



Revolution Reconsidered:  
Evolving Perspectives on Livestock  
Production and Consumption

James Sumberg and John Thompson

# Livestock Revolution

The background of the lower half of the cover is a solid light green color. It features several thick, overlapping, curved lines in various shades of green and brown, creating a sense of movement and depth, reminiscent of a stylized landscape or a network of paths.

## Revolution Reconsidered: Evolving Perspectives on Livestock Production and Consumption

The term Livestock Revolution was coined by Delgado et al. (1999c) to highlight accelerated growth in demand for livestock products in parts of the developing world, tied to human population growth, rising incomes, continuing urbanisation and changing food preferences. The Livestock Revolution – with its promise of diet diversity, better nutrition and health, and also economic opportunities for small-scale producers – is one of the most powerful ideas to emerge in the areas of food, nutrition and agricultural development over the last decade. This paper takes a critical look at the state of the debate around the Livestock Revolution, with a particular focus on sub-Saharan Africa.

As with all foresight exercises, 15 years on, some parts of the Livestock Revolution analysis hold up better than others. Nevertheless, it is surely true that the analysis underpinning Livestock to 2020 has helped frame research and policy debates. At this point it is difficult to tell what impact the of the analysis has actually had on policy, particularly as many of the policy responses, particularly those addressing the potential negative effects on small-scale producers – the so-called ‘equity issue’ – are not distinguishable from a now well-established agenda of investment in infrastructure and technology, strengthening of rural organisations, and closer integration with agribusiness through e.g. contract farming. Delgado et al. are very explicit in indicating that while the Livestock Revolution offers potential benefits for small-scale producers, these benefits are by no means assured. The changes in the production, processing, retail and consumption of livestock products that define the LR have massive structural, financial, social and environmental implications. Given the reach and power of the private sector actors involved, it is not at all clear how effectively policy (at any level) will be able to influence the related trends or processes, or modify the outcomes. A more explicit and contextualised understanding of the social, technical and environmental relationships and dynamics among livestock production systems, and between livestock and other sectors of the economy should help build a basis for more inclusive consideration of potential development pathways and their various poverty, social justice and sustainability implications.

### About the Authors

**James Sumberg** is an agriculturalist by training and has over 30 years experience working on small-scale farming systems and agricultural research policy in sub-Saharan Africa and Latin America. A key research interest has been the dynamics of change within agricultural systems. He joined IDS as a Research Fellow in October 2009. Previously he served as Programme Director at The New Economics Foundation and Senior Lecturer in Natural Resource Management in the School of Development Studies, University of East Anglia. He has also held research positions at WADRA - the Africa Rice Centre and the International Livestock Centre for Africa. He is joint convenor of the STEPS Centre’s Livestock Revolution project.

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**John Thompson** has worked on power, policy and sustainability issues in food and agriculture, water resource management and rural development for nearly 25 years, in both developing and industrialised countries. He joined IDS in October 2006 as a Research Fellow in the Knowledge, Technology and Society Team and serves as joint convenor of the STEPS Centre Food and Agriculture domain and joint convenor of the STEPS Centre’s Livestock Revolution Project.

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# **Revolution Reconsidered: Evolving Perspectives on Livestock Production and Consumption**

**James Sumberg and John Thompson**

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For further information please contact: STEPS Centre, University of Sussex, Brighton BN1 9RE

Tel: +44 (0) 1273915673

Email: [steps-centre@ids.ac.uk](mailto:steps-centre@ids.ac.uk)

Web: [www.steps-centre.org](http://www.steps-centre.org)

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## **Acronyms**

DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
ILRI	International Livestock Research Institute
IFPRI	International Food Policy Institute
LR	Livestock Revolution
MT	Million Metric Tons
WANA	West Asia and North Africa

## 1. Introduction

Over the last two decades much has been written about the on-going re-structuring of the global food system and its regional, national and local manifestations (McMichael 1993; Goss *et al.* 2000; Busch and Bain 2004; Konefal *et al.* 2005; Thompson and Scoones 2009). Often associated with processes of globalisation and driven by corporate interests, this restructuring is evident in both incremental and radical transitions in relation to scale, concentration, governance, sourcing strategies and technology. In some places these changes have engendered a degree of resistance in the form of new interest in 'local food', quality, social and environmental certification, provenance and food sovereignty. These transitions have had and will continue to have important implications for rural livelihoods, poverty, food security, social justice and the environment in both the developed and developing worlds.

Like other parts of the food system, the production, processing, distribution, sale and consumption of meat and livestock products have been affected by these processes of restructuring. With a particular focus on the developing world, ongoing and projected transitions in the consumption and production of livestock products have been termed the 'Livestock Revolution' (LR) (Delgado *et al.* 1999c). In a nutshell the LR highlights accelerated growth in demand for livestock products in parts of the developing world, tied to human population growth, rising incomes, continuing urbanisation and changing food preferences. The notion of the LR – with its promise of diet diversity, better nutrition and health, and also economic opportunities for small-scale producers – is one of the most powerful ideas to emerge in the areas of food, nutrition and agricultural development over the last decade.

This paper takes a critical look at the state of the debate around the LR, with a particular focus on sub-Saharan Africa. In the next section we explore the argument as it was originally put forward. We then trace how this has been developed and critiqued in the 15 years since it was first presented. The last section before a brief conclusion introduces the notion of pathways as developed by the STEPS Centre, and argues that it provides a useful lens through which to understand the poverty, social justice and sustainability implications associated with changes in the livestock sector.

## 2. The Livestock Revolution: the basic argument

The imagery of revolution has become central to modern agriculture development discourse. The Green Revolution is now universally recognised (although still debated), and it has been followed by the White Revolution, referring to small-scale milk production in India (Bellur *et al.* 1990; Parthasarathy 1991); the Blue Revolution, referring to aquaculture (Coull 1993); the Maize Revolution, referring to small-holder maize production in Africa (Byerlee and Eicher 1997); the Evergreen Revolution, referring to the idea that it is possible to use technology to increased productivity in perpetuity without ecological harm (Swaminathan 2004); the Doubly Green Revolution, referring to the necessity of integrating environmental conservation with agricultural productivity enhancement (Conway 1999); and the Supermarket Revolution, referring to the rapid growth of supermarkets in the food retail sector in developing countries (Reardon *et al.* 2003; Humphrey 2007).

The use of the term revolution highlights four important and related dimensions of change. First, it suggests change that is both fundamental and 'at scale'. Second it suggests change that is unpredictable, uncontrolled and associated with risk and danger. Third, the term revolution raises an expectation of positive change, a better future. And fourth, it reminds us

that the making and outcomes of revolutions are always contested. Thus, the imagery of revolution combines elements from the two contrasting metaphors first introduced by de Wilde (2000) and further developed in relation to agricultural biotechnology by Jansen and Gupta (2009), the 'onrushing (threatening) future' and the 'beckoning (promising) future' (Box 1).

One way to raise the profile of a trend or issue, or a research or policy area, is to associate it with the word revolution, which simultaneously plays on the fear of the unknown and the expectation of positive change. Declaring revolution can thus be seen as part and parcel of making revolution (or it is at least part of the dynamic of establishing new policy framings and narratives).

**Box 1:** *Two scenarios: 'onrushing (threatening) future' and the 'beckoning (promising) future'*

Jansen & Gupta (2009) develop two metaphors first introduced by de Wilde (2000) in his analysis of the 'future industry'. The **beckoning (promising) future** metaphor:

'describes a new era with positive change and a better life. The futurists do not negate possible risks but argue that those who are willing to take these risks will be rewarded. The prophecy conditions: society will only benefit if it behaves according to the prophecy. Beckoning futures tend to emphasize autonomy and realization of the benevolent future if external constraints can be reduced. New technologies create a larger freedom of action in this perspective. The past controlled us but we will increasingly control the future, is the message of the beckoning future.'

The beckoning future contrasts with **onrushing (threatening) future** metaphor that describes a situation in which:

'...our current world leaves little choice. If nothing changes, people are doomed to suffer. [...] We are not moving to the future, but the future approaches us. The onrushing future is almost a permanent menace. The future is in a hurry. There is no time for fundamental questions. If we wait too long before acting according to the prophecies, the future will overrule us with new disasters. The onrushing future recognizes only one apposite answer: collaboration. Resistance is impossible (and in our case morally reprehensible: one cannot be in favour of hunger and poverty). The onrushing future uses the language of winning or losing. It teaches us that we have to ensure that we are among the first to join the future. If not, domination by others will be the result.'

Despite the emphasis on revolution it is important to note that there have been strong evolutionary elements to most of these agriculture and food-related revolutions. It is equally important to understand that while these revolutions have brought some positive change, they have been less successful in overturning the power relations that underpin the endemic social injustice that has been so long associated with food and agrarian relations.

The term 'livestock revolution' first appeared in 1999 in work undertaken by the Food and Agriculture Organization of the UN (FAO), the International Livestock Research Institute (ILRI) and International Food Policy Institute (IFPRI) as part of the latter's 'Vision 2020' initiative (Delgado *et al.* 1999b, Delgado *et al.* 1999c; ILRI 1999), although the main lines of argument appeared earlier (Delgado *et al.* 1998). Over the following years these authors published a number of other papers and reports that either summarised or extended this analysis (Delgado *et al.* 2003a; Delgado 2003; Poapongsakorn *et al.* 2003; Hall *et al.* 2004).

Delgado *et al.* (1999c) identify population growth, urbanisation (and the changing patterns of labour force participation and access to domestic technology associated with it), rising incomes and a desire to diversify diets by including more meat and livestock products as driving fundamental change in the consumption of livestock products. They go on to identify seven 'characteristics' of the LR:

1. 'rapid worldwide increases in consumption and production of livestock products in developing countries;
2. a major increase in the share of developing countries in total livestock production and consumption;
3. on-going change in the status of livestock production from a multipurpose activity with mostly non-tradable output to food and feed production in the context of globally integrated markets;
4. increased substitution of meat and milk for grain in the human diet;
5. rapid rise in the use of cereal-based feeds;
6. greater stress put on grazing resources along with more land-intensive production closer to cities;
7. the emergence of rapid technological change in livestock production and processing in industrial systems.' (p. 59).

Delgado *et al.* suggested that the Livestock Revolution is fundamentally different from the earlier Green Revolution because it is 'demand driven' while the Green Revolution was 'supply driven' (p.1, 59) (Box 2). The growth in demand will be particularly large (unprecedented) because of the size of the population of the countries like China and India, and the fact that their consumption of livestock products is presently very low (i.e. they have a long way to go before they even begin to approach per capita consumption levels in developed countries). The challenge will be to meet this growth in demand without negatively affecting the food security of the poor, degrading the environment or increasing the incidence / severity of zoonotic disease. This will require change in policy and technology, as well as in the structure of the livestock sector.

On this basis they suggest that increased consumption of livestock products will be associated with major benefits in terms of improved nutrition and health; and that with the right policies and technology, this 'demand-driven' revolution can be harnessed for poverty alleviation (in rural areas and/or among small-scale livestock producers).

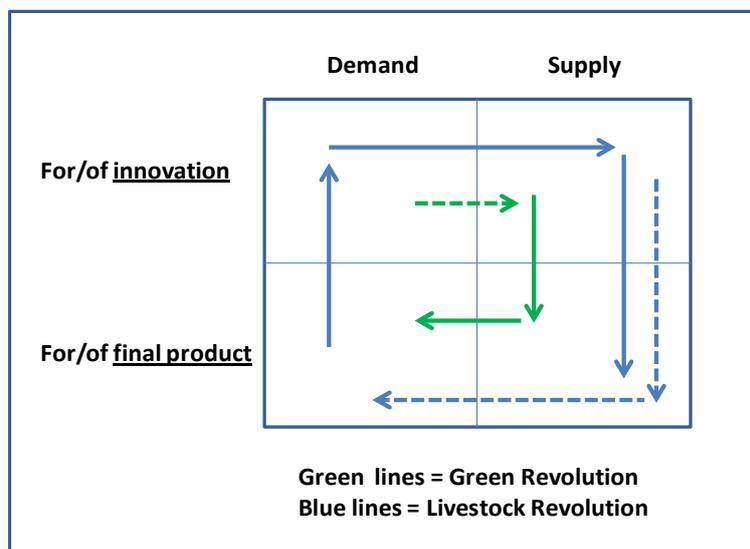
The argument is of course much more nuanced than this and, as presented by Delgado *et al.* (1999c), it is supported largely by statistical materials from the FAO's databases and projections made using IFPRI's global food model IMPACT. Although not mentioned explicitly, the concept of the nutritional transition (i.e. from diets high in carbohydrate to diets high in protein and fat) relates directly to the widely observed trend of increasing consumption of livestock products with rising incomes (Popkin 1998, 2001).

It is not our intention here either to review in detail or to systematically critique the original LR argument or the evidence and analyses used to support it. Rather, in the remainder of this section we will simply highlight some important elements of the original argument before turning in the next section to how the analysis has evolved in the intervening years.

**Box 2: Supply or demand: what 'drives' modern agricultural revolutions?**

Delgado *et al.* (1999) suggested that the Livestock Revolution is fundamentally different from the earlier Green Revolution because it is 'demand driven' while the Green Revolution was 'supply driven' (p.1, 59). The language of 'demand-driven production systems' looms large in the story of the Livestock Revolution, and is depicted as part-and-parcel of what Delgado *et al.* suggest is an important shift, with livestock production moving from a 'local multipurpose activity to a global food activity' (p.60).

This distinction between a supply (Green) and a demand (Livestock) driven agricultural revolution has often been repeated and is now inextricably linked to debates and discourse around the Livestock Revolution. However, to say that the Green Revolution was 'supply driven' is to suggest that an increased supply of wheat and rice, made possible in part by technological advances, preceded demand. Following this logic, the expanding supply then fuelled or drove increased demand for staple foods. This linkage is depicted by the solid green lines in the figure below, but does it hold up to scrutiny?



During the decades prior to the Green Revolution there was widespread and persistent hunger – and at times famine – in parts of Asia and elsewhere. In response, governments imported staple foods and there were large international movements of food aid. Poor, hungry people may not have had the ability to pay for the food they so badly needed, so from a standard economics perspective their hunger should not be seen as 'unmet demand'.

On the other hand, it is right to say that the spectre of mass starvation was a significant part of the motivation to invest in the development and promotion of what came to be known as Green Revolution technology. From this perspective there was certainly demand (i.e. a willingness and ability to pay) for new, productivity increasing technology, and this demand fuelled the process that eventually led to increased supply. This linkage is depicted by the dashed green line on the figure. This situation might be contrasted with one where agricultural researchers, off their own bats and without any prompting from policy makers, funders, farmers or industry, decided to develop (e.g.) new high yielding varieties, in which case any resulting change might rightly be described as 'supply driven'.

Now we turn to the Livestock Revolution. Here, in line with the theory of induced innovation (Hyami and Ruttan 1985), the implication of the label 'demand driven' is that demand precedes and fuels the supply response, where that response might depend on a combination of expanded capacity and technical / institutional innovation (this linkage is depicted by the solid blue lines in the figure). But again, is it that simple? In fact, as acknowledged by Delgado *et al.*, for dairy and poultry in

*Box 2 continued*

the developed world 'technological progress arguably preceded and precipitated changes in demand through lower prices' (p.59). Critically, much of this innovation – in genetics, equipment and feed formulations – has been transferred intact to the same developing country markets where the evidence for a Livestock Revolution is most compelling. This would indicate that for some of those products for which consumption is increasing most rapidly – like poultry meat – changes on the supply side may be much more important than indicated by the label 'demand-driven' (this linkage is depicted by the dashed blue lines in the figure).

The point is simple. When analysing the dynamics of major transformations in food and agriculture it is essential to ask: supply / demand of what (i.e. final product or innovation); and supply / demand by whom (i.e. policy makers, funder, consumers, industry players or producers)? Analysis along these lines may make it more difficult to claim uniqueness for the next food revolution, but it would provide a much better basis for comparative analysis.

Delgado *et al.*'s analysis is very much framed by the process of globalisation and the imperative within development circles at the time to – as made explicit in the title of DFID's contemporaneous white paper – 'make globalisation work for the poor' (DFID 2000). Indeed Delgado *et al.* went so far as to suggest that livestock production was changing 'from a Local Multipurpose Activity to a Global Food Activity' (p.60), with the implication that global trade in both feed and livestock food products will be increasingly important. However, while this global framing may explain the choice of nomenclature – i.e. '*the* livestock revolution' – it is obvious from the analysis that this revolution will be experienced differently by different people, at different times and in different places. In reality therefore it should be analysed as a number of different revolutions. As the authors point out, this differentiation will unfold along several dimensions, but perhaps the most important of these is the regional dimension.

Developments in China, including economic re-structuring, urbanisation and rising incomes loom large in the livestock revolution analysis. Indeed by the time the report was published it appeared as though the revolution was already well underway in China, with per capita meat and milk consumption doubling between 1983 and 1994 (report's Table 2; our Table 1), and the report projected a further doubling by 2020. The real implications of such a rapid rate of increase arise from the multiplication of increased per capita consumption by large populations, and of course in the case of China this results in eye-watering increases in aggregate consumption. For example, total meat consumption in China is projected to increase from 38 MT in 1993 to 85 MT in 2020; while the projected increase in milk consumption in India over this same period – from 52 to 160 MT – is equally impressive. In some other regions where projected growth in consumption is less and/or populations are smaller – including sub-Saharan Africa, most of South Asia and the Andean region – the drama of the livestock revolution, at least in terms of aggregate increases in consumption, was expected to be more muted.

**Table 1: Changes in consumption of livestock products 1993 - 2020**

Region	Per capital consumption (kg)				Total consumption (million metric tons)			
	1993		2020		1993		2020	
	Meat	Milk	Meat	Milk	Meat	Milk	Meat	Milk
China	33	7	60	12	38	7	85	17
Other East Asia	44	16	67	20	3	2	8	2
India	4	58	6	125	4	52	8	160
Other South Asia	7	58	10	82	2	17	5	41
Southeast Asia	15	11	24	16	7	5	16	11
Latin America	46	100	59	117	21	46	39	77
*WANA	20	62	24	80	6	23	15	51
Sub-Saharan Africa	9	23	11	30	5	14	12	31
Developing world	21	40	30	62	88	168	188	391
Developed world	76	192	83	189	97	245	115	263
United States	118	253	--	--	--	--	--	--
World	34	75	39	85	184	412	303	645

Source: Delgado *et al.* (1999c), Tables 2, 6 and 17

\*WANA: West Asia and North Africa

Another dimension of differentiation relates to the characteristics and feed requirements of different livestock types (ruminants and non-ruminants) and species. The form and availability of feed resources, including grain, fodder, and crop and industrial by-products, determines to a large degree the scope for expansion and intensification of production. Development of intensive (near-landless) systems for poultry, pig and milk production has gone much further than for beef or small ruminants. This has implications for the spatial distribution of production facilities needed to meet the projected increase in demand, and particularly the possibility of locating intensive livestock production near to urban areas. Again, from the production side 'the' Livestock Revolution may be more appropriately conceptualised as an aggregated outcome of many different developments, with some being distinctly more revolutionary than others.

A final dimension of differentiation relates to historical, cultural and religious factors that affect the acceptability of, and thus demand for, particular livestock products. In situations where vegetarianism is common, or where there are restrictions on the consumption of particular species (e.g. beef or pork), the dynamics of the revolution will be affected. Similarly, among populations with high levels of lactose intolerance, growth in demand for milk-based products will be lower than might otherwise be expected.

Drawing on de Haan *et al.* (1997), Delgado *et al.* put considerable emphasis on the environmental implications of the livestock revolution and highlight environmental issues associated with both 'low-intensity' (primarily land degradation) and 'high-intensity industrial' (pollution, greenhouse gas emissions and environmental damage associated with the production of feed crops) production systems. Perhaps anticipating the 2006 publication entitled *Livestock's Long Shadow* (Steinfeld *et al.* 2006), there is a palpable sense in the livestock revolution analysis of the vulnerability of the sector in relation to environmental issues, particularly if there is to be significant expansion in 'high-intensity industrial' systems (also see FAO 2009).

Similarly, Delgado *et al.* highlight potential public health issues associated with zoonotic disease, animal wastes and food contamination. While links between public health and livestock are well known, they become increasingly complex and compelling as production intensity, size and spatial clustering of production units increase. Changing patterns of drug use and new feed sources and feed preparation regimes pose new risks. The report argues that as supply chains lengthen, individual producers are less able to counter these risks: 'institutions are required to develop, monitor, and enforce quality standards across the

marketing chain. Unfortunately, government services are being curtailed in this area in many poor countries as the size of the overall public sector is being reduced' (p.51).

### ***The livestock revolution and the poor: threat and/or opportunity?***

'But whether the traditional livestock enterprises of the rural poor can coexist with increasing industrialisation of livestock production is an open question' (Delgado *et al.* 1999, p.37).

Delgado *et al.* address three aspects of how the LR may affect poor people in developing countries: through nutrition, food security and the incomes of livestock producers. In terms of nutrition they identify two pathways. The first is through the positive effect of consumption of 'relatively small additional amounts of meat and milk' on mild to moderate protein-energy malnutrition, while the second is through the negative effects of consumption of livestock products on chronic disease. Here they are careful to distinguish between poultry/fish and beef/pork, and also potential benefits from consumption of milk and eggs 'where consumption levels are low as they are in developing countries'. Their conclusion is that 'the Livestock Revolution appears to have many potential benefits for nutrition in developing countries' (p.38), although, and critically, it is acknowledged that there is the possibility that people who are most in need may not share in these nutritional benefits (p.39).

The discussion of food security focuses on the projected effects of the LR on cereal prices given the dependency of 'high-intensity industrial' systems on nutrient-rich, grain-based feed. By diverting cereals into livestock feed could the LR reduce the availability, or increase the price, of cereals to those who are most dependent on them through direct consumption? The LR analysis was undertaken in a context of a long-term trend of declining cereal prices, and the underlying assumption was that this trend would continue. Even the worst-case IMPACT projections indicated that any increase in cereal prices would be limited. Thus the LR would not be to blame for taking grain out of the mouths of the poor: 'The Livestock Revolution's effect on the food security of poor people, through cereal prices, is likely to be far less important than its effect on the income of the poor' (p.39).

Delgado *et al.*'s expectation that the LR can have beneficial effects on the incomes of the poor is built on: (1) the observation that poorer people (including women) earn a greater proportion of their income from livestock; (2) the proposition that poor people can earn income from animals raised on household waste and common property pastures; and (3) the conclusion that 'livestock production offers one of the few rapidly growing markets that poor, rural people can join even if they lack substantial amounts of land, training, and capital' (p.40). However they also note that subsidies to larger producers create false economies of scale, thus making small producers uncompetitive. In addition, small producers find it difficult to contract and to vertically integrate with processors. Nevertheless, it is suggested that these barriers can be overcome through collective action in the form of outgrower schemes and cooperatives, with rural organisation thus becoming a key area for researchers and policy makers. There are many links here to the discussion of the importance of better rural organisation if small-scale producers are to benefit from the 'supermarket revolution' (Reardon *et al.* 2003; Humphrey 2007).

### ***Assumptions about cereal prices***

It is now nearly 15 years since Delgado *et al.* coined the term Livestock Revolution and described the main features, dynamics, dangers and opportunities associated with such a fundamental, global shift in the production and consumption of livestock products. In the next section we explore how the arguments have developed (and been critiqued) in the

intervening years. Before this, however, we briefly examine how some of Delgado *et al.*'s key assumptions have stood the test of time. Horizon scanning and foresight exercises are always hazardous and projections are, by their nature, hostages to assumptions and unknown future developments. Nevertheless it is necessary to examine these as they may significantly affect the power of the argument and the relevance of the policy conclusions.

Perhaps the most important assumption in the LR analysis relates to future prices of cereals. Indeed, the link between increased livestock production and grain (in terms of supply, availability and price) is central to the analysis. As the report acknowledges, livestock production is open to critique as being an 'inefficient' use of limited grain supplies compared with direct human consumption. This critique can be compelling in the light of continued widespread undernutrition and food insecurity and the skewed distribution in the consumption of livestock products. Crucially, based on the IMPACT model, the study projected that 'real cereal prices, however, are not likely to rise very much by 2020, contrary to the fears of some reported in Chapter 1' (p.36). However, the downward trend in food prices that was so dominant in the 1990s has now been dramatically reversed: there have been two food price spikes since 2007 (and fears of a third spike as this paper is being written in August 2012), and some analysts are predicting that higher cereal prices are here to stay (Piesse and Thirtle 2009). One important factor that is now brought into all analyses of global grain markets is the effect of the demand for biofuels. It would appear that the IMPACT model took no account of the growth in the use of cereals and farmland for biofuels in its projections of cereal prices. More recent runs of the IMPACT model, incorporating the effects of climate change, provide a very different picture of future cereal price trends, with Nelson *et al.* (2010) projecting 'substantial increases between 2010 and 2050' (p.21).

The experience during the recent food price spikes calls into question some of the reports underlying assumptions about the existence and functioning of a 'the system of global markets':

'Another explanation of the high supply responsiveness of cereals is that in a system of global markets, where actors all over the world respond to changing price incentives, individual shocks are smoothed out over time through myriad adjustments throughout the system. In other words, world supply will be more price-responsive than individual country supply, a phenomenon well-captured in IMPACT.' (p.36)

The fragility of this image of a system of global markets was exposed by unilateral actions (i.e. to restrict exports) taken during the 2007-2008 food price spike in the name of 'national interest' (Headey and Fan 2008).

### **3. Subsequent development and critique of the argument**

Since the publication of 'Livestock to 2020: The Next Food Revolution' in 1999 the notion of a livestock revolution has spawned several conferences (Brown 2003; Owen *et al.* 2004), as well as a growing body of comment, analysis and critique. It is perhaps fair to say that, together with public attention given to the links between livestock and greenhouse-gas emissions and a series of high-profile outbreaks of livestock and livestock-related disease, Delgado *et al.* (1999c) helped breathe new life into international livestock policy debates (e.g. The World Bank 2005; FAO 2009; The World Bank 2009; Gerber *et al.* 2010; Steinfeld *et al.* 2010; Otte *et al.* 2012).

The published literature that engages directly with the LR falls into four strands. First, there are reports and papers that essentially summarise the analysis and arguments put forward in Delgado *et al.* (1999c), including Delgado *et al.* (1999a), Delgado *et al.* (1999b), Delgado *et al.* (2001), Delgado (2003), Delgado *et al.* (2003a) Delgado *et al.* (2003c) and Hall *et al.* (2004). As re-statements they add relatively little that is new.

The second strand includes work that either extends or critiques the original analysis, but usually at a fairly aggregate level. For example, Pica-Ciamarra (2007) and Pica-Ciamarra and Otte (2009; 2011) use a Popperian falsification approach to test at regional and country level some of the main assertions put forward by Delgado *et al.* Based on an analysis of data for 88 developing countries between 1980 and 2003, they conclude that there is little consistent evidence for an on-going LR, and perhaps most importantly, much of the increased consumption of livestock products is accounted for by population growth alone. This is in contrast to the LR story of increasing per capita consumption, although much of the drama in Delgado *et al.*'s story is associated with their future projections (i.e. to 2020), which would not be captured in the 1980 – 2003 analysis. Nevertheless, Pica-Ciamarra and Otte conclude that because the evidence for revolution is so heterogeneous, policy makers need to be careful about assuming that the opportunities (and threats) associated with a demand-driven LR are distributed evenly. They also suggest that there is still a role for supply-side approaches to livestock development, particularly where poverty is highest. One important observation they make is that while Delgado *et al.* stressed the fact that the LR was a nuanced story with important country and regional differences, this nuance has not carried over into policy discourse.

A number of studies explore the dynamics of change at country level. Upton's (2000) analysis of the implications of the LR for small-scale milk and poultry producers in Kenya highlights the 'complementary and inter-dependent input and product markets for large- and small-scale producers' (p.9). He concludes that because of this complementarity and inter-dependence, 'large-scale producers may serve a useful function in contributing to the growth of the smallholder sector' (p.9). On this basis, and in the light of government's withdrawal from input and marketing services that might be expected to help smaller-scale producers, Upton warns against policies that discriminate against larger-scale producers. We return to this warning later.

Delgado *et al.* (2003b; 2004) studied the determinants and implications of scaling-up different forms of livestock production in four fast-growing countries (India, Thailand, Philippines and Brazil). While there is much variation across the countries and livestock activities, the authors conclude that active policy intervention will be required if small-scale producers are to remain competitive. They put particular emphasis on the potential benefits of linking small-scale producers to the resources of the private sector through contract farming arrangements, although they are careful to note the diversity of such arrangements and the need to understand 'what contract farming does, can do, how, and what the costs and benefits of extending and modifying it are' (Delgado *et al.* 2004, p.124). Other policy areas that can help or hinder the competitiveness of small-scale livestock producers, and thus requiring careful consideration, are environmental regulation and enforcement, and trade policies and regulation (also see Scoones and Wolmer 2006). In further analysis of these same cases, Narrod *et al.* (2010) conclude that while there is evidence of 'smallholders having succeeded in maintaining operations in some countries and for some commodities', farmers producing broilers and layers in all four countries 'have been rapidly losing their market share' (p.281). More generally, where support services are weak, supply chains are complex or where effort to control animal disease are thorough, 'evidence of gains for producers, particularly smallholders, is minimal' (p.282). Khan and Bidabadi (2004) focus specifically on the India case.

In an important contribution, Dijkman (2009) suggests gradual intensification and scaling-up by small-scale livestock producers – a process referred to as the ‘livestock ladder’ and commonly portrayed as a viable ‘pathway out of poverty’ – is ‘largely mythological’ (p.2). For this reason ‘the distribution of the benefits of the *Livestock Revolution* has been rather patchy, to say the least’ (p.2). This author argues that the objective of pro-poor investment in innovation capacity within the livestock sector should not be to promote small-scale or punish large-scale production, but ‘to mediate sector transition’. Economic growth will be a key element of this process. The notion of scenario-specific, pro-poor livestock development through ‘sector transition’ is further developed in Dijkman and Steinfeld (Dijkman and Steinfeld 2010; cf. Otte *et al.* 2012).

Based on projections from the IMPACT model, Delgado *et al.* (1999c) were sanguine about future cereal prices and argued that the LR would not negatively affect poor consumers by making their staple foods more expensive. Following the food price spike in 2007, new projections from the IMPACT model told a very different story (Rosegrant and Thornton 2008; Nelson *et al.* 2010), with climate change and rising demand for meat and milk contributing to increased prices for maize and other coarse grains, diverting agricultural production away from food crops and reducing the availability of cereals for human consumption. Here the balance between the opportunities and the dangers associated with the LR seem to have shifted significantly, and these authors seem much less convinced of the potential benefits of the LR to poor livestock producers.

There has been some further development of the policy responses to the LR first identified by Delgado *et al.* (1999c). Both The World Bank (2005) and The World Bank (2009) for example use a public goods framework to consider policy options in relation to environmental pollution, the control of livestock disease, public health and social effects (in relation to consumption and production – ‘the equity problem’). The danger of small-scale producers being ‘crowded out’ looms large, and the lack of evidence as to when this happens and whether it can be prevented is highlighted. In both analyses there is some degree of equivocation as to how aggressively policy should seek to support small-scale production. On the one hand, all the standard recommendations are made about vertical integration, contract farming, associative forms and collective action, while on the other hand it is made clear that even these come with no guarantee of a continued and viable small-holder sector. Alternatively, with a nod to the experience in the horticulture sector in the developing world, there might be some basis to be optimistic about employment creation associated with growth in farm size (The World Bank 2005). It is worth noting the irony in the title of the 2005 document – *Managing the Livestock Revolution* – for it begs the question of whether revolutions can indeed be ‘managed’ by policy makers, and the power of policy of any sort to influence the trajectory or outcomes associated with such fundamental shifts and powerful dynamics (see Diao *et al.* (2012) for a broader discussion of the effects of agricultural and policy on poverty in Africa).

One of the key developments highlighted in the original LR analysis was the increasing importance in some developing countries of intensive, and at an extreme ‘landless’, livestock production systems, particularly for poultry, pigs and dairy. Proximity to urban markets, transport infrastructure and processing capacity is a defining characteristic of these systems. At one level, they are very much in the eye of the storm: their scale, intensity and commercial logic bring associated environmental, disease, public health and animal welfare issues into stark relief (FAO 2008; Scoones 2010). Whether, the disconnect between livestock production and a local land base poses a fundamental challenge to sustainability remains to be seen (Slingenberg *et al.* 2002; Naylor *et al.* 2005), but these systems seem set to remain a focus for investment, technology transfer, innovation and global integration. As they serve primarily urban markets, in some situations these systems are also likely to face competition from imported products.

The third, still very limited, strand of literature includes work that uses the notion of the LR as a backdrop against which to examine the dynamics of change around livestock in particular contexts. These studies start to get under the skin of the aggregate national and regional statistics that are at the heart of Delgado *et al.* For example, Lundström (2011) uses the case of the rapid expansion of pork and poultry production in southern Brazil to test Delgado *et al.*'s claim that smaller-scale producers can benefit from the LR. He argues that the vertical integration process requires smaller-scale producers to invest while reducing their profit potential, with the result that they are forced to carry more of the risk. Examples of 'resistance' to this process of marginalisation are cited, including diversification, the identification of alternative markets and illegal occupation of agricultural land. It is important to note that while Delgado *et al.* (1999c) suggest that small-scale producers may potentially benefit from the LR, Lundström interprets this to mean they will necessarily benefit. In the Brazil case, with an apparent absence of any policy to protect the interests of small scale-producers, the necessity of which is clearly highlighted by Delgado *et al.*, it is not surprising that what is effectively a straw man is quickly destroyed.

Finally there is a limited strand of literature that focuses solely on the negative elements of the LR and suggests that it is something that can and should be stopped (e.g. Garces 2002; Moncrief 2010). Literature in this strand starts with the assumed negative effects on smallholders, animal welfare and/or the environment, or with a more general concern about the evils of 'factory farming'. While there are certainly serious environmental and ethical issues around both livestock production and consumption, it is difficult to see how, for example, Moncrief's suggestion that Africa should show the way forward by rejecting increased meat consumption can be taken seriously as an alternative pathway (although the broader point concerning the sustainability and distributional effects of high levels of meat consumption is well taken).

### ***Livestock Revolution in Africa***

In Delgado *et al.*'s original 1999 analysis, Africa stands apart from those regions that characterise and define the LR. Between 1983 and 1993 per capita consumption of meat and milk doubled in China and increased in other parts of Asia and in Latin America, while in Africa it stagnated or declined. Similarly, livestock productivity in Africa is falling behind other regions, where productivity is converging with the levels seen in developing countries.

Nevertheless, some of the ingredients for revolution are clearly present. Population growth and urbanisation have been strong trends, although the narrative of continuing, rapid urbanisation has recently come under scrutiny (Potts 2012a; b). The continent has also experienced a decade of strong economic growth which has been maintained despite the global financial crisis and economic downturn (IMF 2012). While economic growth has been associated with a declining trend in the headcount poverty index, poverty remains widespread and the Millennium Development Goal (MDG) of reducing poverty by half is not expected to be met by 2015. Un- and under-employment remain major concerns, particularly among young people. It goes without saying that there is significant heterogeneity across African countries in economic performance, related in part to the ability to take advantage of inward investment in the petroleum and mining sectors.

Perhaps because dramatic changes in consumption and production have not yet materialised, there is still only a limited literature that directly addresses the LR in Africa (Upton 2000; Mwangi and Omore 2004; Scoones and Wolmer 2006; Ly *et al.* 2010; Maitima *et al.* 2010). Given the importance of small-scale producers to both agriculture and livestock in Africa, it is not surprising that Upton and others focus on policy responses that should specifically benefit small-scale producers. However, in the absence of accompanying

investments in infrastructure and strong institutions they may be the most difficult policies to implement effectively.

The institutional context, and its implications for service delivery and regulatory effectiveness, help explain a focus on the need for new approaches to disease control if small-scale producers in Africa are to benefit from the LR (Scoones and Wolmer 2006; Pica-Ciamarra 2007; Ahmadu 2008; Scoones *et al.* 2012). As illustrated by the recent experience with avian flu in Africa (Ducatez *et al.* 2006; Scoones 2010), the regional and global dynamics of livestock disease are likely to become increasingly important. Livestock producers in Africa may fuel and/or be negatively affected by these dynamics, and this international dimension may play an increasingly important role in orienting national livestock development policy.

In other ways too, developments in Africa demonstrate how changes in consumption and production are affected by policy beyond the narrow confines of agriculture and livestock. For example, the degree to which a country's economic policy embraces liberalisation and globalisation helps explain the difference between Ghana which imports approximately 64 per cent of its domestic supply of poultry meat and Nigeria which imports less than 1 per cent.<sup>1</sup> So while consumption of poultry meat is increasing significantly in both countries the magnitude and distribution of the benefits and effects are likely to be very different.

#### 4. Towards a pathways perspective on the Livestock Revolution in Africa

The STEPS Centre uses the notion of a 'pathway' to refer to the development trajectory of a human endeavour that results from the co-evolution of social, technological and environmental systems over time (Leach *et al.* 2010). The notion of co-evolution suggests that there can be evolution within the social, technological and/or environmental systems, and that for any particular system, this within-system evolution can both affect and be affected by change within the other systems (this is the co-evolutionary element). A pathway is a manifestation of a two-level, interactive, and thus co-evolutionary process.

When considering the social impacts (outcomes) associated with, and the sustainability of, such processes of co-evolution, three dimensions are of particular importance (STEPS Centre 2010). The **directionality** of change suggests that while it may be possible to identify alternative routes, these are constrained by amongst other things path-dependency and technological lock-in. The direction of change can be intensely contested, in part because it shapes the patterns of **distribution** of the benefits, costs and risks associated with innovation. The third critical dimension of processes of co-evolution relates to their impacts on **diversity** (of knowledges, actors, processes, resources and outcomes) and the links between diversity and system properties such as resilience, robustness and sustainability.

Our interest in the politics around and interaction among co-evolving pathways in the livestock sector is rooted in the proposition that an understanding of these can provide useful insights into sustainable development and a powerful platform for intervention in related policy processes.

In any given context there may be one or more (observable) pathways of co-evolution, just as there may be future co-evolutionary pathways that have not been envisaged or have yet to take shape. It is within this understanding of 'multiple pathways' that in STEPS, the

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<sup>1</sup> Calculated as Imports as a per cent of Domestic Supply, average for 2007-2009; source: FAOStat.

adjectives 'dominant' and 'alternative' are often used to modify the noun 'pathway'. Implicit in this binary framing of pathways are:

These multiple pathways are alternatives, meaning that a choice could be made between them (i.e. grid or off-grid provision of power in rural areas; carbon intensive or low carbon economic growth; industrial or agro-ecological agriculture);

The dominant / alternative relationship of different pathways is deeply political, reflecting power dynamics, path dependency etc;

The goals of social justice and sustainability are most often served by promotion of alternative or emergent (understood as non-dominant) pathways which most often do not have the support of, or serve the interests of, powerful actors or networks.

However, in addition to dominant and alternative, the relationships between different pathways of co-evolution can also be described with terms such as 'dependent', 'interdependent', 'complementary', 'synergistic' or 'competitive'. The example of poultry production in Africa helps to illustrate the importance of moving beyond the dominant / alternative framing. Here we use the term 'production system' to describe a combination of inputs, processes, institutions, relationships and outputs observed at a given moment in time, and pathway to refer to a production system's historical development path and as yet unknown future development trajectory.

It is common to classify poultry production systems under three broad headings: '(1) 'large-scale industrial' (e.g. farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for biosecurity); (2) 'intermediate commercial' (e.g. mid-sized commercial poultry operations covering a range of production and biosecurity practices and birds/products usually marketed commercially or in live bird markets); and (3) 'small-scale backyard' (e.g. small-scale production with minimal biosecurity and birds/products marketed and consumed locally) (adapted from FAO 2004).<sup>2</sup> Most livestock policy advocates and development actors promote one or the other of these production systems – variously mobilising efficiency, competitiveness, public health, quality of product, livelihood impacts, environmental impacts and/or sustainability arguments to support their case. In other words, the policy and development options are presented as a stark choice – either large-scale industrial or intermediate or small-scale backyard. There are clear indications, however, that the reality on the ground is altogether different, as there are significant flows, dependencies and complementarities between the these three broad systems (Sumberg 1998; Upton 2000). For example, intermediate commercial and small-scale backyard producers often depend on the large-scale integrated operations for their supplies of day-old-chicks and quality feed. Without the large-scale operations the very existence of the small and intermediate operators would be in question (as would the sustainability, livelihood and other benefits that are claimed to be associated with these systems). In other words, to see these as alternative or independent systems in the sense that a choice could or should be made between them is to miss the point altogether. Similarly, the pathways of these systems must also be seen as linked, interdependent and co-evolving (and this linking and co-evolution extend to the global scale).

While stylised constructions (such as the large-scale commercial, intermediate commercial and small-scale backyard systems referred to above) have their place in distinguishing between different systems and their associated co-evolutionary pathways, they can oversimplify complex and dynamic relationships and suggest isolation or separation where

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<sup>2</sup> The FAO (2004) schema is more elaborate, as it includes four categories: (1) industrial and integrated; (2) commercial with high bio-security; (3) commercial with low bio-security; and (4) village or backyard).

there is in fact significant interaction and mutual dependence. Specifically, the poultry example suggests that there may be multiple levels of co-evolution – i.e. within and between pathways – that must be taken account of in both analysis and policy debates. The LR, with all the social, technical and environmental change it appears to entail – and with all their associated opportunities and risks – would seem to be a particularly appropriate backdrop against which to explore the multiple and complex relationships between poultry production systems and their co-evolving development pathways.

The LR is also interesting from a pathways perspective because it illustrates the complex relationship between analysis, framing and narrative, and how these play into policy debates and processes. Delgado *et al.* (1999c) is clearly an analytical work, the conclusions of which, the authors argue, can and should be used to frame livestock research and development policy. Within their analysis Delgado *et al.* acknowledge clearly the presence and importance of regional and country differences in e.g. trends in consumption. Nevertheless, perhaps in an attempt to guarantee greater policy traction, these authors used and promoted the language of a single ('the') Livestock Revolution, and in so doing helped shift the focus from a nuanced analysis, to a 'policy debate [that] is largely dominated by the global figures' (Pica-Ciamarra 2007, p.13). It is with this shift that the LR moves toward the realm of development narrative (Roe 1991), and as such continues to exert a strong framing effect on livestock policy debates and 'pro-poor' livestock research and development initiatives. As indicated above the directionality of pathways of co-evolution is often hotly contested because of the role it plays in the distribution of benefits, costs and risks. Powerful narratives can play a critical role in this contestation, and thus an understanding of their origin, how they are used within policy processes to promote one pathway over other, and by whom, is absolutely essential (Leach *et al.* 2010).

Other narratives about the future of livestock consumption and production, and potential pathways toward these alternative futures, can be identified. While the LR analysis takes for granted an ever increasing role for international markets and global trade in feed and livestock food products, others promote pathways based on localised production supporting moderated levels of consumption (Fairlie 2012). It is only when a variety of different (if not necessarily alternative) pathways begin to be articulated that debates around directionality, distribution and diversity – and ultimately sustainability – begin to be meaningful.

## 5. Conclusion

As a foresight exercise Delgado *et al.* (1999c) did its job splendidly in that it identified an important set of trends, projected them into the future, and analysed their implications and potential policy responses. Like all such exercises that seek to see into the future, 15 years on, some parts of their work hold up better than others. Nevertheless, it is surely true that the analysis underpinning *Livestock to 2020* has helped frame research and policy debates. At this point it is difficult to tell what impact the LR analysis has actually had on policy, particularly as many of the policy responses, particularly those addressing the potential negative effects on small-scale producers – the so-called 'equity issue' – are not distinguishable from a now well-established agenda of investment in infrastructure and technology, strengthening of rural organisations, and closer integration with agribusiness through e.g. contract farming.

Over the last two decades the claim that livestock development offers a particularly effective channel for poverty reduction, particularly for women, has often been repeated. From this perspective the increased consumer demand that is at the heart of the LR could be seen as a unique opportunity – a 'beckoning future'. Delgado *et al.* are very explicit in indicating that

while the LR offers potential benefits for small-scale producers, these benefits are by no means assured. The changes in the production, processing, retail and consumption of livestock products that define the LR have massive structural, financial, social and environmental implications. Given the reach and power of the private sector actors involved, it is not at all clear how effectively policy (at any level) will be able to influence the related trends or processes, or modify the outcomes. Thus, from a poverty, rural livelihoods or environmental perspective, the future might look more 'on rushing' than beckoning.

In any case, a more explicit and contextualised understanding of the social, technical and environmental relationships and dynamics among livestock production systems, and between livestock and other sectors of the economy should help build a basis for more inclusive consideration of potential development pathways and their various poverty, social justice and sustainability implications.

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