains start with inputs to the production of food or other natural products, which may be consumed ‘whole’, or in a transformed state; and may be marketed and consumed ‘locally’ or transported and then marketed to the final consumer. Along this path, the goods may be bought and sold by one or more intermediary businesses. Each and every function carried out by participants along that chain may add value to the ‘raw’ farm product—value which in the eye of the final consumer is worth paying for, in order to satisfy their particular ‘need’ or ‘want’.

In a world with finite resources it goes without saying, that the food supply system needs to be sustainable, that is it must continue to support human life without exhausting the planet’s resources. But further than that, the impact of that system needs also to cause as little damage to the broader ecosystem as possible. So, sustainability in its widest interpretation means satisfying human needs on an ongoing

R. N. Truelove
Farmer/Agricultural Economist, Cootamundra, NSW, Australia

S. C. Lellyett
Expert Consultant formerly of Australian Bureau of Meteorology, Sydney, NSW, Australia

A. I. Issaka · S. Huda (✉)
School of Science, Western Sydney University, Hawkesbury Campus, Richmond, NSW, Australia
e-mail: s.huda@westernsydney.edu.au

basis without exhausting natural resources and with as little detrimental impact on the inherited environment, as possible.

A more expansive definition of a sustainable food value chain which captures most of the points raised above is:

the full range of farms and firms and their successive coordinated value-adding activities that produce particular raw agricultural materials, and transform them into particular food products that are transported, marketed and sold to final consumers and disposed of after use, in a manner that is profitable throughout, has broad-based benefits for society, and does not permanently deplete natural resources.¹

Both value chain actors who directly own the product and the various business service providers such as banks, transporters, extension agents, input dealers and processors who charge a fee are encompassed within the ‘full range of farms and firms’. The particular business environment in which these actors and service providers operate acts as a strong influence on the way they behave and perform.

A notional activity which expresses a purposeful human activity is referred to as a human activity system. These systems are referred to as notional because they are intellectual constructs and a simplified description of real-world activity. To improve a farming system as depicted in Fig. 1, inputs to animal and plant sub-systems, alongside the processing of their waste products via the decomposing sub-system, are all guided by human activity utilising innovations, allocations and operations which can impact the environment. This produces outputs that in turn impact on and are influenced by broader systems and forces beyond the farm. Managing this impact in a way that is sustainable beyond the farm should be a key objective of policy alongside fostering increased productivity of the farm itself. Capturing these objectives and sub-system interactions within the design of food value chain models is therefore important.

2 Value Chain Modelling of Agricultural Products and Its Interrelationship with the Three Fundamental Systems

The agricultural value chain encompasses all three of the fundamental systems that make up our complex world—the environmental or natural system (ecosystem); the economic system and human social system. All three interact across agricultural value chains at multiple points. Inputs to one system may draw on the stock of resources of another system, for example, gains in the productivity of crops requires an optimal supply of environmental inputs that includes adequate water from rivers, bores or rainfall, daily temperature exposure, solar radiation and evapotranspiration (ET), plus nutrients from soil with further dependency upon texture, chemistry, erosion hazard and hydraulic properties—sometimes built up over millennia in the natural environment. Whilst these may be initially free inputs, their usage may lead

¹ This definition is mainly a variation on and expansion of the definition by Kaplinski and Morris (2000).

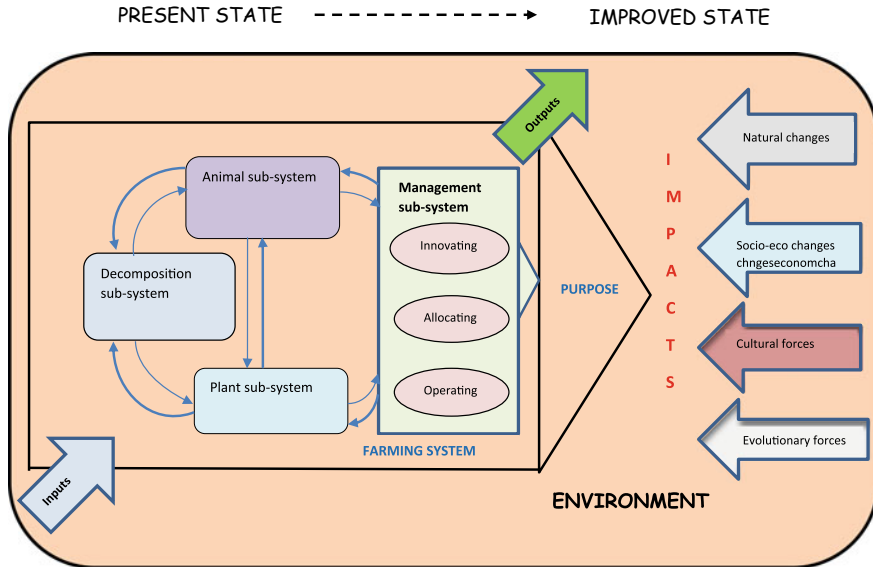


Fig. 1 A model of farming as a human activity system. Modified adaptation from Bawden (1992)

to environmental depletion that is not sustainable in the long run. For instance, unless properly managed (for example, by applying appropriate fertilisers), losses of soil fertility from overuse can eventually impact agricultural productivity, farmers’ incomes and the ability to sustain livelihoods.²

In time, if practised across the farm sector and not rectified, such natural resource depleting activities may ultimately threaten a country’s supply of arable land, food and thus food security giving rise to inter-generational unsustainability. With only narrow opportunities for non-agricultural off-farm income in the rural areas of many developing economies, such impacts can lead to increases in rural poverty. Furthermore, in developing economies the means to avoid natural resource depletion is often limited. E.g. limits in farmer access to capital for high-tech machinery, genetically engineered seeds, or the education required to adopt more sophisticated practices. Hence government investments in infrastructure, appropriate education, plus the delivery of research and development outcomes into practice, to name but a few, are important.

Whilst some of these inter-system dependencies can lead to inter-generational unsustainability of food security, others can lead to undesirable or unacceptable

² To illustrate the complexity of these issues—the manufacture of artificial fertiliser involves the use of fossil fuels and hence adds to carbon pollution, but the use of fertiliser increases the per hectare productivity of agricultural crops leading to less demand for land, hence less clearing of forest, thus preserving important carbon sinks. As well increased plant production results in more carbon absorption through photosynthesis and potentially, with the right farming technology, can lead to increased soil carbon, another important carbon sink. So, artificial fertilisers can be both a contributor to carbon pollution and a carbon sink promoter.

social or environmental outcomes. For instance, some farm production techniques, while dramatically increasing productivity and maximising economic efficiency, can have detrimental impacts on human social systems and the environment. Such is the case with adverse human health and biodiversity impacts due to the use of certain chemical pesticides. The cost of these impacts is not calculated in the farmers cost of production because it is not an immediate cash cost and is, as we discussed above, what economists call an ‘externality’³. One of the earlier examples of a widely adopted agricultural technology causing major ‘external’ costs, not recognised before adoption of the technology, was the use of D.D.T (*dichlorodiphenyltrichloroethane*) by American farmers in the 1950s to control insect pests.

D.D.T is a chemical that does not breakdown readily, so washed into water ways it accumulates in fish and other species. Through its usage within agriculture, D.D.T worked its way up the food chain to eventually reach toxic levels in the prey of species such as the American Bald Eagle that led to its near extinction—the symbol on the seal of the United States of America was nearly lost to posterity.⁴ Moreover, the accumulation of D.D.T in foods also posed significant long-term risks to human health. As a result of these negative externalities, the use of D.D.T was eventually banned in many countries, despite its benefits in increasing the productivity and economic efficiency of farming.

Likewise, in the assessment and optimisation of value chains, positive externalities should also not be overlooked. For example, the construction of dams to support irrigation may also have positive externalities in providing a safe source of water for drinking and sanitation.

Understanding the complex interrelationships of the three fundamental systems, the natural, the economic and the social systems, is critical to managing the sustainability of the food value chain. In order to do this, the component systems must be understood first. In this chapter, we look at the natural (which encompasses agriculture) and economic systems in some depth to build a theoretical framework that facilitates understanding how they interact and behave, and how they impact, and are impacted by the social system. Ultimately, this will enable the construction of

³ In economics, the term ‘externality’ refers to a cost which falls outside the system under study.

“An externality exists whenever the welfare of a firm or household, depends not only on his or her activities, but also on the activities under the control of some other agent” (Tietenberg, 2000). An externality is therefore a form of market failure. An example of a cost ‘externality’ is the pollution from mining activities of the Ok Tedi and Fly rivers in Papua-New Guinea, which caused large scale fish kills and threatened the food supply and health of villages living down-stream from the mine. While no doubt the compensation did not fully account for the cost of the disaster, \$28.6 was paid in an out of court settlement and gives some idea of the cost of the ‘externality’. https://en.wikipedia.org/wiki/Ok_Tedi_environmental_disaster.

⁴ Exposed by Rachel Carson, in her famous book titled *Silent Spring*. In the book Carson said; “chemicals sprayed on croplands or forests or gardens lie long in soil, entering living organisms, passing from one to another in a chain of poisoning and death. Since the ban on the use of D.D.T and other organo-chloride pesticides, the American Bald Eagle population has recovered to the point where it was taken off the endangered species extinction list in 1995.” Chapter 2 “*The Obligation to Endure*” *Silent Spring* Penguin Book 2268 1962 p. 23.

models to represent and aide in the optimisation of the food and other agricultural value chains.

Lellyett (2021) developed Fig. 2 schematically depicting a conceptual framework within which the agricultural value chain for a particular agricultural enterprise, industry or sub-sector can be analysed and optimised within its unique broader national or international context. This differs from the generic value chain model of Porter (1985) in that whilst Porter's model is targeted at the firm level, Lellyett's formulation reveals a view within a system-wide context that can be tailored to either an industry, sub-sector or firm level, depending upon the analysis required. Porter identifies 5 primary activities for a firm (Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service), which together with supporting activities (Firm Infrastructure, Human Resource Management, Technology Development and Procurement), serve to produce a profit margin or competitive advantage at the firm level. Each of Porter's elements is either implicitly or explicitly contained within Lellyett's model, but Lellyett's model also depicts the external economic, environmental and social pressures acting upon and within the value chain. Inclusion of these pressures provides further context and constraints, within which the industry, sub-sector or firm must operate. Furthermore, Lellyett considers the downstream consequences and outcomes beyond the generation of firm margins, such as the consumption of outputs and waste disposal. Neither Porter's or Lellyett's model displaces the other in validity. They are complementary and harmonious, but geared toward different purposes in terms of analysis. The overall focus here is on the development of sustainable agricultural value chains at a macro level, inclusive of not only food inputs and production but also waste disposal, circular economy and external factors such as climate change.

Figure 2 is a high level and generalised outline of the model where the entire value chain exists within a unique national or international context arising from a mix of pressures, influences and constraints imposed by forces from the underlying economic, environmental and social systems. These will vary by country, industry, sub-sector and enterprise. Within that overarching environment, the agricultural value chain generically consists of initial Inputs, flowing into the agricultural production system (represented earlier from a systems perspective in Fig. 1 by Bawden). This in turn produces outputs that are transformed and supplied to consumers for use. The subsequent processes generate waste, which must then be dealt with. Within each of these successive processes along the core value chain, additional value is added in response to consumer demand or the demand of market participants that derives from final consumer demand. These impacts then disperse throughout the given national economy, and may also have international effects. In reality there may be instances where value is not added, not maximised, or where negative externalities are created. Such cases present an opportunity for reform or optimisation.

Depicted parallel to the core value chain in Fig. 2 are the intermediating influences of agriculture-relevant policy, infrastructure and social enablers (above the core), and supporting services (below). These factors are often key in constraining, optimising and sustaining the core value chain. For example, investment in major infrastructure enablers such as dams can provide a basis for irrigation inputs to the

High level agricultural value chain framework over all outline

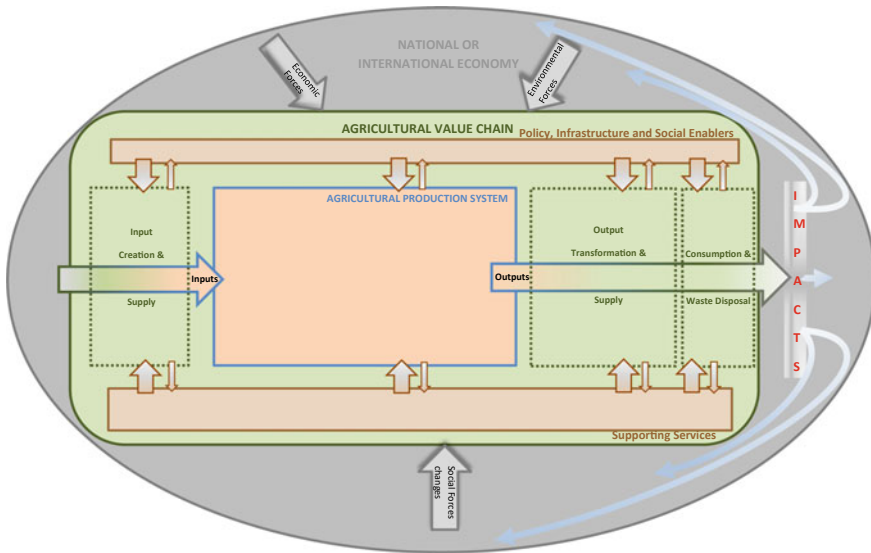


Fig. 2 Working along the length of the core agricultural value chain at various points is the influence of policy, infrastructure and social enablers directly relevant to agriculture on one hand, and various support services on the other. Each in turn may also be influenced by actors within the core value chain itself. The framework is intended for application at the enterprise, industry, sub-sector or global value chain level, within a given set of national and/or international level economic, environmental and social constraints (Developed by Lellyett, 2021)

agricultural production system, which if applied prudently can significantly boost yield quantity and quality. The influence of enablers and supporting services may manifest at any point along the core value chain. For instance, climate analyses and forecasts, available as supporting services, may indicate that in order to maintain product quality, maximise shelf-life, minimise waste and achieve premium pricing there should be an investment in refrigerated transport and storage services within the Output Transformation and Supply segment of the core value chain.

The application of Lellyett’s model will be demonstrated in a later section by populating the framework with relevant details to depict some key differences and similarities in agricultural value chains between Developing, Emerging and Developed economies.

3 Global Agriculture and Sustainable Development in Developing Economies

The United Nations 2030 Agenda for Sustainable Development⁵ provides an informative framework within which to contextualise the existential importance of agriculture into the future. The 17 Sustainable Development Goals (SDGs) and their associated targets provide a valuable yardstick against which to measure progress toward the long-term sustainability of human activity, and existence on earth. Agriculture either features explicitly, or indirectly impacts upon or is impacted by each of the 17 SDGs and a large number of the 169 SDG targets. With a rapidly rising human population, limited arable land, diminishing natural resources, and significant economic reliance on the agriculture sector globally—particularly in developing countries—it is not surprising that agricultural development is central to the SDGs and their attainment. A comprehensive review of all aspects is beyond the scope of this chapter and book, however, in this section, we shall provide some highlights on progress and challenges, in order to convey the importance of agriculture to sustainable development, particularly in developing countries.

Global agricultural output more than tripled between 1961 and 2011. Although an increase in agricultural productivity has generally kept the overall aggregate and growing demand for food, fibre and other agricultural products within reach, the expansion of agricultural land has remained relatively limited. Total cultivated land increased by only 12% between 1961 and 2009, but productivity more than doubled. Where land clearing for agriculture has taken place, it is in developing countries like Brazil and Indonesia with a significant proportion of their population living in relative rural poverty. Worldwide, the amount of land needed to produce food for one person has decreased from 0.45 hectares in 1961 to 0.22 hectares in 2009. During the same period, the extent of irrigated land more than doubled, increasing from 139 to 301 million hectares (Earthscan, 2011). By providing farmers with access to water, irrigation has been a key factor in intensifying agricultural production—yet some 2.2 and 4.2 billion people globally lacked safely managed drinking water and sanitation respectively, in 2017 while post-covid the need for clean water has escalated—highlighting the delicate balance required between allocation of scarce water resources for agriculture to support food security, versus allocations for drinking water. At the same time, despite the observed improvements in agricultural productivity, the proportion of the human population on the earth suffering from moderate to severe food insecurity has been estimated by the United Nations (UNDP, 2020) to have increased from 22.4 to 25.9% between 2014 and 2019.

This brings into focus an example of tensions between achievement of some SDGs, in this case SDG 6 (Water Availability, Management and Sanitation) and SDG 2 (Zero Hunger). It raises concerns not only about the achievement of individual SDG targets, but also whether such tensions can be resolved without having to forego the achievement of either SDG.

⁵ United Nations (2015).

In this case, on the one hand, there is concern regarding the regression in food security against SDG target 2.1 which embodies the elimination of hunger and attainment of food security for all by 2030. With the quantity of food produced having increased significantly, it may be that inadequacy in food access and supply chains are amongst the primary drivers of this regression, highlighting the utility of bringing value chain analysis to bear in identifying specific problems and formulating solutions.

On the other hand, there is competing concern that SDG targets 6.1 and 6.2 that growing water allocations to agriculture may lead to under-allocations to drinking water and sanitation respectively that render these targets unattainable. Again, value chain analysis of water supply, demand and usage provides a useful tool for identifying solutions.

On the question of the adequacy of food production to support SDG2, although developing countries have contributed to the observed rises in agricultural productivity the opportunity exists to lift productivity further.⁶ Small-holder farmers, which dominate agricultural output in many developing economies are often unable to afford the costs, lack the necessary access to capital, don't have the education necessary and lack a supporting national extension, research and development infrastructure to engender and sustain the adoption of better technological farming systems. This is a major risk and challenge to the achievement of SDG 2 generally and target 2.1 (By 2030, end hunger and ensure access by all people to safe, nutritious and sufficient food all year round) in particular.

FAO (2021) reported the first global assessment of progress with respect to food insecurity and malnutrition for 2020 against the 2030 Sustainable Development Agenda. It was found that hunger, as measured by the prevalence of undernourishment, had increased by 60 million people since 2014 to reach 690 million people in 2019. An acceleration in numbers during the later years of that period is attributed to higher numbers of conflicts, climate-related shocks and economic slowdowns. Should the trends continue, with currently estimated population and total available food projections taken into account, it could see numbers increase to over 840 million people by 2030. Developing countries would bear the brunt with Asia accounting for 330 million people, and Africa overtaking Asia to account for 433 million people. Moreover, preliminary findings also suggest that the COVID-19 pandemic may have added between 83 and 132 million people to the global number of undernourished in 2020. Although these estimates must be approached with caution—for example, because we do not know with precision how strong the COVID recovery or economic growth might be—SDG target 2.1 is clearly not on track to be successfully achieved by 2030.

Key to addressing these challenges is the achievement of SDG target 2.a which entails 'increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive

⁶ The FAO estimates farmers in the poorest parts of the world could see crop yields improved 40% by the adoption of technological improvements such as improved varieties, application of fertilizers and mechanisation (FAO, 2018).

capacity in developing countries, in particular least developed countries'. In developed economies intensive agriculture has evolved with industry consolidation and the rise of very large-scale corporate farming, supporting national research and development programmes and ready access to finance and markets all of which, render capital intensive high-tech mechanisation, high cost fertilisers and pesticides, large-scale irrigation infrastructure and genetically engineered grains and animals, plus engagement of private extension agents, more affordable.

For developing countries dominated by small and marginal farmers, opportunities are now opening for transition from subsistence to micro-commercialism via intensification and diversification of production. This supports a virtuous cycle of gradually rising incomes, but also requires government commitment to the ongoing global democratisation of knowledge and research, provision of extension services, the opening of national and international markets and an increased government inclination and capacity to invest in large-scale underpinning infrastructure.

For those developing countries which have already established an agriculture sector dominated by micro-commercialism, the opportunity is to move further up the development scale toward large-scale commercial farming using high-tech intensive farming.

In both the subsistence and micro-commercialism cases, sector-wide structural adjustment is necessary to move further up the development scale. This takes time to achieve in a fashion that does not leave the small-holders and their communities behind, and result in increased poverty. Such outcomes risk placing at risk the achievement of SDG1 (Poverty Eradication) via regression against SDG target 1.5 which includes building the resilience and reducing the exposure and vulnerability of the poor to economic and social shocks. That is to say, a high degree of caution is required to avoid negative externalities in facilitating the transition up the development scale. For example, poorly managed corporatisation of farming may see small farmers unable to survive with rising food prices and without alternate sources of off-farm income, leading to an exacerbation of rural poverty.

With agriculture often still amongst the largest GDP sectors in developing countries, such structural adjustment is also central to achieving overall sustainable national economic growth, and full productive employment for all, which are foci of SDG 8. Agriculture stands to play a significant role, considering that global economic growth had slowed from 2.0% over 2010–2018 to just 1.5% in 2019, with further drops expected as a result of the COVID pandemic. Value chain analysis and modelling can provide a solid foundation upon which to develop and implement robust plans for guiding the necessary structural adjustments.

An important element in achieving the desired structural adjustment and full productive employment is the often very low labour market participation rate of women in developing country agriculture. In many such countries long-held social norms, especially for small farmers, have entailed rural women primarily rearing children and maintaining households, whilst men undertake business and agriculturally related activities. In most cases, the adjustments required involve management of improved infrastructure, diversification of outputs, adoption of new farming and business models and so forth, which arguably cannot all be achieved within the

existing workforce profile. This goes directly to SDG targets 5.1 to end all forms of discrimination against women, and 5.5 includes ensuring women's full and effective participation and equal opportunities for leadership at all levels of decision-making in economic life. Given the entrenchment of social views, in many cases it is likely that without action on reforms to give women equal rights under national law in developing countries as embodied in SDG target 5a, the achievement of targets under SDGs 1 and 2 may not be fully realised.

So far we have discussed some aspects of the human, social and economic forces influencing the future course of agricultural development, however, agriculture is also inextricably dependent on the climate in a complex and non-linear manner. In fact, the global threats posed by anthropogenically forced climate change to human existence as we know it are so significant that SDG 13 is devoted to taking urgent action to combat climate change and its impacts. The 5th IPCC⁷ Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) prepared in 2014 indicates that there is a high degree of consensus amongst leading global models and across a range of feasible planning scenarios out to 2100 that anthropogenic climate change will result in globally higher concentrations of atmospheric carbon dioxide (CO₂) and overall rises in average surface temperatures. For many crops, yield increases with increasing average temperature and carbon dioxide CO₂ through higher levels of photosynthesis. Thus, new cropping areas at higher latitudes that were previously too cold may become feasible. On the other hand, the nutritional quality of food and fodder may decline with the rising CO₂, and at low tropical latitudes rising average temperatures may exceed the survival or growth tolerance for some crops.

Crop and livestock dependence upon climate and the environment extends well beyond average temperature and CO₂ concentrations. Conditions such as soil nutrient levels, soil moisture, water availability, evaporation and many other naturally occurring variables influenced by climate must all fall within the survival and growth parameters and the timing necessary within the growth cycle, for each individual plant or animal species farmed.

Droughts, which have had devastating impacts on interannual agricultural productivity and contribute significantly to long-term desertification are associated with ocean to planetary scale interannual interactions between the oceans and atmosphere. In line with IPCC projections, the frequency, severity and geographic extent of droughts is likely to increase with the anthropogenic climate change. Likewise, floods can decimate crops and livestock. Kim (2016) has found that food security may be threatened, when there are changes in the frequency and severity of droughts and floods. Similarly, ocean temperatures and acidity are also projected to rise, affecting the geographic distribution of fisheries and posing significant threats to aquaculture and the survival of some marine species. Notably the geographic distribution of weeds and pests will also evolve under anthropogenic climate change.

Cognisant of the abovementioned and other threats, SDG Target 13.2 focuses on integration of climate change measures into national policies, strategies and planning.

⁷ Porter et al. (2014).

There have been a range of assessments undertaken for various species in various locations, and the IPCC (See Footnote 7) has found that for the staple cereals of wheat, rice and maize the overall impacts on yield of a 2-degree Celsius rise in temperature above late twentieth century levels is expected to be negative in the absence of adaptive measures. Overall, the IPCC estimates that with agronomic adaptation crop yields could see rises of 15–18%, but with enormous variability in the effectiveness of adaptation measures from dis-benefits to very positive. Notably, for developing countries to achieve the productivity increases mentioned earlier, the adaptation and mitigation measures called for under SDG13 further compound the extent and complexity of structural adjustments that will be necessary.

Furthermore, it should be noted that the variance amongst the emissions scenarios and resultant projections from various underlying models is high, especially for important agricultural inputs such as rainfall which display a degree of spatial variability. Owing to the complex changes in climate variability across the globe under anthropogenic climate change, the complex and non-linear interactions of climate with agriculture, the large number of other non-environmental factors influencing agricultural productivity for each plant and animal species, and the uncertainty in current projections, a detailed coverage of all the permutations and combinations is not possible here. The next assessment report of the IPCC, due in 2021/2022, will no doubt provide more refined projections with reduced uncertainty, and more precise conclusions about the impacts on agricultural production.

The safety, quality and access to food could be significantly impacted by any climate-related disturbance to international or domestic food distribution and transport. For instance, in the United States, large volumes of grains are frequently moved within the food transportation system by water, through the large freshwater lakes and rivers with few, if any, alternate transport routes. In 2012 drought and high summer temperatures interrupted the supply of grains out of the mid-west, by barge, along the Mississippi River and its tributaries.

It is notable that there is also significant sensitivity in the transport, storage and processing portion of the agricultural value chain to loss and wastage of product. The United Nations estimated, in its 2020 report on the Sustainable Development Goals⁸ under Goal 12 (Responsible Consumption and Production), that product losses in 2016 averaged around 13.8% globally equating to in excess of \$400 billion.

There are further close connections between climate action and the 2030 Agenda for Sustainable Development. It will almost be impossible to eradicate poverty and end hunger without building resilience to climate change in small-holder agricultural production systems (FAO, 2016). And if the living standards of small-holder farms aren't raised the task of reducing detrimental farming practices such as 'slash and burn' land clearing that contribute to the problem of global warming will be much harder. This highlights the complexity of the issues and why modelling the systems to better understand this complexity will assist in designing the policies that achieve the desired outcomes and not adverse or even contrary outcomes.

⁸ United Nations (2020).

Poorly designed interventions in the name of climate change can be counterproductive. For example, the Brazilian government under pressure from environmentalists introduced laws mandating that farmers set aside 35–80% of new farm land to be preserved as native vegetation.⁹ The result was increased fragmentation of the Amazonian rainforest, leading to more loss of biodiversity than if a similar more concentrated land area had been allowed to be cleared for farming (Shellenberger, 2020). Probably, the only sustainable way of stopping further land clearing in the Amazon is to raise the living standards of the rural poor so there is less demand for uncleared land. One way of achieving this is by raising the productivity of the existing farmed land area.¹⁰

Notably, individual firms need not await large-scale reforms to demonstrate tangible SDG-based in-roads to improving agricultural development within their value chains. For example, CP All Plc.,¹¹ the sole operator of 7-Eleven convenience stores in Thailand plus several other business lines including logistics and marketing, has helped improve the operation of its considerable upstream supply chain of over 4500 suppliers by adopting a comprehensive set of performance indicators that directly support SDGs 2 (End Hunger), 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production) and 16 (Peace, Justice and Strong Institutions). Achievement of these indicators is underpinned by a Suppliers Code of Conduct and Suppliers Sustainability Management Process that in part seeks to assess suppliers against those SDGs.

In this section selected interdependencies have been discussed between agricultural development, particularly in developing countries, and the United Nations 2030 Agenda for Sustainable Development globally. Whilst some of the key issues connecting agricultural development with Sustainable Development Goals 1, 2, 5, 6, 8, 10, 12, 13 and 16 have been highlighted, this is by no means exhaustive. In fact, there are multiple interdependencies between agricultural development and all of the 17 Sustainable Development Goals, for which a fuller analysis alone could occupy several books. Nevertheless, the coverage of the topic and references elsewhere in this chapter is compelling evidence of the pivotal role that agricultural development, both generally and in developing countries, has to play in ensuring a sustainable future globally.

⁹ In 1965, Brazil enacted the first *Forest Code*. It required landowners in the Amazon to maintain native vegetation on 35–80% of their property. While rural farmers can buy land in the Amazon, they can only farm a portion of it. Of course, while that might be the law, demand for land from poor, landless ‘ruralista’s’ and corrupt politicians means it is often circumvented.

¹⁰ According to the USDA beef production in Brazil increased by 3.2% in 2020, mainly due to increases in average carcass weight. https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Livestock%20and%20Products%20Semi-annual_Brasilia_Brazil_02-15-2020. Improved productivity, such as increased carcass weight, from the existing grazed land area, will help to take pressure off the demand for more land as productivity from newly cleared land is often very poor in comparison with existing pasture land.

¹¹ CP All Plc website “<https://www.cpall.co.th/en/sustain/economic-dimension/supply-chain-management>”, viewed August 2021.

4 Micro-economic Theory Provides the Initial Framework for Understanding Value Chains

If there is a distinct breakthrough moment in our understanding of how the economy works and a ‘foundation stone’ upon which all the succeeding development of knowledge within the economic discipline, is built, it was the publication in March 1776, of Scottish parson Adam Smiths (1723–1790) massive tome titled ‘*An Inquiry into the Nature and Causes of the Wealth of Nations*’.¹² Rather than the established view of commodity markets as chaotic and undisciplined, Smith’s hypothesis was that underlying all of what we would now call ‘noise’, is an orderly system where prices are struck in such a way as to ensure the supply of goods necessary to meet the needs of the human population. Smith analysed why trades people specialised in the production of certain goods and traded these goods for money, which was then used to buy their other needs, rather than each individual producing all the goods needed for their own requirements,

it is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard for their own self-interest. (Smith⁷ p. 27)

In other words, the combined efforts of each of these tradespeople specialising in the production of a particular type of good and acting in their own self-interest serves to maximise the economic output of the society, making everyone in the society better off.

Smith was fascinated with how supply and demand were balanced, and prices determined, in the marketplace. In the Appendix to Book 1 he included a database of wheat prices in England going back to the year 1202 up to 1740 and discussed at length what he thought the causes of variation were. One would marvel at what Smith may have been able to accomplish with the help of ‘number crunching’ computer technology!

Perhaps Smith’s most lasting legacy is the metaphor attributed to him, of a ‘*hidden hand*’ guiding and directing economic activity—a metaphor repeated in almost all introductory economic texts and known to all students of economics—but, which, ironically was not used by Smith in this context in the *Wealth of Nations*.¹³ Smith’s book *The Wealth of Nations* is to economics what Darwin’s *The Origin of Species* is evolutionary biology, a foundation upon which continuing inquiry has built a formidable edifice of knowledge.

Following Smith there were numerous developments in what was then called the discipline of ‘*political economy*’. Notable amongst them is David Ricardo’s discovery of comparative advantage to explain why nations trade; essentially, for what we now know from game theory, as a *Win–Win* situation, that is both parties gain from trade. Jeremy Bentham and his student John Stuart Mill developed the ideas

¹² Smith (1776). This was a “Massive tome” because while originally published in five volumes, the 2012 Wordsworth Classic edition runs to some 957 pages!

¹³ The reference to an “*invisible hand*” in the *Wealth of Nations* is in Book 4 Chap. 2, where Smith discusses issues of foreign trade.

of utilitarianism, that is, the aim of the political economy should be to bring about ‘the greatest amount of good for the greatest number’.¹⁴ Later Karl Marx studied the formation of capital in great detail and the relationship between capital and labour to write a meticulous study of capitalism.¹⁵

But throughout this period many political economists grappled unsuccessfully with how supply and demand were balanced, and precisely how prices were determined. Untangling the causal relationships was difficult, a classic ‘*chicken and egg*’ dilemma, which came first, supply or demand? The techniques of the enlightenment used so successfully in advancing our understanding of the physical world—reducing the problem to its component parts to study how they worked—were now applied to economic thought. The breakthrough in developing our understanding of the behaviour of markets and the way demand and supply interact to determine price, came from Cambridge Professor, Alfred Marshall.

In his book called *Principles of Economics*, (Marshall, 1890), he was able to explain, through a system of abstractions, specifically how the price mechanism worked, overcoming a fuzzy area that had thwarted the earlier political economists with their grander and broader ambitions. Marshall said it was both supply and demand that determined price, and that it was foolish to consider just one effect and not the other. His analogy was to liken it to ‘*the role of the blades of scissors*’ in cutting paper, both blades are important to the process. Marshall was able to use mathematical equations to precisely calculate the equilibria between demand and supply. Not only that; but applying differential calculus the underlying tendencies towards equilibria of the individual component functions could be ascertained. Marshall provided the first building blocks of our modern-day economic models. The hidden forces that lay behind the determination of prices had been exposed, like gravity we knew they were there because of their effect, but now like the Newtonian laws of physics, the underlying mathematical relationship was exposed with certainty and precision.

The field of study, which developed from Marshall’s work and which looks at the behaviour of individuals and single firms in the marketplace, has become known as *micro-economics*. Micro-economics is the theory of how individual businesses or consumers make decisions and act on those decisions. The next step was looking at what lay beyond the supply curve, and a theory of production was developed, which weighed costs and revenue to calculate the optimum level of output for a farm or business operating in an environment of perfect competition. It was found that firms would rationally expand production to a point where their marginal cost (that is the increase in cost that results from the last unit of input) equals their marginal revenue (the increase in revenue that results from the last unit of output); again,

¹⁴ The key notion of Bentham’s Principle of Utility is “*to approve or disapprove every action whatsoever, according to the tendency which appears to have to augment or diminish the happiness of the party whose interest is in question*” (Garvey & Stangman, 2012).

¹⁵ Das Capital, another enormous tome, eighteen years in the making. In fact, it was incomplete when Marx died in 1883 and Frederick Engels and others completed the final volumes.

a mathematically precise optimum, which, by employing differential calculus, was easy to determine.¹⁶ This was another equilibrium.

Next was the development of ideas as to what lay behind the demand curve, led by Arthur Cecil Pigou, who succeeded Marshall as professor of economics at Cambridge University. Building on Bentham's concept of utility, Pigou suggested rational consumers would purchase goods in such a way that maximised their 'utility' or 'economic welfare', and gave precise equations to the idea of a 'hedonistic calculus'.¹⁷ This led to a new field of study in micro-economics, new equations and new equilibria.¹⁸ Numerous economists followed in the footsteps of Marshall and Pigou widening our knowledge of consumer behaviour, production economics and the theory of firm, using marginal theory and mathematical functions to calculate optimum solutions that minimised cost and maximised output, profit and consumer utility—the underlying relationships in all economic models.

Of particular importance was work by Geoffrey Shepherd, from Iowa State University, who analysed the way agricultural commodity markets operate using marginal theory, which enhanced our understanding of the basic forces at play in agricultural commodity markets.¹⁹ Pathbreaking work by Earl O. Heady and his students, also from Iowa State University led to a better understanding of the economics of agricultural production. His book titled *Agricultural Production Functions*²⁰ applied marginal economic theory to a wide range of agricultural production applications.

While the reductionist approach to developing micro-economic theory gave us great insight as to what the hidden underlying forces at play in the economy were, they so abstracted what was occurring in the 'real' world, the world of complexity, that their usefulness was limited. Key assumptions such as a large number of sellers and buyers each not able to individually influence the market price, that is, without what we now term 'market power'; homogeneous products, that is, the output of each producer is indistinguishable from the output of other producers; no barriers to entry, so that anyone could become a participant in the market; did not reflect the 'real' world. Only later as computational power increased could this complexity be imputed into models of the 'real' world.

Also, the reductionist models looked only at one, two or at the most a few variables in relationship to each other. For example, the demand function which measures *the*

¹⁶ For an explanation of the use of calculus and other quantitative methods in micro-economic analysis see James and Throsby (1973) Chap. 7 "The Economic Significance of Derivatives" Part 7.1 Elasticity pp. 81–85.

¹⁷ The notion of maximising happiness had echoes of Epicurean hedonism so was sometimes referred to a "hedonistic calculus". Rather interestingly this notion has returned to modern economic thinking with a focus on not just measuring GDP or other purely monetary statistics to measure progress, but measuring "well-being". See Stiglitz et al. (2019).

¹⁸ While 'utility' and 'welfare' are the terms used in economics, the term 'consumer satisfaction' as used in marketing might more aptly describe what Pigou and later economists in this field were striving to understand.

¹⁹ Shepherd (1941).

²⁰ Earl O. Heady and John L. Dillon *Agricultura; Production Functions* Iowa State U.P. Ames, Iowa (1961).

quantity demanded in relationship to the *price* of a good is a negatively sloped function reflecting the fact that consumers demand less of a commodity as the price rises. When overlaid on a positively sloped supply curve (the relationship between the *quantity supplied* the market and *price*), the intersection of the two curves gives an equilibria; the price at which the quantity supplied matches the quantity demanded (sometimes called the market clearing price). All other factors which affect the two relationships under study were assumed to be held constant—what is known in economics as the *ceterus paribus* conditions.²¹ Of course, that is not what occurs in the ‘real’ world. In fact, because these conditions are in constant flux any equilibria as result of the isolated relationships under study is constantly changing—what we could term as a ‘*dynamic equilibria*’. Again, the parallels with ecological stasis in nature are apparent. And again, with the benefit of enhanced computational power we are better able to capture a representation of the ‘real’ world in our models, by relaxing some of the *ceterus paribus* conditions. This is often done by running the model multiple times under different scenarios (that is varying one of other of the *ceterus paribus* conditions), to measure the sensitivity of model outputs and implied outcomes to a range of inputs.

5 The Emergence of Agricultural Supply Chains

Agricultural supply chains emerged out of village marketplaces. The first step was specialisation in production, which, as Adam Smith observed, in conjunction with exchange, created wealth—in this case it made the villagers as a whole, better off.²² In a classic study on how economic relationships develop within a technologically primitive society, anthropologist and economist, Trudy Scarlett Epstein, examined the economy of the Tolai people from the Gazelle Peninsular of Papua New Guinea, between 1959 and 1961. In her book she described how traditional Melanesian village ‘barter trade’ markets using shell currency evolved into sophisticated trading centres such as the market in the capital city, Rabaul, when the village people started to engage in the cash economy. The copra trade was the main driving force of this change. Quite quickly, after colonisation, an agricultural supply chain for copra developed, creating new opportunities for villages and new economic relationships.

Agricultural supply chains emerge from primitive, subsistence, economies when the development process commences and surplus labour in the rural areas moves to the city. Since the city population can no longer source their food and other requirements locally, traders emerge, buying produce from farmers, aggregating and storing it, and transporting it to the city. In the city more traders emerge to wholesale and

²¹ *Ceteris paribus*—Latin for “other things being equal”.

²² The first Chapter in Book 1 of *The Wealth of Nations* is titled “Of the Division of Labour” where Smith propounds his key thesis that “The greatest improvements in the productive powers of labour, and the greater part of the skill, dexterity and judgement, with which it is anywhere directed, or applied, seem to have been the effects of the division of labour.” That is, what is now termed the ‘specialisation of labour’.

retail the product. Thus, an agricultural supply chain is created—a pathway along which produce moves from farm to final consumer. In its earliest manifestation the supply chain conforms quite closely to the framework provided by micro-economic theory, because many of the underlying assumptions of micro-economic theory are met. There are generally many producers (farmers) in competition with each other to supply traders with product, the produce of each farm is similar (that is homogeneous), there are often many traders in the market also competing fiercely to procure stock. Distribution tends to be through small retailers or wet markets, again conducive to competition, so the result is a supply of cheap produce to consumers, maximising their ‘welfare’ as in Pigo’s models. A supply chain then, as distinct from a value chain, delivers to consumers goods at the cheapest possible price given the costs associated with growing, transporting, marketing and the other functions that are carried out along the chain. Because of competition between the businesses that carry out these functions, prices are continually under pressure all along the supply chain and forced down to provide consumers with the cheapest possible food or other goods. The small firms in the supply chain have limited market power and so tend to make a ‘normal profit’.²³ Commodity markets are typically highly competitive, so to survive businesses must keep costs down and meet the competitive market price to gain sales—that is they are ‘price takers’ rather than ‘price makers’. Competition is the force that drives efficiency. Even today, with far more sophisticated value chains, the underlying efficiency created by competitive markets is all-important in generating economic growth and consequently raising living standards.

According to Porters generic strategy model, which we will discuss in more detail later in this Chapter, a key strategy employed by large firms in any industry sector is a ‘least cost leadership strategy’, which is generally based on achieving economies of scale to keep cost down (Porter, 1980). So, as agricultural supply chains develop, what tends to happen is that a few very large firms begin to dominate the market, breaking down the perfectly competitive market model of many small firms in competition with each other; they secure a large market share, often over 50% of market sales -but not total dominance—by driving down costs so they can price their output highly competitively. This is pertinent in the context of developing economies, because many developing economies find themselves at a stage where their agriculture sector is dominated by small-holders plus fewer but very large multi-national firms with economies of scale from other markets. In order to survive small holders must use alternative marketing strategies, not based on least cost. Sometimes the over-regulated situation by Government disadvantages local small holders making them unable to compete with larger multinationals. Often, there is an outcry from the ‘squeezed’ local producers and a call for regulation to ‘protect’ their livelihoods

²³ Because competition will trade away higher than market prices, economists refer to the profit that a small firm makes, when in competition with many other similar firms, as a ‘normal profit’. Because of competition a ‘normal profit’ in the long term will be equal to the cost of the capital employed in the business. This will be enough to encourage that business to stay operating and not deploy its capital elsewhere, but not enough to generate above market returns (or monopoly profits), because the business has little or no market power to charge higher prices. The result is maximum output of goods or services for the minimum capital required to produce that output.

but the answer as we will explain below is generally less regulation, not more. This will force the small holders to diversify and compete using alternative strategies, and although they will have much smaller market shares, the end result is a more dynamic and prosperous economy. To understand how these firms survive we need a new theoretical framework which has been discussed later in this chapter.

One of the distinctive features of agricultural commodity the supply chains is the variability of the supply. While demand tends to be relatively stable, growing with population, supply can be severely disrupted by the uncontrollable forces of nature. Since man first started farming, droughts, floods, pests' and diseases have been known to disrupt the supply of food, sometimes leading to famine, social unrest and war. As a consequence, food security is the foremost important policy goal of governments around the world. Understanding and managing the food supply chain is therefore critical to achieving this goal.

Supply variability inevitably leads to price variability, where equilibria are struck at different points along a positively sloped supply curve and when the quantity supplied in the market varies, while demand does not. Such price variability can cause social unrest particularly when consumers face higher prices because of supply shortages, so can be a threat to political stability.

Market disruptions also cause perturbations on the supply side with farmers reacting to changing prices by switching to other crops or livestock. Because of the time it takes to produce a crop or grow livestock, lags in the supply response can exacerbate these market moves. Much of Shepherd's book mentioned above is devoted to analysing these supply variations, detecting annual cycles in crop prices, sometimes with a tendency to become dynamically unstable as in the divergent cobweb model.²⁴ Shepherd also identifies cycles in hog and cattle prices related to the time it takes to breed up numbers in each particular species in response to price rises and when the increased supply eventuates, the market is often over-supplied and prices crash.²⁵

Because of this inherent price instability, the farm sector has often sought to protect itself from the competition, which it perceives as a disruptive force because of the impact of price variability on farm incomes. Proponents of intervention in agricultural markets often claim agriculture should be treated as a special case. Frequently, the matter of production uncertainty is raised as the reason why agricultural markets should be 'stabilised'. As Williams points out the quest for price stability is often confused with seeking arrangements for 'price support' and the market interventions

²⁴ Shepherd op cit pp. 35–38. Another good illustration of an unstable divergent supply chain is the MITT, Sloan School of Management "beer game" simulation where after a few hot days and increased demand retailers order in more beer supplies than normal. Wholesalers stocks are then depleted and they place increased orders back to the brewery. By the time the beer is brewed and delivered, the hot weather has passed and the excess supply is no longer required. For a detailed description refer to Senge (1992) Chap. 3 "*Prisoners of the System, or Prisoners of our own Thinking*", pp. 28–54.

²⁵ A relatively recent study of the US cattle cycle and its impact on international commodity beef prices and consequently supply in the Australian cattle industry was done by Griffith and Alford (2002).

in the name of price support generally lead to greater instability, so are self-defeating (Williams, 2012).

6 Interventions in the Agricultural Supply Chain

After the depression of the 1930s, Australia implemented wide-ranging government interventions across the agricultural sector. Price regulation and production quota schemes were introduced for wheat, fresh milk, sugar and eggs. Marketing boards with monopoly control over the purchase and sale of commodities at the State level were also introduced with various levels of market intervention adopted for potatoes, barley, tobacco, apple and pears, wine, dried fruits, rice and other commodities. The wool industry, the country's largest agricultural export industry at the time, introduced a buffer price scheme in 1970, whereby it purchased back its own commodity in competition with buyers, mainly the representatives of overseas woollen mills, in an attempt to raise prices. The result was an accumulation of a massive stockpile of wool, partly underwritten by the Federal government, which eventually became financially unsustainable, prompting the Hawke government to intervene and wind up the scheme in 1991.²⁶

Contrast this with the close 50-year relationship the Australian wool industry has had with the luxury brand Ermenegildo Zegna, whose chairman Count Paolo Zegna was recently appointed as an Honorary Member of the Order of Australia for significant service to the Australian Wool Industry.²⁷ Many Australian woolgrowers have benefitted financially from this relationship and the value that has been created by the Zegna company. Some of this created value has flowed back to fine merino woolgrowers in a sustained and ongoing way, whereas the short-term gains of the Reserve Price Scheme were totally dissipated on the winding up of the unsustainable intervention and went on to depress wool prices for many years after, as the accumulated wool stock pile was liquidated.

At around the same time the Hawke government initiated a major review into the competitiveness of the Australian economy, chaired by Fredric Hilmer, which resulted in the handing down of a report to the Heads of all Australian Governments in 1993 called the National Competition Policy Review (or more generally as the Hilmer report) (Hilmer, 1993). In the report Hilmer devoted a section to Agricultural Marketing Schemes and made the following comment;

Arrangements of this kind are often grossly inefficient, and effectively tax users and consumers. According to the Industry Commission, such arrangements effectively taxed users and consumers by \$550 million. Benefits to these groups from reform of the milk,

²⁶ The collapse of the Australian Wool Reserve Price Scheme is an example of a market intervention that went horribly wrong causing years of low income for growers as the huge stockpile of wool acquired under the scheme was slowly sold off, depressing market prices for many years. Refer to Bardsley (1994).

²⁷ Paolo Zegna receives top Australia Award (2020).

sugar and egg industries alone are estimated to total some \$346 million per annum. (Hillmer, 1993)

The report went on to recommend the legislative and regulatory controls that enabled these schemes to operate be withdrawn in a wide-ranging programme of deregulation and *micro-economic reform*. This was carried out over the next decade and contributed significantly to reducing inflation, increasing productivity, and consequently raising living standards significantly faster in the years following the reform than had occurred in the decades prior.²⁸

The lesson from the Australian experience is that supply and price management interventions in agricultural markets often lock in production inefficiencies, uncompetitive trade practices and hidden consumer taxes—which all act as a drag on economic growth and consumer welfare. So for developing economies with agriculture sectors dominated by small-holders or with the initial entry of larger scale corporate farms, instead of direct market interventions, governments are far better to focus on encouraging direct investment into the value chain by creating the right environment for capital flows into the system; enhancing the adoption of new production technology at both farm level and at other points along the value chain through education and research; setting the rules of the game through legislation that insures competition and discourages ‘rent seeking’; investment in public infrastructure such as transport networks, communications networks and even perhaps cold storage facilities and negotiating trade access to new markets; all factors that will help facilitate economic growth, but generally lie outside of the remit or capacity of individual players in the value chain.

7 Marketing Theory and How Value Chains Develop

Marketing as a specific discipline of study emerged in the decade following the end of WW2. Led by the US most economies in the western world were experiencing a strong, consumer led, economic recovery. Rising incomes substantially increased the purchasing power of consumers and with more purchasing power consumers started to demand more variety, better quality and more expensive goods. No longer spending most of their income on the basic necessities of life, consumers had more discretion as to how they spent their new-found wealth. A new understanding of consumer demand, beyond the price-driven assumption of micro-economic theory was needed. Businesses needed to change their products, no longer were the basic features of the commodity sufficient to attract buyers. New features such as packaging to prevent spoilage, convenience, portion size, and frozen products began to be demanded.

²⁸ See Sheng et al. (2019) for a detailed appraisal of the deregulation of the Australian dairy industry. The deregulation involved removing quotas on the production of fresh milk and controls over the price of fresh milk. Deregulation resulted in market share moving from less productive farms to more productive farms, thus increasing the efficiency of the system, as well as significant price reductions for consumers and increased product choice.

Businesses also needed to communicate these features to their customers, so advertising through the new media of radio, T.V., colour magazines became important. To be successful business needed to understand their customers—who they were, how they lived, what they thought of their product. A new body of theory was needed to provide these answers.

As with the other industries, the focus of the supply chain for agricultural products was shifting away from producers to consumers. No longer was it a matter of producing more to keep pace with the demand, now there was plentiful supply of most commodities, the issue was what to produce. What did consumers want? A prominent business management writer of the time, Peter Drucker, said; '*there is only one valid purpose of a business, to create a customer...*'. (Drucker, 1973). The shift to a consumer focussed supply chain marks the beginning of the emergence of what we now refer to as value chains. Profitable value chains don't simply push commodities down the chain; they focus on targeted marketing to understand what consumers want and are willing to pay for, then pull that product along the chain, transforming it where necessary to accurately meet a consumer's *wants* and *needs*. The *features* that consumers want in a product are those which provide them with a *benefit*. A product that *delivers added benefits* to the consumer is more *valuable* in the consumers' eyes, so they will pay more for it. This is how value is created and how value chains emerge.

A proper understanding of consumer *wants* and *needs* was a vital starting point for this new discipline of marketing. Important to this was the work of psychologist, Abraham Maslow. He said that humans have needs far beyond the simple biological requirements to maintain life. Human needs can be thought of as a hierarchy from the physiological needs which enable our survival to higher level needs that satisfy our self-worth and goals in life. Maslow identified five levels in the hierarchy of needs.²⁹—see Fig. 3

Maslow's hierarchy of needs aligns with economic development, particularly as living standards rise. That is, as consumers become wealthier their needs shift up the hierarchy so the value they place on a particular product's features, change. The process of development starts with the bulk of consumers focused on meeting their everyday physiological needs—food, water and shelter. As the economy transitions consumers' needs change and move up Maslow's hierarchy. In developed economies many consumers are sufficiently wealthy to direct their purchasing according to what Maslow called self-actualization, that is according to deeply held values—so they demand products with features such as; 'fresh and natural', 'low food miles', 'animal welfare', 'fair trade', 'vegan', 'organic', 'non-GM'—often features poorer people cannot afford to be concerned about. As consumers move up the hierarchy the product features they demand change and therefore the value chain must adapt to better meet their needs.

²⁹ Maslow first put forward the idea in an article "*A Theory of Human Motivation*" published in the *Psychological Review* in 1943. While Maslow himself acknowledged that there was little scientific proof to support his contention it has proved to be a very useful tool in marketing, with a number of other authors elaborating on Maslow's initial work. Clayton Alderfer's ERG (existence, relatedness and growth) model for example.

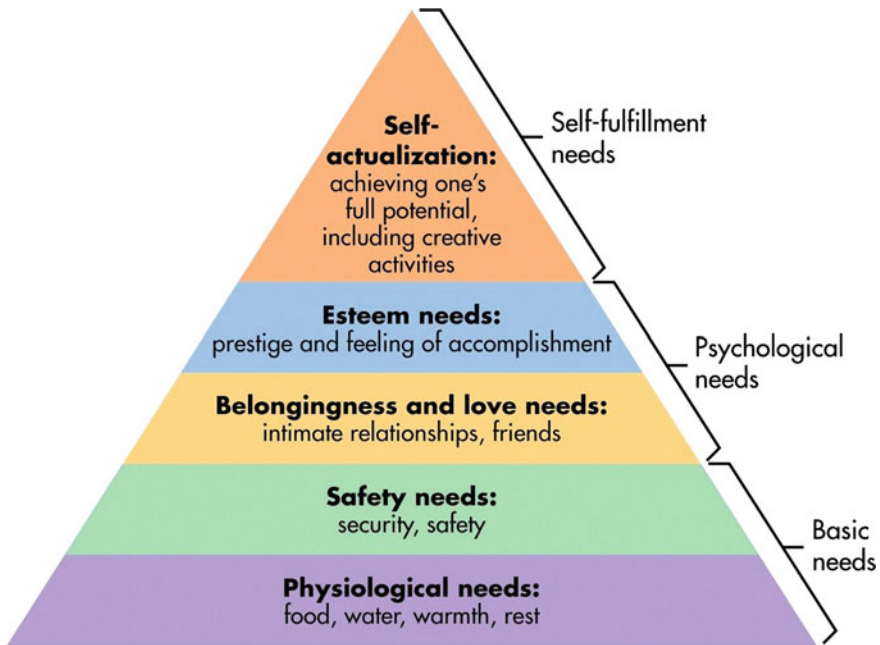


Fig. 3 Maslow's hierarchy of needs

So-called 'Green Marketing' is a good example of Maslow's higher level human needs. Many consumers are now highly conscious of the need to look after the environment and seek re-assurance from the brands they buy, that the product has been produced sustainably without damaging the environment. Narula and Desore (2016) investigated 140 existing green marketing research papers with special reference to consumer behaviour. Their conclusion was that research needs to be advanced in relation to addressing gaps between consumer perceptions and designing green products, identification of green segments, positioning green products and also inclusion of stakeholders in green markets. Within developing economies, this poses additional challenges and opportunities for helping address SDG12 (Ensure Sustainable Consumption and Production Patterns) whilst moving up the development scale.

We introduced above one of the three generic business strategies. Porter suggested businesses follow—overall cost leadership—in order to compete in highly competitive contemporary markets. It is now time to examine this further and discuss the two other strategies—product differentiation and consumer focus. The model Porter used to illustrate the concept is presented in Fig. 4.

Overall, cost leadership arises from the organic growth of the most successful firms in a highly competitive commodity supply chain, as the supply chain evolves over time toward a value chain. These firms use economies of scale to increase output at ever lower unit cost, and over time generally arrive at a dominant market share of a particular product, or category. But the equipoise of demand and supply in a still

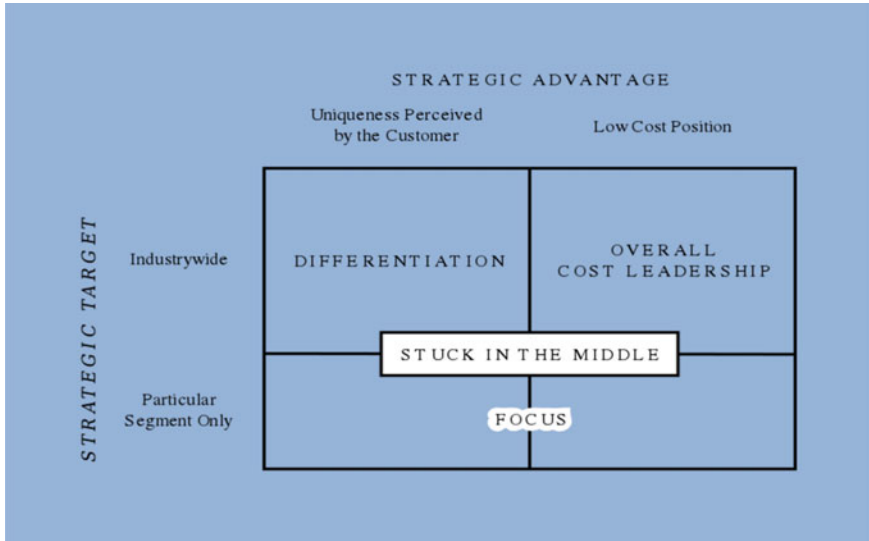


Fig. 4 Porters three generic strategies. *Source* Porter (1980) ISBN 0-02-925360-8, Fig. 2.1, p. 39

highly competitive market means these firms in the long run make little more than the market rate of return on the capital employed and while large, are unable to make significant monopoly profits, even though they may have a dominate market share. This is because any attempt to raise prices generally results in lower market share, hence lower growth and in turn lower volumes of output which reverses their key competitive strategy of continually offering lower unit costs. These firms tend to then become what in marketing terms is called *market leaders* and adopt an aggressive strategy of highly competitive pricing, mass advertising and working closely with their retail outlets to ward off competition.

In this situation, reflecting the situation in many developing economies, small holders will need to adapt in order to survive. Some may adopt differentiation or customer focus oriented strategies (see following sections), others may transition to become contract suppliers to the larger cost leadership firms or shift focus to complementary parts of the value chain, whilst some choose to group together in cooperatives to compete, whilst yet others may exit the sector completely to seek employment in other sectors. Governments should seek to support these transitions through investments in areas such as, to name but a few—research development and extension services, establishing and promoting enhanced access to capital, enhanced infrastructure development, facilitating opening of new markets, and establishing policies that support enhanced rural employment opportunities.

8 Product Differentiation

How do other firms compete against a market dominant least cost producer? One strategy is *product differentiation*. A key assumption of perfect competition is *homogeneity*; that is the output of all the firms in the marketplace are identical, so that a consumer would be indifferent as to which item they purchase. Markets with these characteristics are referred to as *commodity markets*. Contemporary marketplaces although they evolved out of commodity markets, no longer meet this key assumption of perfect competition. Instead they offer a wide array of similar products, but with different features, generally branded to distinguish each business's offering, and provide consumers with a choice as to what they might buy. Products in these markets are differentiated from each other by differences in their features, their branding, their packaging, their image and their pricing.

Basic differentiation by product feature is common in most consumer markets, but especially food, where a unique recipe (or formulation) for example will lead to a loyal base of consumers continually purchasing the product. The iconic Australian product Vegemite for example often introduced to children in school lunch sandwiches can capture a customer for life, once they have acquired a taste for the savoury product. Other nationalities not brought up with the spread, generally fail to understand its appeal. Many of the leading food products in contemporary value chains differentiate themselves from competitors using a unique flavour or recipe strategy—Coca Cola,³⁰ Tabasco sauce, Arnott's Iced VoVo biscuits, etc.

The most obvious point of differentiation used to distinguish products these days is their *brand*. Brands are unique product differentiators because they also create an identity for the product. Supermarkets may display a range of similar items, often side by side in the aisle, but differentiated by brand. Consumers think they are different products even though the basic ingredients may be much the same.

The aim of branding is to identify a product to consumers, highlight the unique features of the product and emphasise its benefits. Successful marketing of a product depends on how well the supplying company differentiates its products from its competitors; how clearly it identifies and communicates the product features to prospective consumers; and finally, how readily the consumer accepts the claimed benefit of buying the product.

An emerging area of differentiation is "provenance" – where the product is grown. This relates to the rise of concerns by consumers about "food safety", "healthy eating" and a new trend for "authenticity". These are examples of Maslow's self actualization attributes and may provide differentiation opportunities for products from developing economies to penetrate highly developed western markets. The

³⁰ As an illustration of the power of recipe's and formulations, in 1985 Coca Cola, in an attempt to take market share from its rival Pepsi, introduced a new recipe, and marketed it as New Coke. Blind taste tests had revealed consumers preferred the sweeter taste of Pepsi to Coca Cola, so after 99 years on the market Coca Cola reformulated its recipe to make it sweeter. However, the New Coke was angrily rejected by Coca Cola's existing consumers as "*not being Coke*". With sales plummeting it was taken off the market a few months later.

Sri Lankan tea brand Dilmah is just such an example and has been able to build a very successful international brand and a valuable export business.³¹ Similarly, the marketing of developing economy outputs as ‘fair trade’ may also provide footholds in developed markets.

As consumers become aware of a brand, they develop a certain level of loyalty to the brand. Identifying who the most loyal customers are is very important, so communications such as advertising can be directed toward consumers most likely to buy the product.³² Customers can be classified according to loyalty into various groups—*switchers* who are price sensitive and show no brand loyalty, *passively loyal* who see little reason to buy other brands, *habitual buyers* who buy a specific brand and see no reason to change, and *committed*. Some customers become so loyal to a brand that they act as *advocates* for the brand. Cultivating advocates has become a powerful means of promoting a business, or brand, especially in social media marketing.

9 Customer Focus

Another important aspect of modern marketing theory, unlike the presumptions underlying the micro-economic models, is the recognition that not all consumers want the same thing. Consumers differ in their demand for products, so choice of a variety of products is important—as any supermarket isles these days makes clear. Focussing on what customers *want* is the other generic strategy in Porter’s model. This often requires in depth market research to find out exactly what *product features* customers want and then how to communicate the *benefits* of these features to the customer.

Consumers are not all the same. As discussed above, they have different needs, and hence different wants. Because of this, it is useful for marketers to group consumers with similar wants together in what are called *market segments*. The classification of a market segment can be by a single or a number of criteria. Multiple criteria will give rise to many market segments, each segment more tightly defined by the classification criteria. There are four broad market segment classifications widely used in marketing: *Geographic, Psychographic, Demographic and Behavioural*.

³¹ Sri Lankan tea producer Dilmah has successfully established itself in a number of developed economy markets in competition with well-established multi-national brands some dating back to colonial times, for example Lipton’s.

³² Garth Hallberg, who worked for the advertising agency J. Walter Thompson, published a book in 1995 called *All Consumers are Not Created Equal*, where he observed that companies derived around 80% of their revenue from roughly 20% of their customers. This uncannily conformed to a long-recognised distribution first discovered by Italian economist Vilfredo Pareto and has become known as the Pareto principle. Pareto observed that 80% of the land in Italy was owned by 20% of the population. Hallberg discovered that the Pareto principle applied to customer spending on a particular product.

Table 1 Dangar Research market segmentation of the Australian beef consumers in 1995. *Source* Dangar Research (1995)

Segment	Definition	Males (%)	Females (%)
Appreciator	<i>'I enjoy red meat, it's an important part of my diet'</i>	31	20
Acceptor	<i>'I like red meat well enough, it's an important part of my diet'</i>	39	36
Resistor	<i>'I do eat some red meat although, truthfully, it wouldn't worry me if I didn't'</i>	22	30
Rejector	<i>'I rarely/never eat red meat'</i>	8	14

Because people tend to live in localities that reflect their income and social class *geographic segmentation* can be a useful proxy for spending power. Some important basis for segmentation includes age, sex, family size and status and education. These are *demographic* factors. Marketers have long used *geographic* and *demographic* criteria to group consumers. Using these criteria consumers can be segmented into social grades or classes. People with similar interests can also be grouped into what are called *psychographic* market segments. Psychographic analysis uses qualitative measures to determine social class, lifestyle and the activities and interests of consumers. Finally, consumers can be segmented on the basis of their *behavioural* characteristics.

Consumer research carried out by Dangar Research [and funded by the Australian Meat and Livestock Corporation (AMLC)] segmented the Australian beef market into four categories according to attitude towards beef: *Appreciators*, *Acceptors*, *Resistors* and *Rejecters*. Table 1 presents the AMLC (1995) which shows the results of this survey.

The higher level of females in the resistor and rejector categories was of concern to the industry, so a campaign pointing out a key feature of beef—as an important source of iron in the diet (commonly more deficient in women than men, due to menstrual bleeding)—was initiated. By highlighting an important benefit of beef to women the campaign was able to reverse an adverse trend and win back some market share.

Having a customer focus means firms not only need to understand their customers, but also need to understand how their customer *perceives* them and their products. This led to a very important concept in marketing called *positioning*. In the marketing world the word positioning is used in a comparative sense.³³ It describes how one product compares to another, *in the eyes of consumers*. Therefore, it is not just the product features that are compared, but the whole marketing mix associated with the product. It is how the product, in its totality, is perceived by the consumer.

.... positioning is not what you do to a product. Positioning is what you do to the mind of a prospect. That is, you position the product in the mind of the prospect. (Ries & Trout, 2000)

³³ The concept of positioning was first introduced to the marketing field by Ries and Trout (1981).

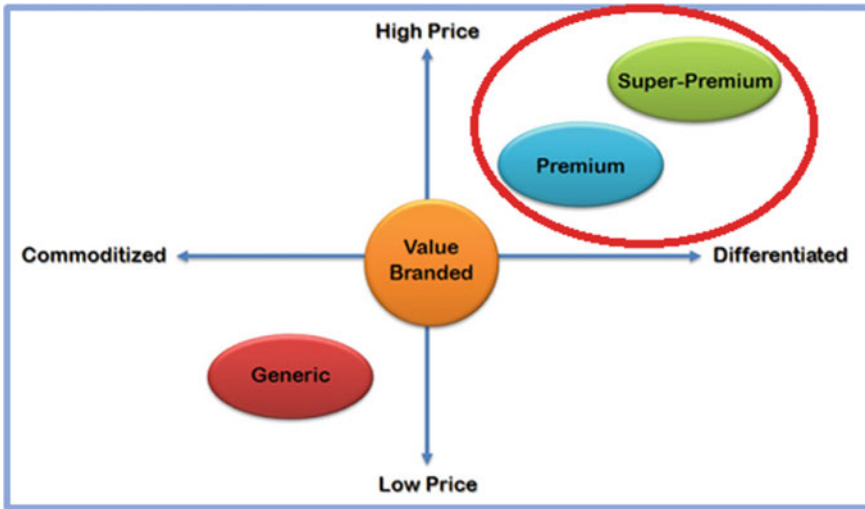


Fig. 5 A classic positioning grid

In marketing the word *position* is used in a holistic sense; it is the total of all aspects of the product that are compared, not just individual aspects. Product *position* is therefore multi-dimensional, even though certain characteristics may be emphasised in one product more than another, and this helps to differentiate the product from its competitors, it is the whole character of the product and its image in the minds of potential consumers that truly defines the market position. *Position* and *differentiation* are like the partners in a tango; both need to move together for the dance to succeed even though in reality both are moving in opposite directions—one forward and one backwards! Figure 5 shows the classical position grid derived from Reis and Trout’s ideas which are now widely used in marketing.

Targeting a particular market segment, understanding the wants and needs of that market segment and tailoring a product to meet those needs are the basis of having a customer focus. But to be successful in the market place the product also needs to be positioned correctly to attract customer interest and sales.³⁴ All the nuances of modern marketing strategy are vital for success. Perhaps the most obvious candidates for failure are what Porter calls businesses that are ‘*stuck in the middle*’. That is, businesses that follow neither one of the other of the three generic strategies. The corporate graveyard is full of such firms.³⁵ The decline of Department Stores in

³⁴ In 1982, Colgate, the world famous toothpaste brand, tried to introduce a range of frozen ready to cook meals. It was a complete flop. As you would expect given a moment’s thought—Colgate was positioned in the mind of consumers as toothpaste—not a food brand. It goes to show even big international companies can make serious marketing mistakes (Rosenbaum, 2017).

³⁵ The bailout of Chrysler Motors in 2009 by the US Federal Government and the failure of American Airlines which filed for bankruptcy in 2011, are often cited as examples of business failures attributable to a ‘*stuck in the middle*’ business strategy (Symonds, 2014).

recent years in the face of competition from ‘category killer’ speciality stores is an example of being ‘stuck in the middle’.

10 The Impact of Innovation and Technological Change

One of the *ceterus paribus* conditions that impacts the supply of all commodities, but has particular importance in agricultural commodity markets, is the technical change. New technologies enable increased production efficiency; either by reducing the level of inputs required for a certain level of output (hence reducing the costs of production) or increasing the level of output for a given level of inputs, (or fixed resource base such as land). Technological change will shift the supply curve to the right, that is, enable more products to be supplied to the market at any given price. Technical innovation in agriculture over time has greatly reduced the number of people employed in agriculture as capital is substituted for labour.

In developed economies, technical change in agricultural production continues to be a major driving force of productivity growth and wealth creation. From the 1970s through to the early 1990s a mini-revolution in broadacre farming occurred with the widespread adoption of chemical weed control, improved varietal genetics and larger mechanical equipment such as air-seeders and combine harvesters. This led to productivity gains for broadacre cropping in Australia of over 2.0% per annum. Recent gains have been more modest, but overall broadacre cropping productivity over the period 1977–1978 to 2018–2019 has been 1.5% per annum (Boult & Chancellor, 2020). What this means is, that in Australia grain production has increased by between 1.5 and 2.0% each year since 1977–1978 from essentially the same production resource base. With an unchanged demand curve, the inevitable consequence of this increase in the quantity supplied the market, must be lower prices. However, demand does not stay constant and one of the main demand shifters is population growth. Australia’s population growth over the 10 years to 2017 averaged 1.7%, not including net migration it was around 0.68%, so the increased productivity would have gone close to meeting the increased demand from population growth and certainly, if net migration were excluded, the increased supply would have been more than enough to cover the increased demand as a result of population growth from the balance of births and deaths (Australian Bureau of Statistics (ABS), 2018).

In the modern-day food value chain, technical innovation occurs at all steps in the value chain and competition forces firms to adopt new technologies or perish. Great steps have been made in food processing, the development of new consumer products and packaging of food that prevents spoilage and contamination, more efficient cold storage chains and logistics for transporting and storing food. Wholesaling and retailing are also under going dramatic change as a result of the digital revolution. The food value chain has probably never been more challenged than it is at present from the dynamic impact of technological change.

This impact means businesses are constantly searching for new and better ways of doing business. It means developing new products in order to compete. It also means

‘revitalising’ existing products to keep them relevant to contemporary consumer wants and needs.

All products go through a life cycle. Some claim this cycle is shortening because of the technological change. The product lifecycle has four stages:

- Introduction
- Growth
- Maturity
- Decline

Some products are shooting stars—flashing brilliantly for a few seconds and then fading out; other seem to last for eons and never change, but these are rare and eventually old age catches up with them too. Some products have fast lifecycles—women’s fashion for example which changes every season—others, long cycles that can last decades, even centuries, without change and some of the leading food product brands are good examples—Kellogg’s Corn Flakes or Vegemite.

The profitability of a product tends to lag the sales cycle, as shown in Fig. 6 so that mature products often generating the highest profit. This creates the danger that the company will ‘rest on its laurels’ and may fail to revitalise the product before sales start to decline. Wise revitalization of a mature or even declining product can often lead to dramatic sales turn around and excellent profit results.

Technological change is also the driving force behind economic development. In the early phase, it may involve importing the technology and applying it to the local situation, but later on locally developed technologies will emerge. Adopting

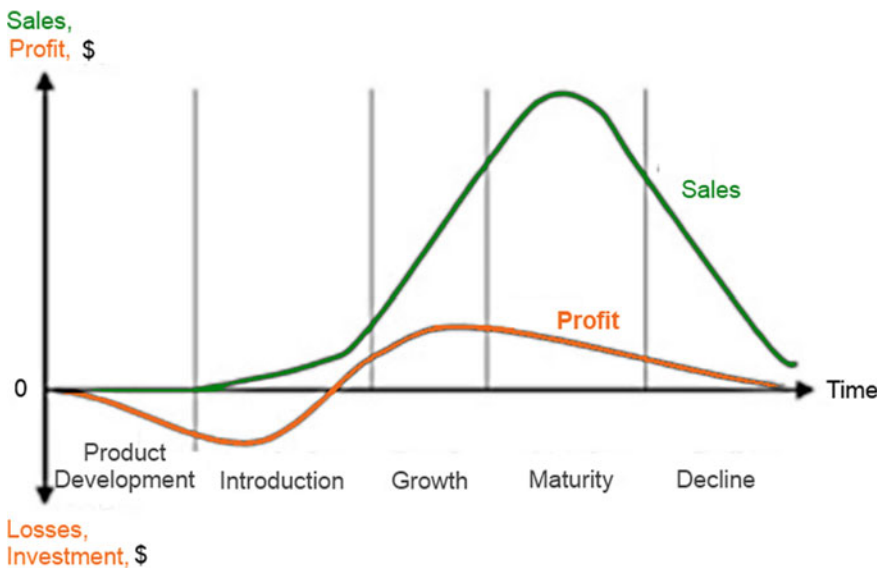


Fig. 6 The product lifecycle; sales versus profits

new, labour saving techniques of production is one of the main features of economic development³⁶ (Thirwell, 1972, p. 30). This leads to a migration of the surplus rural labour from farms to city-based employment, hence creating a demand for food and other farm products in new urban centres. This process kicks off the development of an integrated agricultural/food supply chain.

In the so-called ‘East Asian model of development’, the surplus labour resources that exit the farm sector are used to develop an urban-based light manufacturing sector, primarily export focussed (Kuznets, 1988). Using the comparative advantage of low labour costs, the manufacturing export sector imports foreign capital in exchange for the exported manufactures, creating a virtuous cycle that eventually leads to higher levels of savings and domestic capital formation, which in turn can then be applied both to improving the efficiency and enlarging the manufacturing sector and to supporting investment into the agri-business supply chain. While the ‘East Asian Model’ relies substantially on market-driven private sector capitalism, direct government investment in providing seed capital, infrastructure, education and training and providing a strongly pro-business legal framework is also a feature of the model, with the emphasis on these differing between countries.

Thailand has largely followed the East Asian model of development and one of its leading companies, Charoen Pokphand Foods Public Company Limited (CP Foods) illustrates many of the concepts we have discussed above. It is an example of how simple supply chains evolve into sophisticated value chains in parallel with economic development. CP Foods is part of the Charoen Pokphand Group (CP Group), an agro-industrial and food conglomerate headquartered in Bangkok. It is the world’s largest producer of animal feeds and shrimp (prawns), as well as being one of the top three global producers of poultry and pork.³⁷ CP group was started in 1921 by Chinese immigrant Cha Ek Chor, with a single store selling seed grains in Bangkok’s Chinatown. In 1964, Dhanin Chearavanont, Cha’s fourth son, took over the family business and is credited with building it into the multi-national business it is today. In 2020 CP Foods reported sales of 589,713 million baht (US 17,891 million) and net profits of 26,022 million baht (US 789 million)^{38,39}. Total assets under management were estimated to be 761,719 million baht (US 23,110).⁴⁰

The company’s core businesses are livestock and aquaculture. Approximately, 64% of CP Foods revenue now come from overseas operations, with 30% from its home market in Thailand and 6% from exports. The company’s main livestock business’s include; vertically integrated chicken broilers, chicken layers, ducks, and swine. Its aquaculture business is mainly vertically integrated shrimp (prawn) and

³⁶ Thirlwell largely subscribed to Rostow’s theory of the five stages of development; traditional (as the Tolai economy before the copra trade); transitional (as countries like Papua -New Guinea are today; take-off (Vietnam today); maturity (as much of China and many other east Asian countries are approaching today) and high mass consumption. Rostow (1960) for a figurative model of Rostow’s stages of growth see Drakakis-Smith (1990).

³⁷ https://en.wikipedia.org/wiki/Charoen_Pokphand_Foods#cite_note-1.

³⁸ Exchange Rate 2nd August 2021 32.96 baht to 1 USD.

³⁹ File:// <https://www.cpfworldwide.com/en/investors/annual>.

⁴⁰ File:// <https://www.cpfworldwide.com/en/investors/annual>.

fish farming. In its annual report CP Foods breaks down its vertically integrated businesses into three levels of operations; its feed supply business represents 37% of revenue, its farm production and processing 47% and its food distribution business 16%.

Following concerns raised in the press about employment conditions in some of its supplier firms, the company embarked on a major operational review of its supply chain and developed a sustainability programme⁴¹. In its latest sustainability report CP Foods confirms it has 1,332 suppliers—87.22% of which it classes as critical Tier 1 suppliers. The report goes on to state that 94.64% of Tier 1 suppliers have been supplied with a code of conduct.⁴² It further states;

Charoen Pokphand Group (C.P. Group) is fully committed to the responsible management of our suppliers, across our entire supply chain. However, due to the diversity of our business operations, with businesses, products, and services located in all regions of the world, this management might not cover all suppliers, particularly those located very far away. Another key challenge is that suppliers could still be lacking a full understanding of sustainability principles. Nevertheless, supply chain management is not merely one of the Group's key strategies for achieving sustainable growth, but also a way to create shared value among the group, suppliers, and producers, in line with the Group's 'Three-Benefit' Principle⁴³.

The '*Three-Benefit Principles*' are based on the following UN Sustainable Development Goals;

- SDG 4 Quality Education

Increase the number of youth and adults who have relevant skills, and promote Entrepreneurship

- SDG 8 Decent Work and Economic Growth

Promote development-oriented policies that support decent job creation, entrepreneurship

- SDG 9 Industry, Innovation and Infrastructure

Upgrade infrastructure to make them sustainable, with increased resource-use efficiency and greater adoption of technologies

As the company has grown and the supply chain developed into a more sophisticated value chain, it has focused on Maslow's higher level, 'self-actualization' needs of its customers (as discussed above). These include developing a comprehensive 'responsible supply chain management' programme which includes the three SDG's listed above.

On its supply chain management website it states;

⁴¹ "Revealed; "Asian slave labour producing prawns for supermarkets in U.S. and U.K." The Guardian, 11th June 2014.

⁴² https://www.cpgroupglobal.com/homes/SD_Responsible-Supply-Chain.

⁴³ op. cit.

Supply chain management is the heart of the Company's business operation which propels competitive advantage, fulfillment of consumers' needs and mitigates the business risks. Therefore, the Company's goal is to support and reinforce all supplier groups' capacity in operating business for sustainable growth. This was achieved through integrating aspects of sustainability comprising governance, society and environment throughout the supply chain. The efforts aim to drive the organization and supplier's growth sustainably, in unison.⁴⁴

CP Foods exemplifies how the business sector can often take the lead in pursuing SDG's, because the internal drivers of business success, that is meeting customers 'self-actualization needs', align closely with many of the aims of the SDGs. It is a good example of policy in action and the role governments and international bodies can play in setting business agendas.

11 Value Creation

It can be seen from the analysis above that value, in the eye of a consumer, takes many forms. It may be that the cheapest priced product will be perceived by some consumers as '*value for money*', but increasingly as consumers become wealthier, this is less and less so. Value might be having the knowledge that a food product is prepared in a hygienic way and safe to consume. It may be enhanced by having a government certificate that states just that—such as the health certificates issued by AQIS for meat killed in Australia abattoirs for export.⁴⁵ Value might be a quality attribute such as knowing a CAAB steak will not be tough when ordering it in a restaurant, or buying it for home cooking.⁴⁶ Value might be being able to afford to buy and drink a bottle Penfolds Grange wine.⁴⁷ Consumers buy goods on basis of the *perceived value* to them. The notion of the *value* of a product is quite different to its *price* as Treasury Wine Estates the company that owns the Penfolds brand can attest, because not so long ago the company had to dispose of millions of litres of cheaper end wines because they couldn't sell them, yet they sell all they release of the Grange hermitage every year without any difficulty.

To analyse value we need to dissect it. Value can be divided into two components:

- Use Value
- Esteem Value

Use Value is given by the properties that accompany the product, i.e. in marketing terms its *features* which we discussed above. *Esteem Values* are the properties that

⁴⁴ <https://www.cpoll.co.th/en/sustain/economic-dimension/supply-chain-management>.

⁴⁵ AQIS—Australian Quarantine Inspection Service.

⁴⁶ CAAB (Certified Australian Angus Beef) is a trade mark owned by the Angus Society of Australia and licensed to participants in the beef value chain that comply with a quality assurance program that has among one of its aims guaranteeing the eating quality of CAAB steaks.

⁴⁷ Penfolds Grange Hermitage is a South Australian premium wine brand owned by Treasury Wines Estates Ltd. A bottle of the current vintage sells for around \$AUD750 in Australia. <https://www.penfolds.com/en-au/wines/the-penfolds-collection-2020>.

make a consumer want to buy and own it. Most luxury goods e.g. Cartier Watches, Chanel Perfume, Ermenegildo Zegna suits, have high *Esteem value*. There are often similar products, in terms of function, available at much lower prices in the market, but some people buy these high priced luxury goods simply because they can afford to—and this is an important component of esteem value—the capacity to pay the high asking price.

Value is multi-dimensional and as such creating value in the food marketing chain is open to any business or individual with an entrepreneurial flair who sees an opportunity to make money by selling someone a product.

Value can be created at any point in the chain and because of the integrated nature of the chain, value creation often involves multi-participant changes. The quality assurance programme for CAAB, discussed above, involved farmers, abattoirs, meat processors, wholesalers and retailers. All were required to adopt a QA system specific to their operations and subject to audit, so that the quality of the steak the final consumer bought could be assured because it had passed a QA test at all stages of the chain. As it developed the CAAB value chain acquired ‘esteem value’ s the brand became known for quality and was able to penetrate leading fine dining restaurants, not only in Australia, but also in developing countries such as Malaysia.⁴⁸

To maintain this dynamism the environment in which businesses operate needs to be conducive to entrepreneurial endeavour, so regulation and the role government plays important.

12 Regulation and the Business Environment

On our journey so far, we have seen how sophisticated modern-day value chains emerged from highly competitive commodity supply chains. Competition in value chains still exists; they are still highly competitive, but in a different way. Rather than a focus on selling price, the competition is focussed on winning sales. This means offering consumer value and choice. Regulation needs to recognise this fact and create an environment that fosters competition within all the steps of the value chain. As discussed above, blunt instruments like price controls, compulsory acquisitions, government monopoly trading boards are not conducive to developing a competitive value chain. Regulation that focusses on eliminating anti-competitive behaviour should be the goal. Set the rules of the game so as to foster competition. Competition is still the best policeman for controlling price and all the other aspects of creating value. Regulation that prevents monopolistic or oligopolistic behaviour, breaks up cartels, breaks down barriers to entry and consumer protection laws that help prevent fraud and misrepresentation are what is required. What economists call ‘*rent seeking*’, where businesses foster favours and preferment from government,

⁴⁸ The lead author was consultant to the Angus Society of Australia to develop a marketing plan for CAAB. He was also involved in developing export opportunities for the brand, specifically in Malaysia.

is a major anti-competitive problem in both the developed world and in developing countries and needs imaginative regulation to bring under control.

From a systems perspective regulation needs to work with the market to achieve better outcomes for consumers, not work against the market. This also applies when looking at how best to manage ‘externalities’, such as climate change—where market-based solutions are generally a superior option to heavy handed interventions.

Having good models of the system under examination are therefore valuable tools for designing and testing policy options.

13 Characterising Agricultural Value Chains for Developing, Emerging and Developed Economies

With micro-economic aspects of agricultural value chains covered above, we now turn to the macro-scale to consider what factors differentiate and characterise agricultural value chains in Developing, Emerging and Developed economies.

In line with the previous discussions, the process of development begins with the local supply and demand relationships at village level evolving into longer supply chains that are primarily focused on the efficient use of inputs. At this stage, the emphasis is on price, competitive supply and the creation of value will emerge later with the rise of incomes. So, as economic development progresses, supply chains evolve into value chains encompassing the full breadth of inputs, outputs, consumption and waste disposal, with the creation of value-addition along the chain in response to changing consumer preferences. Initially, it is often the unmet demand for food in fast growing rural populations that provides the impetus for increased agricultural production beyond subsistence. Usually, this is first achieved through expanding resource use, particularly land. As a result of finite land availability, together with increased productivity, land becomes more scarce and expensive. At this very early stage, the supply chain is relatively unsophisticated and the demand is characterised by the populations’ physiological need for food, corresponding to Maslow’s⁴⁹ bottom tier. As development occurs the supply chain evolves into a value chain where the focus is no longer just on increasing supply, because the physiological needs of the population are already being met. At this point businesses in the chain now focus on meeting Maslow’s higher level needs for their customers. Producers become proactive in identifying what customers want and produce accordingly.

To disaggregate this in greater detail, but at a broad scale, to reveal some key features that characterise agricultural value Chains in developing, emerging and developed economies, we first consider Rostow’s model (1960). This model forms the basis for Modernisation Theory within the field of development economics and is outlined in Table 2, below. A full discussion of development theory is beyond the scope of this chapter. Suffice to say that whilst a number of assumptions may

⁴⁹ Maslow (1943)—a more in-depth discussion of Maslow’s relevance to the development of marketing within value chains is covered later in the chapter.

or may not apply for individual economies, the model remains a useful indicator of development markers.

In addition to Rostow's insights, a key difference between developed and developing economies is often the extent to which supporting services are provided as public versus private services. There is a strong tendency in developed economies to provide nearly all agricultural extension services privately, whereas in many developing economies, because of a market failure by the private sector to provide these services, they are often publicly provided or supported. Furthermore, there is usually more public investment in supporting the agricultural research and development services (R&D) in developing countries to help drive productivity, although considerable public investment in these activities often continues in more developed countries as well. This is because public investment in R&D, has been shown to accelerate the development process in particular by making available by making available new technologies that enhance productivity and hence the economy.

By reframing the salient characteristics of each stage of Rostow's model (Table 2) in terms of their implications for agricultural value chains, along with the likely available policy, infrastructure and social enablers on the one hand, and

Table 2 Summary of key characteristics describing Rostow's (1960) model of economic growth as they correspond to Developing, Emerging and Developed economies

Rostow's stage of growth	Description of key characteristics	Correspondence to developing, emerging or developed economy status
Traditional society	Hunter-gatherer survival or subsistence agriculture. Extremely Limited technology. Lack of individual economic mobility. No centralised political system. Stability is the main societal imperative	No national economies remain at this stage of overall development
Pre-conditions for take-off	Centralised political system forms. Entrepreneurs emerge. Population growth accelerates. External demands for raw materials and/or unmet demand for food provide an impetus for economic growth. Trade commences. Agriculture led to growth. Investment into resource enhancement, such as ports and irrigation. Ohno (2009) stresses heavy reliance remains on extractive resources, monoculture exports, subsistence agriculture and foreign aid	Developing economies

(continued)

Table 2 (continued)

Rostow's stage of growth	Description of key characteristics	Correspondence to developing, emerging or developed economy status
Take-off	Urbanisation escalates. Industrialisation develops. Trade escalates. Strong investment in technological development. Shift from primary sector to secondary sector dominated economy. Supply chains develop. Ohno (2009) highlights the use of Foreign Direct Investment and foreign management to direct unskilled labour, in order to help progress industrialisation and expand exports including food	
Drive to maturity	Diversification of the industrial base. Heavy focus on export trade. Rapid development of transport infrastructure and social infrastructure (e.g. hospitals). Large investments in education. Shift toward domestic consumption as Maslow's lower-level needs is satisfied. Value chains supplant supply chains. Ohno (2009) stresses the need for locals to replace foreigners, and expansion to higher value activities is required for further progression	Emerging Economies
Age of high mass consumption	Disposable incomes are high. Consumption of high value and luxury goods becomes normative. Demand shifts to Maslow's highest tiers. The industrial base dominates with the services sector rapidly growing and the primary sector shrinking to a minor component of GDP. Technology, management and production of high quality goods are mastered. Equity, welfare and security issues are of primary importance. Heightened attention to sustainability and the circular economy	Developed economies

supporting services on the other, Lellyett’s (2021) model (Fig. 2) can be customised. This provides an indicative view of how agricultural value chains can manifest in developing, emerging and developed economies.

These are displayed in Figs. 7, 8 and 9. Of course, this is idealised and carries the inherent challenges of Rostow’s model in the real world. Nevertheless, these figures provide a broad but useful qualitative benchmark against which the individual progress of any given economy could be compared. This may help identify areas of need in facilitating a movement to the next stage of development.

Recent research has pointed to the significant contribution of Global Value Chains (GVCs) to trade-led economic development. GVCs are instances of value chains where two or more of the main production activities along the core of a value chain are undertaken in different countries, usually under the umbrella of a transnational company. For example, raw foods might be produced in a country endowed with high levels of natural resources (arable land, suitable climate, adequate water), then refined and transformed into other finished or semi-finished goods in a country possessing

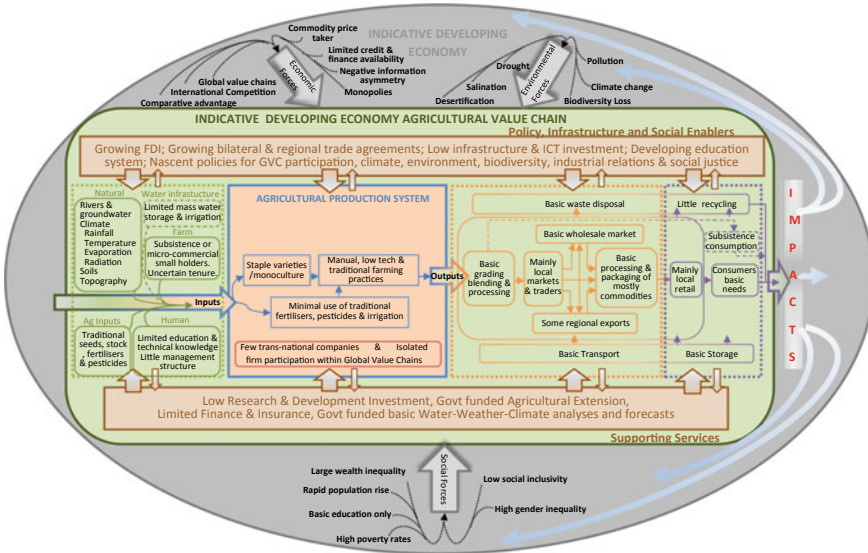


Fig. 7 Shown is an indicative developing economy agricultural value chain within the context of broader economic, environmental and social forces typically acting within and upon developing economies. Salient features such as subsistence or micro-commercial farms with limited technology and infrastructure supports, limited cropping varieties, low farmer education levels and limited access to capital selling into unsophisticated local markets with limited exports align to Rostow’s Pre-conditions for Take-off and Take-off stages. At this stage of development the value chain downstream of agricultural production is usually not developed enough for participation in Global Value Chains (GVCs), however where natural resources are ample with farms beyond subsistence there is the possibility of farms contributing their raw outputs to GVCs. This representation is indicative only therefore drawing conclusions about any particular developing country requires a detailed analysis of its unique circumstances (Developed by Lellyett, 2021)

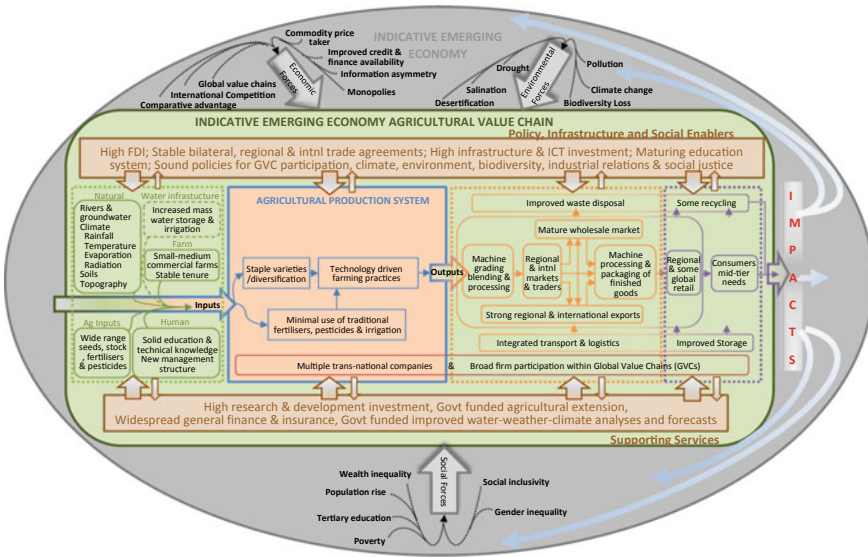


Fig. 8 Shown is an indicative emerging economy agricultural value chain within the context of broader economic, environmental and social forces typically acting within and upon emerging economies. Salient features such as proliferation of small to medium sized commercial farms with technology driven farm practices and enhanced infrastructural support, diversified crop and livestock operations, good farmer education levels, adoption of management structures, more readily available basic finance and insurance with selling into more sophisticated regional markets and increasingly global markets align to Rostow’s Drive to Maturity stage. At this stage of development specific activities along the full length of the value chain may be sufficiently mature for participation in Global Value Chains (GVCs), particularly where natural endowments align strongly to GVC needs. This representation is indicative only therefore drawing conclusions about any particular emerging economy requires a detailed analysis of its unique circumstances (Developed by Lellyett, 2021)

the advanced technology and know-how required, in fact there could be several links in the chain from raw to finished goods.

Such GVC development leverages lower cost production of raw goods in the firms of one set of economies, and the efficient high-tech processing into semi-finished and finished goods of firms in other economies. With international transportation costs having reduced significantly and major advances in international communications and IT systems integration, this fracturing along the length of the value chain often renders GVCs a more efficient and productive structure. Key to their functioning is the very deep trade agreements required, usually at the firm level. Such deep agreements involve not only monetary exchange for purchases of inputs to successive steps along the value chain, but also agreements to provide access to intellectual property such as advanced research and development or production methods, management expertise and advanced technology.

The World Bank (2020) reports that GVCs account for around half of world trade today, but that trade growth rates have stalled since the global financial crisis of 2008. Whilst reforms to address the stalled growth is beyond the scope of this

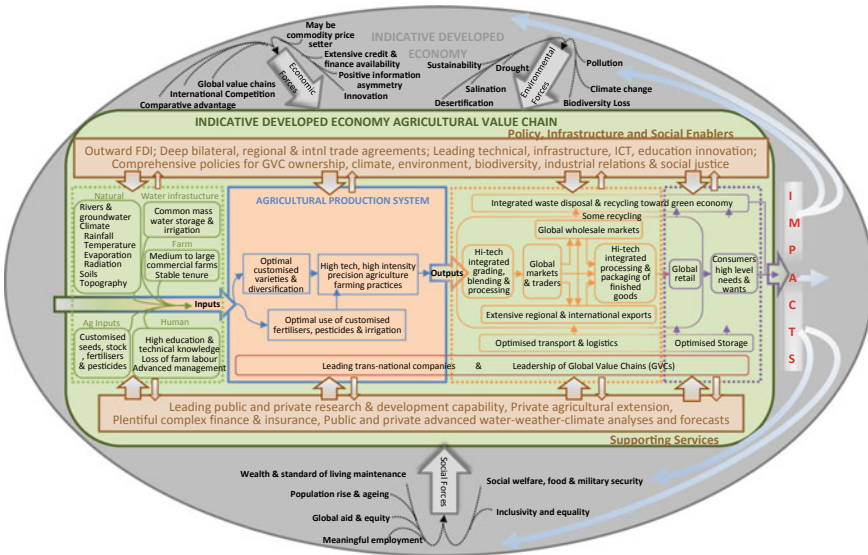


Fig. 9 Shown is an indicative developed economy agricultural value chain within the context of broader economic, environmental and social forces typically acting within and upon developed economies. Salient features such as dominance of medium to large sized commercial farms with high-tech high intensity precision agricultural practices and strong technologically advanced infrastructure supports, tertiary educated farmers and advanced management structures, technologically advanced inputs such as genetically modified seeds and breeding stock, ready access to customised finance and insurance with selling into sophisticated global markets align to meet consumers’ higher level needs and wants align to Rostow’s Age of High Mass Consumption stage. At this stage of development company scale, specific activities at all points along the value chain, plus ICT integration are collectively sufficiently mature to develop and lead Global Value Chains (GVCs). This representation is indicative only, therefore drawing conclusions about any particular developed economy requires a detailed analysis of its unique circumstances (Developed by Lellyett, 2021)

chapter, there is solid evidence that GVC participation by developing and emerging economy firms can lead to increased productivity and economic growth. Progressing along the value chain from inputs toward consumption, the value added is cumulative. Hence, precisely where on that trajectory an economy is able to participate matters. Upgrading to later stages is more beneficial, but usually accords higher technical difficulty, demanding successively more advanced infrastructure, knowledge and expertise.

How developing and emerging economies engage with GVCs is important in determining their ability to upgrade along the value chain, and not get trapped at the less profitable earlier stages. The engagement must be such that it enables the capture and leverage of technology and knowledge transfers. These transfers must be sufficiently dispersed throughout the economy, and accompanied by matching education and available capital to support their adoption. Ohno (2009) asserts that this needs to extend to local human capital at all levels in all areas replacing foreigners in order to successfully transition from Emerging to Developed economic status.

Because individual developing and emerging economy firms may lack the expertise required to successfully negotiate such engagements there is an important role for government to help facilitate.

Thus given the right circumstances, participation in GVCs provides a potential pathway for developing and emerging economies to accelerate development. Reverting to Lellyett’s (2021) model, Fig. 10 shows an indicative GVC with an embedded developing economy farm enterprise. Notably, developing economies generally lack sufficient maturity in most functions along the value chain to effectively participate in GVCs, except perhaps for the production of raw outputs which may be possible if farms are already commercial, of adequate scale, and endowed with favourable natural inputs. Emerging economies by contrast may well have individual firms with sufficiently developed capabilities at other points along the value chain to effectively participate in GVCs.

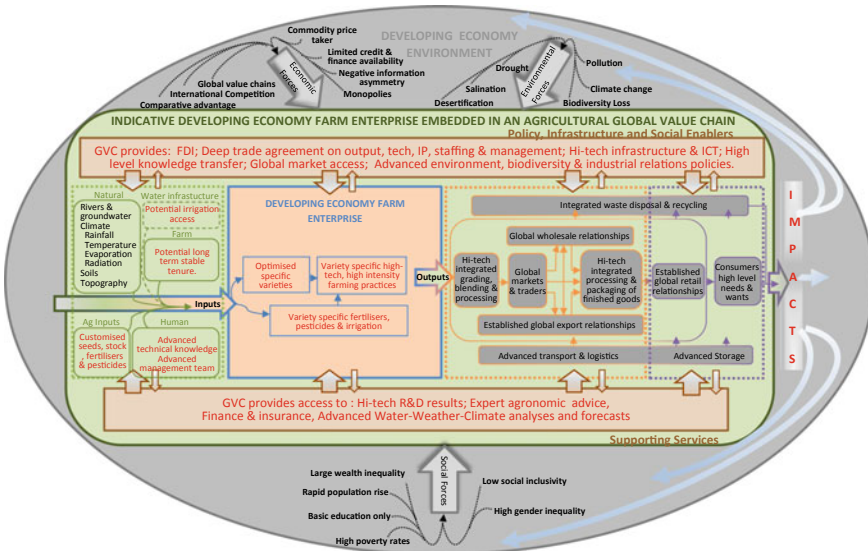


Fig. 10 Shown is an indicative Global Value Chain with an embedded developing economy farm enterprise. Highlighted in red text are the capabilities inherent in the GVC that may be made accessible and available to the developing economy farm enterprise. Typically developing economies lack sufficient maturity in the greyed-out functions within the GVC, however specific functions may be accessible to emerging economy firms sufficiently developed. Notably, the GVC capabilities are beyond what is generally available within overall developing or emerging economies themselves—hence participation in GVCs provide a pathway for the accelerated development of developing and emerging economies through technology and knowledge transfer. Realising accelerated development is however contingent upon dispersion of knowledge more broadly throughout the economy and sufficient available capital to support adoption of high-tech infrastructure and practices. (Developed by Lellyett, 2021)

14 Sustainability

Ensuring a sustainable agricultural/food value chain is a vital imperative for all governments. Feeding their populations, guaranteeing food safety, ensuring future needs will be met, having reserves in case of emergencies, are all part of this remit. Nobel prize winner Amartya Sen in his careful analysis of twentieth century famines concluded they were often caused by government policy, political interference, wars and social disturbances causing disruption in the supply chains and not from a lack of agricultural productive capacity (Sen, 1982). Famines in recent years in Somalia, Yemen and the Dafur region of South Sudan reflect the same with ongoing civil war disrupting agricultural production and supply chains in regions that would otherwise be food self-sufficient.

The object of this disquisition has been to show the complexity of modern food value chains, but also how they can be better understood by analysis and how by using the knowledge gained from a thorough understanding of how they work, better management and regulation of the systems can be achieved. This management needs to be focused on creating and maintaining sustainable food value chains. That is, despite our focus in the paper on economic efficiency, also on the maintaining a sustainable environment and human social well-being—what is commonly referred to as the triple bottom line.

Sustainability also means designing systems that are robust and able to withstand changes in the external environment including unforeseen ‘shocks’. Nassim Nicholas Taleb in his book *AntiFragile* makes the point that most natural systems and man-made systems that have evolved over a long periods of time tend to be ‘robust’, whereas newly created man-made systems, even though they may be brilliantly engineered to survive most foreseeable shocks, can in fact be quite ‘fragile’ (Taleb, 2012). This is because causation variables that are distributed according to a normal distribution (or ‘bell curve’), tend to revert to the mean over time. So, over a large number of events, as occurs in nature, or through ‘trial and error’ experimentation by humans over many generations working out what practices are the best, ‘robust’ (and by default the less fragile) systems evolve. Many traditional farming methods fall into this latter category and that is why it can sometimes be very hard to get subsistence agriculturists in developing economies to change their practices. When your existence depends on getting a crop every year to feed your family, certainty of the result is more important than achieving a higher yield.

Taleb also makes the point that extremely rare events (low probability of occurrence), but with high costs in terms of outcomes, perhaps even catastrophic, can make what appear to perfectly sustainable systems that go on for years, fragile. He called these ‘black swan’ events, a term that has now become part of the modern lexicon. ‘Black swan’ events are rare, unforeseen, events, events nobody thought possible, so-called because of the shock Europeans had, when used only to swans being white, they first saw Australian Black Swans. Planning for ‘black swan’ events is difficult, because, by definition they are unforeseen. But with thought, systems can

be designed to be more robust and therefore more able to withstand ‘black swan’ shocks.

The emergence of the SARS Covid 2 virus in late 2019 in Wuhan, China, which quickly became a world-wide pandemic, is just such a ‘black swan’ event. Extremely difficult to foresee, although some argue a pandemic was inevitable at some time or another; the consequences have been extremely costly, both in terms of human health and lives, as well as economic. The impact of lockdowns to try and curb the spread of the virus has disrupted many global supply chains including vitally important food supply chains. It has led to calls in many countries of greater self-sufficiency, especially for medical and vital food supplies. It has exposed the weaknesses (‘fragility’) of some global and even local supply chains.

Some general principles apply in reducing ‘fragility’; a wider distribution of players rather than concentrated participants in a market; small rather than large, because a few small businesses going bust do not have a significant impact on the overall economy, whereas one large business such as the failure of American Bank Bear Stearns, triggered a global financial crises; short rather than long supply chains, because the possibility of disruption is far greater in long supply chains, as the recent Covid 19 ‘black swan’ experience has shown.

Many man-made systems are actually specifically designed (by default) to fail in ‘black swan’ events. A widely accepted design precept is to design to a 95% tolerance level for a particular variable. Black swan events, being extremely rare, generally have less than a 5% chance of occurrence, so fall outside this tolerance level. Failure to understand the true causation and probability of occurrence can lead to the conflation of causations and effects and miss diagnosis of a problem.

The drive for greater efficiency can also be a cause of increased ‘fragility’. The running aground in March 2021 of the MV Ever Given in the Suez Canal is a good example. Originally built in 1869 to take the vessels of its day, the canal is less than 200 m wide in many parts and just 24 m deep. But since its construction the drive for greater transport efficiency has led to significantly bigger vessels. The Ever Given, carrying 18,300 containers, is around 400 m stern to bow and 60 m across with little draft beneath the vessel in the canal. When strong winds swept out of the desert the huge bulk of the cargo deck acted like a giant sail, causing the vessel to veer uncontrollably from side to side. The vessel displaced hundreds of thousands of tonnes of water which had to squeeze through the narrow passages between the hull and the shore on either side, making the steering dynamically unstable. The result was it ran aground blocking the canal for 6 days, holding up billions of dollars of seas freight and disrupting Asia—Europe supply chains.⁵⁰ At least 20 bulk carriers of livestock were reported as delayed in the event,⁵¹ raising concerns over animal welfare, the potential for disease and loss of profits due to the impact on the deteriorating conditions of animals. Asia-bound grain cargoes alone of 768,000 tonnes were also reported as delayed.⁵² It is almost certain, that supplies

⁵⁰ Chellel et al. (2021).

⁵¹ The Guardian (2021).

⁵² Grain Brokers Australia (2021).

of lumber, vegetable oils, fertilisers and cereals were also delayed considering the very high annual tonnages transiting the canal—with respective 2019 totals⁵³ coming in at 2.8MT, 124.8MT, 138MT and 363.8MT.

15 Conclusion

Agricultural value chains develop in tandem with economic growth. In developing countries rising agricultural productivity drives a transition from small-holder subsistence through to small-scale commercial farming to an eventually much larger scale, intensive, agricultural production. This leads to a capital intensive, consolidation of production resources. Progressively surplus labour moves out of the countryside to new industrial cities. City workers need for food and clothing creates a supply chain, which in time evolves into a value chain as the wants of city-based consumers become more sophisticated. Value is created by meeting the wants and needs of consumers. Over time consumers become less sensitive to price as their incomes rise and although it is always part of the value equation, other product features such as convenience, safety and eating quality become more important to consumers. As consumers place value on these features, opportunities arise for new production methods, transformations, services etc., which creates jobs and economic activity.

Moreover, throughout this transition there are growing global economic, social and environmental pressures that may threaten global food security including population growth, inequality, poverty and anthropogenic climate change. Not only must developing country agriculture face these challenges to meet and sustain increasingly higher levels of productivity, but often those involved in the value chain itself also face intense challenges within their own communities and businesses. The 2030 Sustainable Development Goals and Targets provide broad yet useful guide lines to progress for incumbents within agricultural value chains and governments which help illuminate pathways forward in undertaking structural transitions, including those facilitated by the provision of appropriate infrastructure, policy and education plus research, development and extension services.

Moving forward, the businesses will have to adopt one or more of three generic strategies; cost leadership, differentiation or customer focus. If competition is allowed to do its task, then the efficient value chains will deliver to consumers all the variety and choice they demand at prices consumers are willing to pay. In other words, a competitive market is the best way of assuring a sustainable supply. The role of government then is to set the rules within which the businesses must compete, in particular ensuring businesses are always subject to competitive pressure as this will create the most efficient value chain. As economist Milton Friedman observed, businesses fundamentally don't like competition and so will do everything they can to reduce or avoid it (Friedman, 2009). It is therefore up to the government to set

⁵³ Suez Canal Authority (2021).

the rules to make sure businesses do face competition and don't mislead consumers. Businesses need to be 'rule takers', not 'rule makers'.

The biggest threat to efficient markets in many developed economies is 'rent seeking', that is where businesses seek government protection (licensing, tariffs, quota's, etc.), in order to avoid competition. 'Rent seeking' is one of the greatest threats to the development of efficient value chains and is especially a problem in developing countries where corruption is rife and legal and regulatory institutions are weak. The object then of government policy in order to do the 'most good' for its population, following Bentham's precept, should be the creation of competitive, sustainable, value chains.

By modelling complex systems, we get a better understanding of the cause and effect relationships and from that a better understanding of the threats that are likely to disturb the system, that is an understanding of the 'fragility' of the system. Nothing can be more important than the food supply system to human well-being. Identifying threats to the food supply system in particular potential 'black swan' events, is vitally important. And although 'black swan' events cannot be foreseen, by definition; these can be countered to some degree by building 'robustness' into the system, so the system is less 'fragile' and better able to withstand shocks. Modelling is a powerful tool for experimenting with 'fragility'. By tweaking different variables, weaknesses or 'fragility' can be identified. So, rather than trying to forecast future outcomes, which are almost inevitably wrong, the true value of modelling is to understand how systems behave and their potential 'fragility'; so this knowledge can be used to make them more 'robust' and thus make them more resilient.

References

- Australian Bureau of Statistics (ABS). (2018). *Population projections, Australia, 2017 Publication 3222.01*. Retrieved August 26, 2020, from <https://www.abs.gov.au/statistics/people/population/population-projections-australia/latest-release>
- AWI and The WoolMark Company. (2020). *Paolo Zegna receives top Australian Award, Beyond the Bale* (p. 15). September 2020.
- Bardsley, P. (1994). The collapse of the Australian wool reserve price scheme. *The Economic Journal*, 104(426), 1087–1105.
- Bawden, R. J. (1992). Systems approaches to agricultural development: The Hawkesbury experience. *Agricultural Systems*, 40(1–3), 153–176.
- Boult, C., & Chancellor, W. (2020). Agricultural productivity estimates. Retrieved August 26, 2020, from <https://www.agriculture.gov.au/abares/research-topics/productivity/agricultural-productivity-estimates#broadacre-productivity>
- Chellel, K., Campbell, M., & Oanh Ha, K. (2021). Global trade held hostage as six days unfold in Suez. Bloomberg Business Week reprinted in Australian Financial Review 30th July 2021.
- Dangar Research. (1995). *Beef usage and attitudes study*. AMLC.
- Drakakis-Smith, D. (1990). Concepts of development (Chap. 3). In D. J. Dwyer (Ed.), *South East Asian development* (p. 55). Longman Scientific
- Drucker, P. (1973). *Management: Tasks, responsibilities and practices*. Harper & Row Publishers.
- Earthscan. (2011). *The state of the world's land and water resources for food and agriculture: Managing systems at risk*. Routledge.

- FAO. (2016). *The state of food and agriculture. Climate change, agriculture and food security*.
- FAO. (2018). *The future of food and agriculture: Alternative pathways to 2050* (pp. 76–77).
- FAO. (2021). The state of food security and nutrition in the world, SOFI 2021. Digital Report.
- Friedman, M. (2009). *Capitalism and freedom*. University of Chicago Press.
- Garvey, J., & Stangman, J. (2012). *The story of Philosophy Quercus* (p. 298).
- Grain Brokers Australia. (2021). Modern-day Suez crisis disrupts world trade. 30 March 2021.
- Griffith, G., & Alford, A. (2002). The US cattle cycle and its influence on the Australian beef industry. *Australasian Agribusiness Review*, 10(1673-2016-136837), 1–14.
- The Guardian. (2021). At least 20 livestock ships caught in Suez logjam. 26 March 2021.
- Hallberg, G. (1995). *All consumers are not created equal*.
- Heady, E. O. (1961). Economics of agricultural production and resource use.
- Hillmer, F. (1993). *National competition policy*. Report by the Independent Committee of Inquiry, Australian Government Publishing Service, Canberra.
- James D. E., & Throsby, C. D. (1973). *An introduction to quantitative methods in economics*. Wiley.
- Kaplinsky, R., & Morris, M. (2000). *A handbook for value chain research*. University of Sussex.
- Kim, E. J. (2016). The impacts of climate change on human health in the United States: A scientific assessment, by us global change research program. *Journal of the American Planning Association*, 82(4), 418–419.
- Kuznets, P. W. (1988). *An East Asian model of economic development: Japan, Taiwan, and South Korea. Economic development and cultural change* (Vol. 37, No. S3). University of Chicago Press.
- Lellyett, S. C. (2021). A new value chain framework applied to agriculture (personal communication).
- Marshal, A. (1890). *The principles of economics: An introductory volume*. Macmillan.
- Maslow, A. (1943). A theory of human motivation. *Psychological Review*.
- Narula, S. A., & Desore, A. (2016). Framing green consumer behaviour research: Opportunities and challenges. *Social Responsibility Journal*, 12(1), p1-22.
- Ohno, K. (2009) Avoiding the middle income trap: Renovating industrial policy formulation in Vietnam. *ASEAN Economic Bulletin*, 26(No. 1), 25–43.
- Porter, M. E. (1980). *Competitive strategy: Techniques for analysing industries and competition*. The Free Press.
- Porter, J. R., Xie, L., Challinor, A. J., Cochrane, K., Howden, S. M., Iqbal, M. M., Lobell, D. B., & Travasso, M. I. (2014). Food security and food production systems (Chap. 7). In: C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change* (pp. 485–533). Cambridge University Press.
- Porter, M. E. (1985). *Competitive advantage: Creating and sustaining superior performance*. Simon and Schuster. ISBN 9781416595847.
- Ries, A., & Trout, J. (1981). *Positioning: The battle for your mind*. Warner Books.
- Ries, A., & Trout, J. (2000). *Positioning: The battle for your mind*. Mc Graw Hill.
- Rosenbaum, A. (2017). *What were they thinking #6 Colgate kitchen entrees*. Retrieved from <http://that401ksite.com/2017/02/17/what-were-they-thinking-6-colgate-kitchen-entrees/>
- Rostow, W. W. (1960). *The stages of economic growth*. Cambridge University Press.
- Sen, A. (1982). *Poverty and famines: An essay on entitlement and deprivation*. Oxford University Press.
- Senge, P. (1992). *The fifth discipline*. Random House.
- Shellenberger, M. (2020). *Apocalypse never: Why environmental alarmism hurts us all*. Harper.
- Sheng, Y., Chancellor, W., & Jackson, T. (2019). Deregulation reforms, resource reallocation and aggregate productivity growth in the Australian dairy industry. *Australian Journal of Agriculture and Resource Economics*, 6(Issue 2) (December).
- Shepherd, G. S. (1941). *Agricultural price analysis*. Iowa State College Press.

- Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. March 1776.
- Stiglitz, J. E., Fitoussi, J.-P., & Durand, M. (2019). *Measuring what counts*. The New Press.
- Suez Canal Authority. (2021). Yearly Cargo Ton by Cargo Type report, Navigation Statistics. Retrieved August 2021, from <https://www.suezcanal.gov.eg/English/Navigation/Pages/NavigationStatistics.aspx>
- Symonds, M. (2014). *Stuck in the middle; Take the flexible approach*. Retrieved February, from <https://www.forbes.com/sites/mattsymonds/2012/02/24/stuck-in-the-middle-take-the-flexible-approach/#1a07d3322ebd>
- Taleb, N. N. (2012). *Antifragile: How to live in a world we don't understand*. Allen Lane London.
- Thirlwell, A. P. (1972). *Growth and development; With special reference to developing economies*. Macmillan.
- Tietenberg, T. (2000). *Environmental and natural resource economics* (5th ed.) (p. 66). Addison-Wesley Longman Inc.
- United Nations. (2015). Resolution 70/1, United Nations General Assembly 25 September 2015.
- United Nations. (2020). *The sustainable development goals report 2020*. ePub ISBN: 978-92-1-358332-6; <https://sustainabledevelopment.un.org/>
- Williams, J. (2012). *Supply chain distortions. Competition and efficiency in international food supply chains* (pp. 19–38). Routledge.
- World Bank (2020) *World development report 2020: Trading for development in the age of global value chains*. World Bank. License: Creative Commons Attribution CC BY 3.0 IGO. <https://doi.org/10.1596/978-1-4648-1457-0>