

Animal welfare and efficient farming: is conflict inevitable?

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Abstract. The potential conflicts between animal welfare and efficient farming can often be resolved or at least reduced by showing the financial benefits that improving animal welfare can bring to both society and individual farmers. These benefits include increased profits through: (i) reduced mortality; (ii) improved health; (iii) improved product quality; (iv) improved disease resistance and reduced medication; (v) lower risk of zoonoses and foodborne diseases; (vi) farmer job satisfaction and contributions to Corporate Social Responsibility; and (vii) the ability to command higher prices from consumers. Current conflicts between animal welfare and production may be resolved by future developments in genetics, management practices and new technology. Financial benefits reinforce, rather than replace, ethical arguments for good animal welfare.

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Introduction

Livestock farming is under increasing pressure to become more efficient and more sustainably intensive (Garnett *et al.* 2013) to meet the twin demands of climate change mitigation and feeding the 9 (or even 11) billion people who are projected to be alive in 2050 (Godfray *et al.* 2010). At the same time, there is increasing public concern over standards of farm animal welfare, with a widespread view that the drive for efficiency (raising more animals in less space, with less food and less cost) has already been responsible for welfare problems, such as lameness and obesity in chickens (Mench 2002; Webster 2005) and that greater efficiency will inevitably lead to a further decline in animal welfare. As if this were not enough, farmers are criticised for using too much medication, especially antibiotics (World Health Organization 2014; O'Neill 2015), and so faced with the problem of how to rear more animals, more efficiently and with higher standards of food safety but without using antibiotics. In short, farmers are expected to become more efficient and competitive, while improving animal welfare and food safety and reducing medication and their environmental impact. Is all this possible or are there unavoidable conflicts between the different demands being made on the global agricultural industry? In particular, is the conflict between efficient, competitive farming and animal welfare inevitable?

A growing number of new laws and regulations covering the rearing, transport and slaughter of food animals, and even the costs of welfare assessment itself, impose costs on farmers who already have small financial margins (Sumner *et al.* 2011; Stott *et al.* 2012). Rising costs put pressures on farmers to become more efficient and therefore potentially put animal welfare on a collision course with profitability (Rauw *et al.* 1998; Ingemann *et al.* 2008). For example, an obvious way of reducing costs of

broiler chicken production is to increase the number of birds kept in a given space as there are higher financial returns as stocking density increases (Estevez 2007; Verspecht *et al.* 2011). Increased stocking density, however, is associated with negative welfare effects such as more birds becoming lame, greater bruising and scratching (Dawkins *et al.* 2004; Bessei 2006; Estevez 2007). Similarly in pigs, reducing stocking density is costly for farmers (Jensen *et al.* 2012), but recommended on welfare grounds by the European Food Standards Agency (European Food Standards Agency 2005). In dairy cows, genetic selection for increased milk production has led to an increasing incidence of health problems such as lameness and a decline in longevity and fertility (Oltenacu and Algers 2005). Even for free-range sheep, there can be conflicts between efficiency (for example by reducing the number of stockpersons or increasing flock size) and the reduction in welfare resulting from a shepherd having to monitor more sheep in larger or more spread out groups (Waterhouse 1996; Stott *et al.* 2012).

In this article, I argue that it is possible to reduce or even avoid these conflicts by stressing the benefits that humans, even the poorest of humans, can derive from giving priority to farm animal welfare. Some of these benefits of animal welfare are directly translatable into financial benefits for individual farmers (e.g. reducing mortality or improving product quality), some are benefits to society that could be given a financial value, even though this has not so far been widely applied (e.g. reducing the risks of outbreaks of human disease or use of antibiotics) and others are less easy to translate directly into financial terms but are nevertheless valued by society enough for at least some people to be willing to pay for them, such as the satisfaction of knowing that the food they consume has been raised in ways they consider to be ethically acceptable

(Broom 2010; Bennett and Thompson 2011). This emphasis on the many different ways in which human beings gain directly from good animal welfare is a deliberate departure from the more conventional view that has been dominant for the past 40 years (Christensen *et al.* 2012) that the benefits of animal welfare are 'intangible' and derive from ethics and moral values or what the public see as a 'good'. Although fully accepting the value and importance of animal welfare as a 'good' in its own right, I here emphasise the importance of also putting a financial value on animal welfare and stressing its utility to human health and wellbeing (Arlinghaus *et al.* 2009; Dawkins 2012). Once its financial benefits are appreciated animal welfare is far less likely to be seen in conflict with efficient farming (Guy *et al.* 2012), more likely to be given priority by the agricultural industry and more likely to appeal in countries where animal welfare is currently less valued.

This pragmatic view of animal welfare has strong parallels with the way that ecologists now make the case for conserving habitats or preventing the extinction of species by invoking the 'services' or 'natural capital' that the environment provides for human wellbeing and prosperity (Costanza *et al.* 1997; Balmford *et al.* 2002; Natural Capital Committee Report 2013). Services such as water retention, healthy soil, tourist attractions or pollinators for crops are given monetary value (Le Maitre *et al.* 2002; Klein *et al.* 2007; Markandya *et al.* 2008). As with animal welfare, these financial arguments based on services do not replace moral or aesthetic arguments, but they do add to and reinforce them. Indeed, Balmford (2012) argues that it is only when these financial benefits are great enough to outweigh the (financial) benefits of cutting down trees or draining wetlands that conservation projects have any hope of succeeding (Engel *et al.* 2008). By quantifying the value of conservation measures and putting a financial value on them, conservationists have made human self-interest the ally rather the enemy of conservation. Similarly, if animal welfare is to be seen as more than just a luxury for wealthy people who do not have to worry about having enough to eat, this will be achieved through stressing the tangible, financial benefits good animal welfare brings to all humans and by showing that it makes livestock farming more rather than less efficient (Bennett and Thompson 2011; Guy *et al.* 2012; Bruijnijis *et al.* 2013).

Putting actual numbers on the costs and benefits of welfare improvements is, however, complicated by the fact that the livestock industry itself is changing rapidly and is likely to continue to do so. Two major sources of change, both of which are capable of radically altering the relationship between welfare and efficiency, are genetics and the technological control of animal environments. For example, selective breeding of animals with high welfare traits such as disease resistance (Zwald *et al.* 2004), better walking ability (Chapinal *et al.* 2012) and reduced tendency to peck the feathers or bite the tails of other individuals (Sinisalo *et al.* 2012; Ellen *et al.* 2014; Grams *et al.* 2015) can directly improve both the efficiency and the welfare of a system (Grandin and Deesing 2014). Similarly, precision livestock farming that involves assessment and control of many aspects of animal lives (Rutter 2012; Berckmans 2014; Bocquier *et al.* 2014) may revolutionise the industry of the future and alter the balance between welfare and efficiency as we see it today. With both genetics and

management changes, however, it is obviously critically important to make sure that welfare is improved rather than decreased (Dawkins 2012; Fraser *et al.* 2013). This means using a clear definition of what animal welfare actually means in practice.

Defining good welfare

The simplest and most pragmatic definition of 'good welfare' is that the animal is healthy and has what it wants (Dawkins 2008). The emphasis on animal health stresses the importance of factors that contribute to health (food, water, and lack of injury) although the inclusion of what the animal itself wants stresses that good welfare goes beyond just physical health. This two-part definition has the advantage that it is readily understood by farmers, scientists, and members of the public and has the further advantage that it encompasses the 12 criteria of the Welfare Quality (2009) but delivers them in a simpler and more empirically based form. The 12 criteria of the WQ are 'absence of prolonged hunger, absence of prolonged thirst, comfort around resting, thermal comfort, ease of movement, absence of injuries, absence of disease, absence of pain induced by management procedures, expression of social behaviour, expression of other natural behaviour, good human-animal relations and positive emotional state'. This list is long and quite difficult to remember and can usefully be reduced to just two. 'Animal health' includes the WQ criteria of absence of disease, injury, pain and the provision of food, water and bedding necessary for health whereas 'what the animal wants' includes comfort, ability to move, interactions with others and positive emotional state. The 'two question' approach differs in that it makes fewer assumptions about what animals themselves actually want (Dawkins 2008) and has the further advantage that it can also provide guidelines for incorporating other criteria for welfare. For example, the ability to perform 'natural behaviour' (Bracke and Hopster 2006) or have positive interactions with humans (Hemsworth *et al.* 2009) can be included if it can be demonstrated that these improve animal health or provide something the animals want. However, if the animals show no evidence of wanting to perform a particular type of natural behaviour (such as fleeing from a predator) and/or the performance of it makes no contribution to its health, then on the two question approach, it would not be said to contribute to that animal's welfare, however 'natural'.

The simple straightforward two-question approach to welfare, with its primary emphasis on good health but ability to include other types of evidence makes it particularly easy to look at the various ways in which animal welfare currently contributes to efficient farming and how it might make an even greater contribution in the future.

Financial benefits of animal welfare

(i) Reduced mortality

The most obvious way in which welfare and efficiency go hand in hand is through reduction in mortality. By keeping animals in conditions in which they are more likely to stay alive will, generally speaking, result in improvements to their welfare as well as giving the farmer more animals to sell. For example,

neonatal mortality in newborn lambs, calves and piglets is caused by factors such as hypothermia from cold and wet conditions, maternal malnutrition and mis-mothering, injury and infection especially from diarrhoea and respiratory diseases and gives rise to large economic losses to farmers as well as serious welfare insults to the newborn (Mellor and Stafford 2004; Windeyer *et al.* 2014). Taking steps to reduce this mortality could therefore improve both welfare and production (Uetake 2013). Even in species such as chickens where the economic impact of the death of one individual animal are small, the very large numbers of animals involved (a broiler farm with 10 houses could be rearing over 3 million birds per year) make the reduction of mortality a key part of improved efficiency.

Outbreaks of tail-biting in pigs are relatively rare but, when they do occur, have devastating consequences for both welfare and production (Sinisalo *et al.* 2012; Harley *et al.* 2014). Similarly, feather pecking in laying hens can result in the death and injury of many birds with devastating economic consequences for producers (Rodenburg *et al.* 2013). Finding solutions to both of these persistent welfare issues would contribute directly to production efficiency by reducing mortality and would at the same time have the double welfare benefit of reducing injuries to animals and the need for mutilations such as tail docking and beak tipping.

Chickens that are so lame that they become unable to reach food or water and have to be culled are another example where poor welfare, in this case recognised by gait deficits, directly contributes to wastage and inefficiency in the production system.

(ii) Improved health

Even when animals do not die or have to be killed, disease and injury have major economic and welfare consequences. Improving their health thus provides another way in which efficiency and welfare are both working hand in hand. Healthy animals cost less in veterinary bills, medication and in the labour needed to treat them but there can be knock-on benefits as well. For example, treating sheep for footrot not only ameliorates lameness and the condition of their feet, but can also contribute to profit by improving the body condition of the sheep, their production of offspring and the subsequent growth of their lambs (Green *et al.* 2012). The high incidence of foot disorders in dairy cattle seriously impairs the welfare of these animals and also cause high economic losses to farmers (Bruijnijis *et al.* 2010). At least some of the known ways of remedying this – such as providing straw bedding – have been demonstrated to be cost effective as well as improving cow welfare (Bruijnijis *et al.* 2010).

(iii) Improved product quality

Welfare problems in poultry including hock burn and pododermatitis (Bessei 2006) also lead directly to loss of profit, as birds with skin burn marks on their legs fetch less as carcasses and those with ulcerated feet are worth less in the lucrative far-Eastern market for chicken 'paws'. Keeping chickens in environments that reduce the incidence of pododermatitis and hock burn therefore improve both welfare and product quality. Another important contributor to product

value is the effect that welfare is now recognised to have on that the price and quality of meat. Lambs reared in an environment with ramps, straw and bedding had higher daily weight gain, heavier carcasses and higher fattening scores than those reared without these enrichments (Aguayo-Ulloa *et al.* 2014).

Transporting animals from the farm where they have been reared to a new environment or to the slaughter plant is an acknowledged source of stress and reduced welfare (Grandin 1997; Broom 2000; Earley 2006). Animals such as pigs undergo a chain of novel events such as being loaded into a truck, mixed with unfamiliar individuals, the movement and stopping of the truck, unloading, further mixing, being moved within the slaughter plant, stunning and so on (Barton Gade 2004). Taking steps to improve the welfare of animals during transport and handling (Grandin 2012), for example by gentler handling and care over equipment design can lower lactate levels in the blood and improve meat quality (Aaslyng and Barton Gade 2001; Dokmanović *et al.* 2014). Animal welfare can pay dividends in product quality.

(iv) Improved resistance to disease and reduced medication

Under this heading are benefits that are more speculative but represent some of the promising areas of research for the future. There is a growing body of evidence that links 'stress' and the immune system (Segerstrom and Miller 2004; Klasing 2007; Hoerr 2010). Acute, time-limited stressors, such as being chased by a predator, give rise to a set of behavioural and physiological responses that prepare the animal to remove itself from the source of the stress. An increase in heart rate and in hormones such as adrenalin prepare it to run fast and an increased immune function prepares it for fighting infection in case it gets caught and wounded. Chronic long-term stress, however, can lead to suppression of immune responses and an increase in vulnerability to disease (e.g. Broom 1991). Furthermore, the ability of the immune system to mount a cellular response can itself be compromised by a variety of factors including disease, poor nutrition, weaning, reaching sexual maturity and injury (Johnston *et al.* 2012; Yun *et al.* 2014).

The problem for domestic animals living in environments they were not originally adapted to is that the stress responses that are adaptive in one environment (running away from a predator, choosing to move closer to other members of its species, moving to a more comfortable resting place) may not be possible in a farm environment and/or not have the desired outcome of removing the source of stress. Constantly faced with stressors that do not go away over long periods of time, stress responses become damaging, and may include reducing the animal's ability to mount an effective response to infection (Sapolsky 1994). For this reason, discovering what the animal is motivated to do by way of removing stressors and what it cannot achieve in the conditions in which it is being kept may be very important not only in defining what conditions optimise its welfare but also for discovering how to keep animals in conditions in which their own natural immunity to disease has the best chance to work.

With increasing world pressure to reduce antibiotics, this will put more and more emphasis on rearing healthy livestock

without medication, which could mean boosting animals' natural immunity by helping animals to lead stress = -free (high welfare) lives. Investigating the relationship between good welfare, good welfare, good health and disease resistance could become more important than ever (Ghareeb *et al.* 2013; Ingvarsten and Moyes 2013). Good welfare could even turn out to be one of the best one of the best vaccines available, with huge commercial and social benefits in setting higher standards.

It could become neither practical nor acceptable just to keep animals in a state of adequate health, boosted by doses of antibiotics if things start to go wrong. Rather, it could be important to aim higher to positive health and to make sure that the absence of even sub-clinical disease is given priority (Ringø *et al.* 2014). This is an area ripe for research and one where the right questions have not yet even been asked.

(v) Lower risk of zoonoses and animal-borne infections

Animal health directly affects human health (Tomley and Shirley 2009). The 'One Health Initiative' promotes the integration of animal, health and environmental health on the grounds that these need integrated, cross-disciplinary solutions (Monath *et al.* 2010). According to the World Health Organization ~75% of the new diseases that affect humans originate from animals and animal products (World Health Organization 2011). 'Bird flu' and 'swine flu' have potentially devastating effects on human health and major economic costs as well (Beach *et al.* 2007). Food-borne bacterial illnesses, such as *Campylobacter* and *Salmonella*, pose a major threat to human health (Platts-Mills and Kosek 2014) whereas parasitic zoonotic diseases such as toxoplasmosis and cysticercosis have major impacts on the lives and economies of countries around the world (Zinsstag *et al.* 2007; Torgerson and Macpherson 2011).

Improving the welfare of animals is increasingly being recognised as one of the key interventions in achieving control of zoonotic disease (Singer *et al.* 2007). For example, although *Campylobacter* and most *Salmonella* species have traditionally been thought of as zoonotic diseases, dangerous to human but giving no clinical signs of disease in chickens themselves, it is increasingly evident that chickens with high welfare are less likely to carry these bacteria and are therefore safer food for humans (Humphrey 2006). We are only just beginning to understand the connections between the welfare of non-human animals and how this can affect human health but it is already clear that the financial implications of getting these links right are considerable (Grace 2014). The impact that animal welfare has on human health provides some of the most solid financial and social arguments for giving it high priority in food production of the future (de Passillé and Rushen 2005).

(vi) Farmer and producer satisfaction

Most stockmen take great pride in looking after their animals and producing healthy, high welfare animals (Hemsworth *et al.* 2009; Hemsworth and Coleman 2011). Although such advantages are difficult to quantify in financial terms, they have clear financial implications, for example, in being able to retain good staff and job satisfaction, which in turn feed back to higher standards of animal welfare as staff. Farmers who are

happy with the way their stock are being kept will be likely to inspect them more often and spot problems at an early stage.

In addition to the direct effect on personnel on the farm, good animal welfare also pays dividends at company level. Corporate Social Responsibility is an increasingly important part of the policy of many companies, in which the company participates in initiatives that benefit society, such as those for product safety, nutritional improvement, care for employees, environmental protection and animal welfare. An ethical approach to these issues becomes part of the company's business model, through practices that enhance its reputation in the eyes of its customers and other stakeholders and can be an important part of its marketing strategy (Brammer and Pavelin 2006). For example, many customers feel comfortable eating in restaurants where they can be reassured the company has a concern for animal welfare and will continue to patronise them for the peace of mind it gives them. Once again, animal welfare pays, although the returns on investment may only be realised in the long-term and may be difficult to quantify on a short-term balance sheet.

(vii) Higher prices from customers

The most obvious way in which good animal welfare can pay might seem to be through the increased price that customers are willing to pay for food produced with high welfare (Broom 2010; Christensen *et al.* 2012; Vanhonacker 2014). But although there are some customers who say they are willing to do this, shoppers are notoriously fickle. When asked in telephone surveys about how much extra they would be prepared to pay for high welfare products such as cage-free eggs, consumers will often claim they would be prepared to pay between considerably more. However, when it comes to actually purchasing products in a supermarket, they frequently go for the cheapest, regardless of the welfare provenance of the product (Little and Berrens 2004) or are not prepared to pay enough to cover the extra costs (Martelli 2009). This reinforces the idea that relying on ethical arguments alone (in this case, persuading consumers that they should pay more for high welfare products) may not be enough to drive improvements in animal welfare on a sustainable basis. Ethics is a good starting point but it is the economic benefits of good welfare ((i)–(vi)) above that are needed for a robust business model.

When there is a conflict between welfare and efficiency

It would, of course, be quite wrong to conclude that all improvements to animal welfare necessarily result in commercial gain. There are many cases where animal welfare improvements actually cost money and are therefore unlikely to be implemented without pressure from new laws, regulations or incentive schemes. For example, reducing stocking density may be perceived by consumers as a prime way of improving welfare but is one of the most costly for producers to implement because it means raising fewer animals in the same space and immediately becoming less efficient.

The situation is further complicated by the fact that improving one aspect of welfare and production may actually reduce other aspects, making it difficult to know how the conflict should best be resolved. Pregnant sows are often confined in farrowing crates to stop them lying on and crushing their piglets

to death (Barnett and Hemsworth 2001). The welfare of the sow may be improved by not being confined in a crate and her increased welfare may have positive commercial consequences, but the welfare of the piglets (and commercial profit from them) is severely reduced by the risk of piglet deaths.

The aim of this article is not, however, to make the claim that improving animal welfare always results in improved profits or that resolving any conflicts between them is easy. On the contrary, the aim of this article is to argue that there *are* often conflicts between welfare and efficiency but given the real potential financial gains that good welfare can bring, this should act a goal of future research programs to see if such conflicts can be resolved or reduced by finding solutions that deliver both higher welfare and greater efficiency. In other words, conflicts exist but that does not mean that they are inevitable. In order to see whether such conflict resolution is possible in practice, there may need to be many changes of mind set and some revolutions in thinking about what goals are being aimed for and how they can be achieved. Here are some of the ways in which thinking about the welfare of food animals and efficient farming may need to change:

- (1) The true commercial value of good welfare needs to be documented at both producer level and societal level so that animal welfare is no longer seen as just an 'ethical extra' but as having commercial clout in its own right. As argued earlier, this does not remove ethical values from animal welfare but it does strengthen the case for good welfare in the eyes of people who would not otherwise be convinced by ethical arguments alone.
- (2) In identifying conflicts between welfare and efficient farming, it is important to remember that any such conflict refers to current genetics, current management practices and current technology. Often animals that have been bred for many generations for high productivity in one system (e.g. cages) are suddenly put into a completely different system (e.g. free-range) and the public are then surprised and dismayed to find that there are problems and that free-range does not necessarily come out best even on measures clearly related to welfare such as incidence of vent-pecking (Sherwin *et al.* 2010). This should not be a surprise. As in nature, animals selected in one environment may not be adapted for life in another but by expanding the range of breeding goals so that these include selection for robustness and high welfare traits in the new environment both welfare and efficiency it may be possible to improve both at the same time (Lawrence *et al.* 2004; Dawkins and Layton 2012). Management and building design can also be used to reduce welfare issues such as fear, slippages, injury, bone breakages (Grandin 2012; Stratmann *et al.* 2015). If these are initially expensive, the cost should be a spur to finding different, less expensive solutions, not an immovable obstacle to improving welfare. We now have a range of new technologies with as yet untapped potential for improving animal health, welfare and efficiency. Animals can be fed diets suited to their own individual needs, their environments can be adjusted for optimal comfort and they can even be given choice over when and where they perform different behaviours (Berckmans 2014; Bocquier *et al.* 2014). Their health and welfare can be continuously

monitored so that health and welfare problems are detected early and not allowed to become serious, a boost to both welfare and efficient management. For example, monitoring chicken flocks with cameras to reveal patterns of optical flow in the flock movements gives early indications of welfare issues such as hockburn, poor gaits and even infection before these are clinically apparent (Dawkins *et al.* 2012; Colles *et al.* 2016), giving the farmer the ability to intervene at an early stage and target treatment.

- (3) We should not make prior assumptions about what systems optimise animal welfare without good backing evidence about what is best (a) for their health and (b) what most gives them what they want. Many people assume that giving animals access to 'free-range' is inevitably going to result in the highest welfare but the 'outdoors' with its hazards of predation, low temperatures during cold wet winters and high temperatures during scorching summer heat may be less than ideal from the animals' point of view (Sherwin *et al.* 2010). High welfare indoor systems should not be discounted just because they are not 'free-range'. What actually does improve the welfare of animals and what well-meaning people perceive as improving it may be quite different.

Conclusion

The main conclusion of this article is that by realising that high standards of animal welfare can pay dividends in hard cash, we can make animal welfare the welcome partner rather than the opponent of efficient farming. There can be conflicts between welfare and production but, given the commercial value of high welfare standards, these conflicts may not be nearly as great as is sometimes supposed. Multi-goal research and new ways of thinking about how to optimise welfare in practice (including the use of new technology) are now needed to find solutions that deliver both higher standards of welfare to farm animals and the means of achieving greater efficiency to the farmers whose living depends on them. Animal welfare is both an ethical driver with economic consequences and an economic driver that carries moral weight. This makes it a powerful and necessary component of sustainable food production for the future.

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