History of sustainability: postponing the inevitable?

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Agriculture is perhaps the most significant of human activities, in that it is one of the most basic. Agricultural food production, and the labour which has thereby been freed for other tasks and specialisations, have allowed human civilisation to achieve the level of complexity that we have now (McKittrick, 2012). That increase in complexity, however, has been linked to a series of environmental and social issues and dilemmas which we have yet to effectively address. The methods which we have used to increase agricultural production have been drawn from the manufacturing sector of industry, and the current industrial agriculture system is the result. This system, based on the same premise of unlimited resources that marked the manufacturing processes of the beginning of the industrial revolution, is not well suited to a world in which resource limits are increasingly obvious and problematic (Davidson, 2000). The sustainability movement, and in particular the idea of sustainable agriculture, has been established to address the issues introduced by the current industrial agricultural methods. What is not clear is if that goal can be achieved, or if our best efforts to reform our agricultural system without impacting productivity are at best a means of postponing the inevitable.

In some ways, the term industrial agriculture is a misnomer. What we mean by it is intensive agriculture - highly managed, capital intensive agricultural production systems utilising mechanised planting, cultivating and harvesting, and involving the manufacture and use of synthetic fertilisers and pesticides (McKittrick, 2012). These intensive, highly mechanised systems have significantly decreased the human labour required to produce agricultural goods at the same time as they have increased the amount of food produced globally (McKittrick, 2012). However, at the same time as the techniques of industrial farming have resulted in an increase in food production and availability, they have also had negative environmental, health and animal welfare impacts. Fertiliser run-off pollutes waterways, generating overgrowths of algae which cause eutrophication and death of wildlife. As much as two thirds of fertiliser applied to crops is not absorbed, instead polluting local waterways (Adler, 2002). High stocking rates lead to difficulties in managing animal wastes, as the land area does not have the capacity to act as a sink for the amount of waste produced. Pollution resulting from dairy production is, according to the FAO, the cause of about 10% of the total anthropogenic eutrophication potential worldwide (Battini, Agostini, Boulamanti, Giuntoli, & Amaducci, 2014). Mechanisation and high stocking rates both lead to soil compaction (Woodhouse, 2010), with associated water infiltration problems leading to groundwater reserves failing to renew and decreasing soil fertility. Pesticides leach into the soil as well as polluting waterways, and even when they remain on the crop plats which they are intended to protect they cause high mortality rate sin beneficial insects and contribute to resistance in pest species. Use of artificial pesticides is linked to honeybee colony collapse disorder and die-off (Adler, 2002), making it a direct threat to our food production systems. Intensive or industrial production uses high levels of resources and creates large quantities of waste products concentrated in a relatively small area. As such its ecological impacts are huge.

It would be a mistake, however, to directly blame intensive agriculture for the problems we see resulting from it. Industrial agriculture is a symptom rather than a cause in itself, a response to the dilemma of increasing food production within a limited ecological system. Our use of industrial techniques may have been ill-advised, but it is understandable in its historical context. The availability of fossil fuels provided a replacement for human labour, made scarce by the demands of industrialisation and urbanisation (McKittrick, 2012). Those same factors produced a market and demand for agricultural products produced for sale rather than for use on the farm. In 1820 American farmers sold 30% of their harvests, while 40 years later that percentage had jumped to 60% (McKittrick, 2012). As a result of industrial agriculture, food represents a smaller percentage of the average person’s household budget than ever before. The real problem is that our current agricultural model values ever-increasing production without taking into account the long term consumption patterns, or environmental and health hazards associated with it (Gibbon & Jakobsson, 1999). The traditional economic system places value on the outputs of agricultural production, but does not incorporate all the costs associated with the intensive agricultural production systems that produce those outputs into the overall net value (Tietenberg & Lewis, 2012). Those costs, or ‘externalities’ in economic terms, include ecological and welfare impacts such as pollution, loss of species diversity, eutrophication of waterways, erosion and soil degradation, anthropogenic climate change, antibiotic resistant bacterial strains resulting from the overuse of antibiotics in livestock farming, and social inequalities resulting from capital-intensive production systems. These costs are not explicit in the prices we pay for the agricultural products of industrial farming systems, and are instead implicit in the effect that those farming systems have on the environment. Our current industrial agricultural model focuses only on increased production without factoring in a respect for the resulting social and environmental issues (Hodges, Foggin, Long, & Zhaxi, 2014). As such, it reflects the same issue as much of industrial society: we have discovered that our world and the resources it contains are finite, and our economic and agricultural systems are geared to the assumption of infinite resources and an infinite ecological capacity to handle our waste products.

Clearly, an alternative to intensive or industrial agriculture is needed. Since as early as the 1970s there have been people suggesting that more sustainable farming practices were needed, such as reducing the scale and size of farms to improve the efficiency of resource use (Woodhouse, 2010). Sustainable agriculture is the current proposal to address the problems of our current agricultural production systems. Sustainable agriculture utlises techniques to allow the optimal use of ecological and environmental resources without damaging the environment or ecological balance (Singh, Pandey, & Singh, 2011). Among the various elements of sustainable agriculture is a respect for individual situations and systems, responding to the environmental context rather than attempting to treat every farm as an identical production unit (Gibbon & Jakobsson, 1999). It includes changes to both agricultural management practices and techniques or technologies (Singh, Pandey, & Singh, 2011). Although there is no global agreement on the specifics of exactly what practices are and are not sustainable, the intention of sustainable agriculture is to address the ecological issues created by industrial agriculture while maintaining an equivalent level of agricultural output.

To many proponents of sustainability, technology and Western science is a dangerous component of the industrial system, a large part of what got us to where we are now. However, it is important to note that technology and scientific knowledge are equally important in the development of sustainable agriculture. While avoiding the reliance on mechanisation, chemical fertilisers, and pesticides which characterise industrial agriculture (Woodhouse, 2010), sustainable agriculture is still reliant on technologies and scientific discoveries. For example, specific, selected strains of beneficial bacteria and other microorganisms from all over the world have been used in food processing, treatment of agricultural and municipal wastes, and to improve crop health and productivity (Singh, Pandey, & Singh, 2011). Computer modeling systems allow farmers to plan their crop planting and rotation as well as livestock needs and products, and predict how to best manage the farm ecosystem for long term sustainability as well as optimal production. For example, biointensive farming, which has been widely shown to provide good production levels, relies heavily on pre-planning of planting to ensure a complete nutritional profile and effective nutrient and carbon cycling (Schramski, Rutz, Gattie, & Li, 2011). Perhaps most significantly, sustainable agriculture requires the use of modern management techniques in order to produce enough food to be seen as a viable alternative to the established industrial agriculture system. The food production methods of pre-industrial agriculture do not produce enough to satisfy the current human population (McKittrick, 2012). Without the research and the techniques and tools resulting from industrial development, sustainable agricultural production would not support the human population at current or predicted levels.

The 2014 United Nations Population and Statistics report predicted that the world population will reach 9.6 billion by 2050 (Hodges, Foggin, Long, & Zhaxi, 2014). Unless we are prepared to accept and ethically condone the idea of a significant portion of those people suffering malnutrition or starvation, our agricultural systems must provide enough food for all 9.6 billion people. However, that imperative must be tempered by the fact that the Earth's ecological support systems have a finite carrying capacity; at some point we will inevitably reach their limits. Unless we can limit ourselves to within the carrying capacity of the ecological systems that provide for our basic needs, then even if we manage to feed those 9.6 billion people by 2050 we are merely delaying the point at which some people will go without. Just as the technologies and consequences of industrial agriculture are not the cause but an effect of an underlying problem, technological expertise is not the answer to or a rescue from that problem. Even in the form of sustainable agricultural techniques, technology and science cannot save us from the detrimental environmental and social effects of industrial society (Davidson, 2000). Unless we address the root cause of those problems by reassessing our socio-economic model and change the policies and processes which support it, it is fair to say that we will only be postponing the inevitable.

That seemingly inevitable collapse is not, however, as inevitable as it seems. Although current human usage of many resources and production of pollutants have been to shown to have already passed sustainable levels, there is still the opportunity to avoid the resulting decline in food output and industrial production. The single most significant problem we face is the focus our society and our economic system have on ever-increasing growth, both in material consumption and in population (Gibbon, 1999). If we are to achieve a sustainable society, we must count not only the benefits of industrial-style production methods, but also their full costs – including the previously overlooked environmental costs, long and short term. We must modify all the policies and processes which perpetuate this focus on growth, including modifying our measures of success on both an individual and a national scale to be based on something other than production per capita (Gibbon, 1999). There are many challenges to setting up and maintaining a state of global equilibrium, but the challenges we will face if we continue on with our industrial processes and the ecological consequences of them are very likely to be significantly greater.

Without detracting from the importance of sustainability generally or of the sustainable agriculture movement, it is clear that more is needed than a solution to the obvious problems of industrial agriculture. No matter what actions we take to resolve pollution, loss of species diversity, soil degradation, or climate change, it is almost certain that for each issue we resolve another will take its place. The ecological consequences of current mainstream farming methods are a direct result of social, political and economic policies. If we wish to maintain the complexity of our civilisation, then we must act to make the deep structural changes necessary to reach an equilibrium with our environment.

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