

Animal welfare assurance programs in food production: a framework for assessing the options

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Abstract

Various animal welfare assurance programs are being used to encourage or require the adoption of animal welfare standards in food production, and to assure the public that such standards are followed. The programs involve five main formats. Non-mandatory codes/guidelines are relatively easy to institute and appear well-supported by the industry, but provide only minimal assurance to the public unless measures are taken to ensure compliance. Programs based on government regulations and inter-governmental agreements are more challenging to institute; they are likely to generate less industry acceptance, but may provide more public confidence if enforcement is adequate. Product differentiation programs, and retailer policies requiring products to meet certain standards, serve a range of functions; these may generate public confidence but only for products covered. The various programs include several types of requirements. Requirements that are designed to maintain animal health and functioning have a widely accepted scientific basis, are often easy to incorporate into existing production systems, and often provide economic benefits, but do not fully address public concerns over animal welfare in some cultures. Requirements that address pain, distress and other affective states, and those that accommodate certain natural behaviour, have a growing but less traditional scientific rationale and appear likely to generate public confidence; however, they sometimes require significant changes to existing practices. Requirements for more natural surroundings (outdoor, free-range) seem to generate public confidence, but appear most likely to increase costs, least likely to be supported by the existing industry, and may involve trade-offs with productivity and with other aspects of animal welfare. The various formats and requirements provide a range of policy options for addressing animal welfare concerns in different cultural, industry and market contexts.

Keywords: animal welfare standards, assurance programs, international agreements, regulations, welfare codes

Introduction

The end of the 20th century and beginning of the 21st have seen the emergence of many different animal welfare assurance programs in food production, developed by such diverse players as animal producers, corporate customers, civil organisations, governments and inter-governmental organisations. The result is a somewhat confusing array of programs intended to encourage or require the adoption of animal welfare standards, and to assure the public that such standards are in place. These developments have created a rapidly changing environment for the production, sale and international trade of animal products, with both potential opportunities and potential constraints for the animal-based industries.

This paper illustrates the different types of programs that have emerged by examining first the formats used in the programs, and second the elements or requirements included in them. The paper discusses the relative strengths and weaknesses of the different approaches, how they may

be suited to different cultural and market conditions, and the various ways that animal welfare assurance programs may influence other goals, including animal health, productivity and production costs.

Formats used in animal welfare assurance programs

The formats used to create animal welfare assurance programs can be grouped roughly into five types.

(1) Non-mandatory welfare codes and guidelines

One of the earliest responses to public concern over farm animal welfare was to create non-mandatory welfare codes and guidelines for animal production. These generally took the form of recommended practices that were believed, on the basis of practical experience and the available scientific research, to enhance animal welfare. Some codes and guidelines have been created by industries themselves, some through multi-party consultations involving the industry and other groups, and some with government taking the lead.

The United Kingdom (UK) provided some of the first examples. In 1968 the UK's Agriculture (Miscellaneous Provisions) Act commissioned the creation of welfare codes that are currently drafted by the UK government in consultation with relevant groups including the Farm Animal Welfare Council (FAWC), a committee that includes producers, scientists, veterinarians, animal advocates and others. The codes were designed as recommendations rather than mandatory requirements. However, the Act also made it an offence "to cause unnecessary pain or unnecessary distress" to livestock on agricultural land. Under the terms of the Act, failure to follow the provisions of a welfare code is not an offence, but such failure can be used to help establish guilt in cases where a person is charged with causing unnecessary pain or distress (Defra 2004).

Other jurisdictions also created welfare codes, but there was substantial variation in how they were developed and used. Beginning in the early 1980s, Canada developed codes by convening *ad hoc*, multi-party committees, which included industry representatives, regulators, veterinarians, scientists and the humane movement. The national government supported the development of the codes and published them as government documents, but the codes had no status under the law.

A different, two-stage process for developing guidelines was used by the United Egg Producers, an association of egg producing companies in the United States of America (US). As a first step, the United Egg Producers convened a committee consisting mainly of scientists who were commissioned to review the relevant scientific literature and recommend suitable animal welfare practices for the industry. Then a second committee, consisting of producers and industry representatives, developed actual guidelines on the basis of the scientists' recommendations together with other considerations including practicality and economics. For example, the scientific committee found that certain basic welfare indicators (eg survival rate, individual rate of lay) declined for caged hens at certain levels of crowding and they recommended space allowances on this basis (Bell *et al* 2004). For the actual guidelines, the industry committee adopted these recommendations but proposed, for practical and economic reasons, that they be phased in over a period of several years and that they be applied as house averages rather than maximum limits for each cage (UEP 2002).

When first developed, non-mandatory welfare codes and guidelines appeared to provide some assurance to the public that the welfare of farm animals was receiving attention. However, unless some form of monitoring was in place, public reaction sometimes shifted toward scepticism over the actual degree of compliance. Four types of response have been used to address such scepticism.

First is the development of an auditing or inspection program to monitor compliance. For example, the American Meat Institute (a US-based association of slaughter plants) developed an audit program associated with its recommended animal handling guidelines. The audit program involves scoring the performance of

slaughter plants on several quantifiable criteria including stunning efficacy, use of electric prods, slipping and falling by animals, and other measures. Grandin (2004) has made some of the audit results available — but not the identity of the plants — so that industry progress in implementing the guidelines can be followed.

Second, some industries are organised in a way that allows a central body to require that codes are followed. The production of the pharmaceutical Premarin by the Wyeth-Ayerst Company involves many farms that collect the urine of pregnant mares. Animal care is covered by a welfare code, and the company purchases only from farms that are inspected and found to comply (NAERIC 2004). A somewhat similar result is achieved in some provinces of Canada where the bodies that regulate the supply-management system for broiler chickens award production quota only to producers who have sufficient capacity to stock birds at the recommended density (Fraser & Leonard 1993).

A third response is to certify producers who conform to the provisions of welfare codes. For example, the United Egg Producers allows its members to identify eggs with a distinctive logo if the producer undertakes to follow the guidelines, files a monthly compliance report and undergoes an annual audit (Animal Care Certified 2004).

Finally, non-mandatory codes can be given a degree of legal standing similar to the system in the UK. For example, New Zealand's 1999 Animal Welfare Act specified that failure to comply with the country's non-mandatory codes could be used as evidence to support a prosecution for an animal welfare offence (Biosecurity New Zealand 1999).

(2) Regulations

Government regulations are a second format used by some jurisdictions to provide assurances about animal welfare. Many countries have a history of legal protection of animals, some of it dating back nearly 200 years. Typically, the earlier legislation was intended to protect animals from individual acts of cruelty or violence, to end specific blood sports, or to regulate the use of animals in specific areas such as scientific research. In the 20th century many countries created provisions that required humane animal transportation and humane handling of animals at slaughter plants, and a number of countries, especially in Europe, created new laws setting welfare standards for animals on farms.

In some cases regulations required an industry to follow what had previously been non-mandatory recommendations in codes and guidelines. For example, UK regulations made it mandatory (effective 1988) for hens in cages to have a minimum of 450 cm² of floor space and 10 cm of feed trough space per bird, a maximum floor slope of 8 degrees, plus other provisions largely corresponding to the existing non-mandatory code (HMSO 1987a).

In other cases, regulations were used to effect more radical changes in animal production methods. For example, Switzerland imposed restrictions that effectively banned the battery cage in 1981 (Swiss Society for the Protection of Animals 1994); Sweden passed legislation in 1988 to end

the use of cages for hens, stalls for pregnant sows, and zero-grazing systems for dairy cows (Animal Protection Ordinance 1988); and the UK banned the use of narrow veal calf crates effective in 1990, and stalls for pregnant sows effective in 1999 (HMSO 1987b, 1994).

(3) Inter-governmental agreements

The UK ban on the veal calf crate highlighted the need for trading partners to have similar animal welfare requirements. Before the ban there had been an appreciable export of veal calves from the UK to continental Europe where many calves were raised in crates, and nothing in the British ban on crates prevented this export of calves from continuing. Moreover, trade rules made it impossible for the UK to block imports of meat from those calves from re-entering the UK for sale. This led critics to claim that the ban on crates had not solved the problem but merely exported it. A somewhat analogous situation arose when Switzerland banned standard cages for laying hens in 1981. At the time, Switzerland imported approximately half its eggs from countries where cages were still in widespread use. The ban on standard cages was followed by a modest decline in domestic production (from 44 thousand tonnes in 1980 to 36 thousand in 2000) and a slight increase in imports (from 35 thousand tonnes in 1980 to 37 thousand in 2000), presumably some or most of this coming from countries where cages were in use (FAOSTAT 2004). As these cases illustrate, animal welfare regulations may lose some of their intended effect if trading partners do not agree to follow similar standards.

The European Union (EU) has been particularly active in developing international agreements for animal welfare. Most of these have been EU Council Directives which require member nations to create their own mandatory requirements that achieve the results specified in the Directive. Directives were initially created for laying hens (1988) and for pigs and calves (1991). The early provisions generally required incremental changes to existing production systems, for example by setting minimum space allowances. Later amendments, passed in 1997–2001, were much more demanding (Stevenson 2004). They required:

- a ban on narrow veal calf crates effective after 2006;
- a ban on standard battery cages for laying hens effective in 2012, although larger ‘enriched’ cages will still be permitted;
- a ban on stalls for pregnant sows effective in 2013, although stalls will still be permitted for the first four weeks of pregnancy.

These Directives will create substantial differences in production methods between the EU and some other countries. This has led to the fear that European products could be replaced by lower-cost products from less regulated jurisdictions, and to discussion of whether the EU could legally block imports of such products, for example by invoking provisions of Article XX [sic] of the General Agreement on Tariffs and Trade (Swinbank 2000).

The creation of internationally harmonised standards is one way to prevent unequal animal welfare requirements from becoming a point of contention in international trade. In

2002, noting the close link between animal welfare and animal health, the member nations of the World Organization for Animal Health (OIE) voted unanimously to develop international animal welfare standards. Initial priority was given to the slaughter of animals for human consumption, the killing of animals for disease control, and the transport of animals by land and by sea (Bayvel 2004). Draft guidelines in these areas were adopted in 2005 (OIE 2005). The OIE is recognised by the World Trade Organization as the reference body for standards regarding animal health, and its animal welfare standards could play an important role in international trade.

(4) Assurance programs of corporate customers and their associations

A number of restaurant and food retail companies — some of them active in many parts of the world — have developed programs to assure their customers of the animal welfare standards followed in producing the food that they sell. In some cases this has been done to create fairly basic standards in jurisdictions where no satisfactory program of welfare codes or regulations existed. In other cases, corporations developed programs of distinctive standards to provide products that would exceed (or be perceived to exceed) existing standards.

For example, the UK retailer Marks & Spencer established a system of animal welfare standards for their organisation and suppliers. The company announced in 1997 that it would sell only free-range eggs throughout its system, and in 2002 that it would use only free-range eggs in all its food products. The company also developed a network of suppliers that conform to the Marks & Spencer Select Farm scheme and work to specific standards for housing, feed, care and animal transport, in part on the basis of the Five Freedoms of the UK Farm Animal Welfare Council (FAWC undated). The program has had a substantial impact on suppliers. For example, the requirement for free-range eggs covers the production of some 250 million eggs per year laid by 700 thousand hens (Marks & Spencer 2004).

A quite different program is that of the US-based chain restaurant companies. McDonald’s Restaurants in the US developed a set of animal welfare standards that it requires its suppliers to meet, especially in the slaughter and egg industries. Unlike Marks & Spencer’s insistence on free-range eggs, the McDonald’s standards in the US are fairly basic. For example, they require 72 in² per laying hen in cages (similar to the EU requirement at the time of 450 cm²), and require that slaughter plants pass the American Meat Institute audit described above (McDonald’s Corporation 2004). (Note, however, that McDonald’s in the UK uses different standards, notably requiring free-range eggs for some of their products [McDonald’s Corporation 2005].) Initially McDonald’s in the US applied its standards to suppliers only in that country, but the program later spread to Canada, Latin America and elsewhere (McDonald’s Corporation 2004). In 2001–2002 other US-based chain restaurants, notably Burger King and Wendy’s, announced similar programs.

Burger King concentrated initially on its US suppliers, but the program has now been extended to its suppliers in Canada, Australia and New Zealand, and is continuing to expand (Burger King 2004).

With this growing trend toward corporate animal welfare standards, it was recognised in the US chain restaurant industry that a proliferation of individual company programs would become confusing for consumers and onerous for suppliers who might find themselves audited for similar or identical standards by several different companies. Hence, some of the US-based chain restaurants commissioned their national trade association, the National Council of Chain Restaurants (NCCR), to develop a harmonised program of standards and audits that the different member companies could adopt. At roughly the same time, some US-based supermarkets also commissioned their national association, the Food Marketing Institute (FMI), to create a program of animal welfare standards and audits on behalf of the grocery sales industry. Since 2001 the FMI and the NCCR have worked together to produce a single program. Rather than creating standards *de novo*, the FMI/NCCR encouraged producer associations (usually national associations in the US) to submit standards which were then reviewed by a scientific advisory committee. An independent company was then commissioned to create and oversee an audit process on the basis of the standards (Brown 2004).

The joint FMI/NCCR standards could potentially have a major influence on the welfare of farm animals. The NCCR represents 40 chain restaurant companies operating some 50 thousand restaurants directly and an additional 70 thousand under franchise and licensing agreements. The FMI has roughly 2300 member companies that are active in 60 countries and have had annual food sales totalling US\$340 billion in recent years (Brown 2004). If many of the member companies implement the standards, they could influence substantial amounts of food production.

(5) Product differentiation and labelling programs

A final approach to animal welfare assurance involves labelling programs designed to differentiate products that are produced according to defined methods or standards. McEachern and Tregear (2000) described nine such programs from the UK, divided into three groups: (1) producer-led programs (supported by government in the UK) that certify compliance mainly with established regulations and welfare codes; (2) retailer programs whereby retail companies use labels to assure their customers of specific welfare standards; and (3) programs of independent bodies including animal welfare organisations and organic certification agencies. The third group is generally the most exacting, and the resulting products may be sold at a premium price which helps to defray the costs of compliance and of program administration.

Of this third group of programs, one of the most influential is Freedom Food, a voluntary animal welfare assurance scheme set up in 1994 as an independent subsidiary of the Royal Society for the Prevention of Cruelty to Animals (RSPCA) in

the UK (RSPCA 2004). The program involves species-specific welfare standards based mainly on the FAWC Five Freedoms. To join the program, farms, transporters and abattoirs must pass an initial audit and are then re-assessed annually by inspectors. The program has reached a substantial size with over 2000 licence-holders (farms, transporters and abattoirs) and, for example, egg sales of 51 million per month. Similar programs, generally inspired by Freedom Food, exist in the US (HFAC 2003) and elsewhere.

A somewhat different approach, implemented in Austria since the early 1990s, is based on the Tiergerechtheitsindex or Animal Needs Index (ANI). The program emphasises mobility, social contact, condition of the floor, ambient conditions and human care. The ANI is a point system that awards points for different levels of performance on species-specific criteria. A good score in one aspect can compensate for a poorer score in another but certain minimum conditions must be met (Bartussek 2001).

Organic production programs generally include animal welfare standards. The International Federation of Organic Agriculture Movements (IFOAM), which was created to harmonise organic standards in different jurisdictions, has set out animal welfare requirements that should be included in organic standards. For example, IFOAM (2002) states that animals should be provided with sufficient space to stand naturally, lie down easily, turn around, and go through normal postural movements; that herd animals should not be housed in isolation; that cages may not be used for poultry, rabbits or pigs; and that there should be "sufficient fresh air, water, feed and natural daylight to satisfy the needs of the animals". Many countries now have certified organic animal products, in some cases with substantial market share (Vaarst *et al* 2004).

The optional labelling programs described above are generally designed to identify products produced according to standards that are deemed to be favourable for animal welfare. An alternative approach is mandatory labelling of all major production methods. In particular, since 2004 the EU requires that eggs be labelled to specify whether the hens were housed in cage, barn or free-range systems (Council of the European Union 2000). The requirement applies only to eggs produced in EU member countries, but Swinbank (2000) argues that under certain circumstances (eg where consumers expect that a particular standard will be followed and expect to be warned if this is not the case) mandatory labelling of non-conforming imported products may be warranted.

Strengths and weaknesses of the different formats

The effectiveness of a given program for ensuring (and assuring the public about) animal welfare standards will depend on several factors including the degree to which the program is supported by industry players such as producers, transporters, and slaughter plants; whether the program is easy to institute and maintain; whether it is enforceable; and how comprehensive it is in its application. It is difficult to generalise about the relative strengths and weaknesses of

Table 1 Five formats used in farm animal welfare assurance programs and a subjective score intended to reflect the relative degree to which they are likely to be: supported by the existing industry; easy to institute and maintain; enforceable; and comprehensive in application.

Degree to which the programs are likely to be:	Non-mandatory codes/guidelines	Regulations	Inter-governmental agreements	Corporate programs	Product differentiation programs
supported by the existing industry	++	-	--	+/-	+/-
easy to institute/maintain	+	-	--	++	-
enforceable	--	+	o	+	++
comprehensive in application	+	+	++	-	--

Note: items are rated high (++), somewhat high (+), somewhat low (-) or low (--), with 'o' denoting neutral, variable or unpredictable.

each of the five formats because there is substantial variation from case to case within each type. The following comparisons, summarised as subjective scores in Table 1, are intended to provide general guidance. The logic used to assign the scores is indicated below, but given that little actual research has been carried out the scores should be regarded as hypotheses to be re-assessed from case to case; for example, in a specific situation a regulatory program might be judged more acceptable to the existing industry than non-mandatory guidelines, contrary to the score given in the Table.

Because non-mandatory codes and guidelines do not impose change on the industry, they appear most likely to generate support from existing industry players, especially if (as is often the case) the industry is closely involved in their creation. Non-mandatory programs should be among the easiest to institute because they can be created without government involvement and do not require infrastructure for enforcement; however, the development and revision of codes may still be challenging if consensus within a diverse industry is required. Codes can be comprehensive in the sense of applying to all products within a given industry and jurisdiction; however, being non-mandatory by definition, codes are not enforceable and hence provide relatively little assurance to the public that the standards are being followed unless additional measures (described above) are taken to establish compliance. Codes and guidelines therefore tend to serve an educational role by informing producers and consumers about what standards are accepted in an industry, and a mild public assurance role by demonstrating some attention to animal welfare by the industry.

Logically, regulatory programs might appear ideal from the viewpoint of the animal industries because regulations should create a level playing field and provide a high level of public assurance while potentially funding the program from public revenues. Experience suggests, however, that new regulations are often resisted by producers, who evidently see them as unwanted government meddling in their industry. Furthermore, regulatory programs are likely to be rather onerous to institute and maintain because they normally require political commitment plus (if they are to be effective) infrastructure for enforcement. In theory a regulatory program is enforceable, but the structure of the industry may impose certain limitations; for example,

enforcement will be difficult in industries involving a very large number of widely dispersed players. Regulations can be comprehensive in that they can be applied at least nominally to entire industries within a jurisdiction, and hence should be relatively reassuring to the public as long as enforcement is perceived to be adequate.

Inter-governmental agreements are perhaps the least understood of the various options. We can reasonably expect the existing industries to be suspicious of such programs because the decisions are likely to be made at a political level remote from the industries themselves. Inter-governmental agreements should be the most difficult to create and maintain because they require agreement both within and between different governments plus some form of enforcement or inspection in different jurisdictions. Although the enforceability of international agreements remains to be seen, their chief advantage is their comprehensiveness because they can be applied to entire industries within multiple jurisdictions.

Corporate requirements — notably conditions of purchase required by restaurant and retail companies — may enjoy the support of those industry players who participate and therefore achieve access to desirable markets, but they may be resented or ignored by other industry players. Of all the options, corporate programs should be particularly easy to institute because they require a decision only by the corporation itself, although this would often be done in consultation with key suppliers. Corporate programs should be reasonably enforceable because a corporation can limit its purchases to those suppliers that demonstrate compliance, but the length of the market chain may impose certain limitations; for example, a restaurant company purchasing beef may impose requirements on the slaughter plants from which they buy meat, but only indirectly on feedlots supplying the slaughter plants and the breeders supplying the feedlots with young animals. Corporate programs are not comprehensive in their application in that they apply only to products sold in certain sales channels, but if the corporations are large the coverage may still be considerable. Corporate programs can provide significant assurance to the public in that consumers can choose to buy from corporations whose programs they trust, but

corporate programs do not provide a means of establishing standards throughout a jurisdiction.

Product differentiation programs obviously receive support from those industry players who participate, but may be resented by others because such programs create a perception that non-participating producers are using inferior standards. This may be an unwarranted perception; for example, Main *et al* (2003) found that the welfare of dairy cattle on farms registered in the Freedom Food program was better than on non-registered farms according to some criteria of animal welfare but worse according to others. Product differentiation programs tend to be difficult to institute because they require substantial infrastructure for inspection, certification and often traceability from farm to consumer. They should be highly enforceable because participating producers can be inspected regularly as a condition of participation; hence, the programs tend to provide a high level of assurance to the customer about the specific products in the program. The main drawback to such programs is that they, by definition, apply only selectively, usually to some products in some sales channels. Therefore they are a means of providing consumers with choices, but not a means of assuring the public that standards are in place throughout an industry or jurisdiction.

Requirements included in animal welfare assurance programs

In addition to the variety of formats used to implement animal welfare assurance programs, the requirements included in the programs are highly variable and sometimes contradictory. For example, the FMI/NCCR animal welfare program requires laying hens to have a certain space allowance in cages, whereas the 1999 EU directive requires that cages for hens be replaced by larger and more complex environments, and Marks & Spencer requires that hens be kept under free-range conditions. To make sense of the discrepancies it is useful to see the requirements as falling into four broad categories (modified from Fraser 2004).

Certain requirements (called 'Type 1' here for ease of communication) are designed primarily to maintain basic health and bodily functioning as reflected by a low incidence of disease and high rates of survival, reproduction and growth, on the assumption that declines in such variables are among the clearest indicators of impaired animal welfare. Examples of Type 1 requirements include:

- requirements for space allowances (eg 450 cm² per hen in cages, 0.65 m² per market-weight pig) that prevent crowding-related reductions in survival and productivity;
- requirements that ammonia concentration in the air be kept below levels that impair respiratory health and growth rate;
- a requirement that veal calves kept on low-iron diets to produce pale-coloured meat should receive enough dietary iron to prevent anaemia.

Type 1 requirements figured prominently in some of the earliest animal welfare standards, such as the early welfare codes, the initial UK regulations and EU Directives, and the on-farm standards of the US chain restaurants. For example, 450 cm² for laying hens was required by the EU until 2003

and a similar space allowance is cited in various welfare codes and the requirements of some restaurant companies.

A second group of requirements (Type 2) are focussed more specifically on the 'affective states' of animals. Many are designed to eliminate or reduce unpleasant states, such as pain, distress and hunger. Examples include:

- requirements that local anaesthetic be used for certain painful procedures, such as hot-iron disbudding of dairy calves;
- a ban on the practice of withdrawing all feed from laying hens for several days to cause them to moult ('forced moulting');
- requirements that electric prods (instruments that deliver electric shocks to animals to cause them to move) be limited to certain current levels and not be applied to sensitive parts of the body;
- requirements that a high percentage of animals at slaughter plants be stunned successfully on the first attempt.

Type 2 requirements have a long history in welfare standards at slaughter plants where reduction of pain and distress is commonly seen as an important goal. They are also used to some degree in on-farm standards, although pain management is often not required for some presumably painful procedures, such as the castration of young animals.

A third group of requirements (Type 3) attempt to provide animals with the opportunity to carry out elements of their natural behaviour, especially types of behaviour that animals are highly motivated to perform. Examples include:

- requirements for hens to be able to perch, dustbathe and enter a nest box for laying;
- requirements for sows on restricted diets to have access to roughage;
- requirements for calves and sows to be able to walk and turn normally.

Type 3 requirements are basic to many alternative-production systems, such as organic and free-range, and are becoming more common in government regulations and EU Directives, notably those that ban keeping hens in standard cages and keeping calves and pregnant sows in stalls long-term.

A final group of requirements (Type 4) stipulate that animals should have some level of access to natural components in their environment, such as natural light, fresh air and the outdoors. Examples include:

- requirements for hens to have daily access to the outdoors in free-range systems;
- requirements for cows to be kept on pasture in the summer months;
- requirements for barns to have windows that admit natural daylight.

Type 4 requirements are widely used in alternative-production systems, such as organic and free-range, and occasionally occur in regulatory requirements, such as Sweden's ban on year-round confinement of dairy cows.

There is, of course, substantial overlap between the different types of requirements. For example, allowing animals to

Table 2 Four types of requirements commonly used in farm animal welfare assurance programs and a subjective score intended to reflect the relative degree to which they are: supported by a strong scientific rationale; related to other aspects of animal health, welfare and productivity; easy to incorporate into existing production systems; favourable for production cost; supported by the existing industry; and likely to generate public confidence that animal welfare is being addressed.

Degree to which the requirements are generally:	Type 1 (basic health and functioning)	Type 2 (affective states)	Type 3 (natural behaviour)	Type 4 (natural environment)
supported by strong scientific rationale	++	+	+	+/o
related to other aspects of health, welfare and productivity	+/o	+/o	+/o/-	+/o/-
easy to incorporate into existing production systems	+	+/o/-	-	--
favourable for production cost	+/o	+/o/-	-	-
supported by existing industry	+	+/o/-	-	--
likely to generate public confidence	--	+	+	++

Note: items are rated high (++), somewhat high (+), somewhat low (-) or low (--), with 'o' denoting neutral, variable or unpredictable.

perform behaviour that they are highly motivated to perform (Type 3) may well prevent negative affective states, such as frustration and distress (Type 2); and keeping animals outdoors (Type 4) generally prevents respiratory diseases caused by ammonia in the air (Type 1). Nonetheless, we can often identify a primary motivation for a given requirement. For example, in banning the continuous housing of pregnant sows in stalls, the Council of the European Union (2001) cited the animals' preference for social interaction in a complex environment, rather than citing the improved muscular and cardiovascular functioning that might also result from less restrictive housing.

Strengths and weaknesses of the different requirements

In deciding what requirements to include in animal welfare assurance programs it is useful to consider a number of factors (summarised in Table 2) including: whether the requirements are supported by a strong scientific rationale; how well the requirements are related to other aspects of animal health, welfare and productivity; whether the requirements are easy to incorporate into existing production systems; their effect on the cost of production; whether they are likely to be supported by the existing industry; and whether they are likely to generate public confidence that the welfare of the animals is being addressed. Here again, it is difficult to generalise because requirements differ considerably within a given type. Subjective scores have been assigned in Table 2 on the basis of the logic given below, but again the scores should be regarded as hypotheses and starting points to be refined for specific cases.

Type 1 requirements: basic health and bodily functioning

The scientific rationale for Type 1 requirements generally consists of studies demonstrating that basic aspects of animal health and functioning are impaired if

the requirements are not met. For example, the requirement for laying hens to have 450 cm² of floor space is based on extensive research showing increased mortality rate and decreased rate of lay if less space is provided (Bell *et al* 2004). The requirement (for many species) that ammonia concentration in the air does not exceed 25 ppm is based on research showing a higher incidence of respiratory illness or reduced productivity at higher levels (eg Miles *et al* 2004). In these and many examples, the science involves traditional and well-accepted measures of animal health and productivity. Hence, Type 1 requirements tend to have a straightforward scientific rationale.

By definition, Type 1 requirements should closely reflect the health and productivity of the animals but these requirements may not be strongly related to some other animal welfare criteria. For example, the requirement that pigs have 0.65 m² of floor space, while supporting a high level of productivity, provides the animals with little opportunity to avoid fear or pain inflicted by aggressive pen-mates (a Type 2 issue) or to perform natural behaviour (Type 3).

Type 1 requirements should in general be easy to incorporate into existing systems because they often involve modest refinements, such as increased space allowances or easy access to food and water. The changes are likely to be relatively inexpensive, especially if (as is often the case) they involve only housing improvements, as housing is generally only a small fraction of the total production cost. Moreover, Type 1 requirements often reduce losses attributable to disease, injury and stress; hence the net effect on production cost will often be favourable. In some cases, however, even where animal welfare requirements improve health and production, there may still be some economic penalty. For example, crowding hens to the point of reducing their individual survival and rate of lay will actually increase profit under certain market conditions (Adams & Craig 1985). For

the various reasons above — positive links to productivity, ease of implementation, and often favourable economics — Type 1 requirements can be expected to enjoy the greatest support from the existing industry.

An important drawback is that Type 1 requirements are likely to be seen by the public in some cultures as minimal standards implemented mainly to improve production; hence, they provide probably the lowest level of public confidence that animal welfare is being addressed.

Type 2 requirements: pain, distress and other affective states

The scientific rationale for Type 2 requirements generally consists of studies using behavioural and physiological indicators of pain, distress, hunger and other negative states. Research has shown, for example, that hot-iron disbudding of dairy calves leads to many behavioural and physiological signs believed to denote pain, and that these can be reduced or eliminated by certain pain-management techniques (Weary & Fraser 2004). Research also suggests that forced moulting of laying hens by withdrawing feed causes hunger and frustration in the birds (Bell *et al* 2004). Such research is expanding rapidly, but it tends to be recent and many of the measures — such as behavioural indicators of pain — are less familiar and more controversial than traditional measures of health and production. Moreover, in cases where the science is poorly developed, some requirements are based on seemingly common-sense assumptions about what is likely to cause pain and distress in animals. For example, it is assumed that incorrect mechanical stunning is likely to cause pain if it fails to render the animal unconscious. On balance, therefore, the scientific basis for Type 2 requirements, although substantial, is often more controversial than for Type 1.

For Type 2 requirements, most of which focus on unpleasant affective states, the links with other aspects of animal health, welfare and productivity should be either positive or neutral. Handling animals in ways that produce less fear and distress tends to improve growth and reproduction (Hemsworth & Coleman 1998), and reducing pre-slaughter stress often improves meat quality (Gregory & Grandin 1998). However, some measures, such as the control of short-term pain, may not have lasting effects on animal health and productivity.

Some Type 2 requirements (eg eliminating the inappropriate use of electric prods) should be relatively easy to incorporate into existing systems and may have positive effects on the cost of production by eliminating negative consequences of stress. Other requirements (eg use of local anaesthetics) will be more onerous to institute and will involve costs that may not be recovered through any compensating increase in production. Industry support will likely be variable, depending on the ease and cost of instituting a given requirement. However, Type 2 requirements are likely to generate public confidence because of the strong public tendency to view the elimination of pain and suffering as important for animal welfare.

Type 3 requirements: accommodating natural behaviour

The scientific rationale for Type 3 requirements generally consists of studies showing that animals are motivated to carry out certain types of natural behaviour, and in some cases that behavioural or physiological indicators of distress are present if such behaviour is prevented. For example, hens show a very strong motivation to enter a nest box in the hour before they lay an egg, and they show behavioural signs of frustration if they are prevented from doing so (Duncan 1998). Sows on restricted diets appear highly motivated to forage for food and in barren environments they often develop repetitive behaviour that can be reduced by providing roughage, such as straw, which serves as a substrate for foraging (Fraser 1975). In cases where research is absent, some requirements have been based on seemingly common-sense assumptions, for example that calves confined permanently in narrow stalls will be motivated to move more freely. Although the science is evolving rapidly, much of the research is recent and uses methods (eg testing of motivation strength) that are relatively novel in animal and veterinary science, and hence perhaps more controversial than the science used to justify Type 1 requirements.

For Type 3 requirements, links with other aspects of animal health, welfare and production may be positive, neutral or negative. Allowing hens to perch tends to improve leg bone strength (Hughes & Appleby 1989); allowing sows to walk may reduce problems of lameness (Scientific Veterinary Committee 1997). However, there may also be trade-offs. For example, individual stalls for pregnant sows prevent the animals from fighting and from competing over food; allowing sows to socialise may therefore incur certain welfare costs unless aggression and competition are carefully managed (Scientific Veterinary Committee 1997).

Many existing systems (cages, stalls) achieve economies by failing to accommodate natural behaviour. Hence, Type 3 requirements are likely to involve substantial adjustments to existing systems and in some cases increased costs. For example, to accommodate perching and dust-bathing by laying hens will require a major redesign of cages, and although the use of perches may lead to fewer broken legs when the birds are shipped for slaughter, any resulting economic gain is not likely to cover the cost of converting. Nonetheless, where Type 3 requirements can be met by changes to housing alone (without ramifications for feed, labour and other costs) any net increase should be relatively small for the reasons outlined above, apart from the short-term cost of conversion. For example, the Scientific Veterinary Committee (1997) reported that the income from a pig farm is only slightly influenced by the cost of operating a group housing system with electronic sow feeding instead of stalls for pregnant sows. Type 3 requirements are not likely to be welcomed by the existing industry, especially if they require substantial changes and increased costs of production. However, Type 3 requirements are likely to provide significant public confidence especially where there are important public concerns about close confinement and the prevention of natural behaviour.

Type 4 requirements: natural components in the environment

The scientific rationale for Type 4 requirements, which focus on natural components in the environment, generally consists of research showing animal health and welfare problems among animals confined to (usually restrictive) indoor environments. Such problems include respiratory illness, lameness, stereotypic behaviour, aggression, and injurious behaviour such as tail-biting and feather-pecking (Benson & Rollin 2003). Keeping animals in more 'natural' and less restrictive environments is proposed as a way of avoiding such problems. The research often involves relatively traditional measures of animal health and abnormal behaviour, but the work has included relatively little critical evaluation of other health and welfare trade-offs that may arise when Type 4 requirements are followed. Hence, although research can be cited in support of Type 4 requirements, critics can argue that welfare may not be uniformly or unequivocally improved by such requirements.

Type 4 requirements are likely to involve both advantages and disadvantages in terms of animal health, productivity and other aspects of animal welfare. On the one hand, some Type 4 requirements can be expected to have health advantages; for example, cows in pasture-based systems typically have a lower incidence of mastitis than those in confinement systems (Washburn *et al* 2002). However, keeping animals outdoors can expose them to harsh weather, predators and pathogens carried by the air, soil or wildlife vectors. Therefore some health, welfare and productivity benefits of controlled, indoor environments may be sacrificed in systems that comply with Type 4 requirements (Cox & Bilkei 2004).

Because many animals are now housed entirely in human-made environments, Type 4 requirements are likely to be difficult or impossible to incorporate into existing systems, and hence will require a change to different systems. Where this involves outdoor or semi-outdoor production, there may be substantial increases in cost for labour and land and, in some cases, greater losses through increased mortality rate unless management standards are kept high. Hence, Type 4 requirements tend to be implemented in product differentiation programs (free-range, organic) where products sell at premium prices. On the other hand, where land is available, low-input outdoor systems can be cost-effective because of major savings in housing (Cox & Bilkei 2004).

For various of the above reasons — some trade-offs with health and productivity, incompatibility with existing systems, and sometimes higher cost — many existing producers can be expected to resist Type 4 requirements. However, these requirements are likely to generate strong public confidence where consumers equate animal welfare with freedom and natural environments (te Velde *et al* 2002).

Factors influencing the choice of options

To date, animal welfare assurance programs have been established mainly in the industrialised countries. However, especially as animal welfare becomes a focus for inter-governmental agreements and international corporations,

we are likely to see such programs being created more widely. Hence it is useful to consider how well the different options may fit in different cultural contexts.

Different people and different cultures attach different levels of importance to animals and their quality of life (Preece 1999). Where the priority accorded to animals is relatively low, it may be impossible to achieve reforms other than prudential ones (especially Type 1 requirements) whereby attention to animal welfare creates clear benefits for humans. For example, minimum space allowances might be accepted on grounds that these improve productivity, or a ban on shipping non-ambulatory animals might be achieved on the grounds that such animals are more likely to spread dangerous pathogens. Animal welfare standards may also be acceptable in such cultural contexts if they provide producers with access to certain markets. However, cultures that attach a higher level of importance to animals and their welfare may welcome measures intended to prevent animal suffering (Type 2), or to allow natural behaviour (Type 3), or to provide animals with more natural surroundings (Type 4).

In addition to cultural differences in the level of importance that people accord to animals, there are also differences in the emphasis that people place on different aspects of animal welfare (Fraser & Weary 2004). In Western culture, many animal producers and veterinarians have traditionally put particular emphasis on basic health and growth as key elements of animal welfare. For example, a veterinarian (Taylor 1972) argued that animal welfare is generally better in intensive production systems than in outdoor systems because the animal is "freer from disease and attack by its mates; it receives much better attention from the attendants, is sure of shelter and bedding and a reasonable amount of good food and water". In contrast, many humanitarians put particular emphasis on affective states, especially the prevention of animal suffering (Carpenter 1980). As a third position, philosopher Bernard Rollin (1993) has described a 'new social ethic' which, in addition to requiring the prevention of suffering, also requires that "animals' basic natures will not be submerged in the course of their being used by humans" (Rollin 1993 p 11). These different areas of emphasis relate in obvious ways to the different types of requirements noted above. Hence, although the different types of requirements can all be regarded as 'science-based', the relative importance attached to each is at least partly a matter of value judgements about what is more or less important for the quality of life of animals. Therefore certain requirements may fit better in one culture or another, depending on the relative importance that people attach to the different aspects of animal welfare.

Moreover, a given culture's level of concern over animal welfare, and hence the type of animal welfare assurance program that is most appropriate, can change markedly with time. The UK moved from non-mandatory codes to regulations to international agreements during just a few decades. The EU Council Directives circa 1990 tended to emphasise fairly basic Type 1 requirements; ten years later Type 3 requirements, including bans on barren cages and narrow stalls, figured prominently.

Another important cultural factor is a society's degree of commitment to market economics. Societies that are highly committed to market economics are likely to treat animal welfare as a consumer preference issue to be solved by providing market choices between high-welfare products and other products; hence, product differentiation programs and corporate programs would presumably be the most acceptable. However, other societies appear to view animal welfare as a public-good issue beyond the scope of market solutions; in those cases, favoured solutions are likely to be based on regulations and inter-governmental agreements. A related cultural variable is the degree to which government regulation is accepted in agriculture and the marketplace. For example, the northern European countries have shown a willingness to regulate on-farm production methods that would be culturally less acceptable in some jurisdictions.

It is often claimed that only in prosperous societies will people be concerned about the welfare of other species. In reality those cultures with the strongest traditions of concern for animals are by no means the most prosperous; for example, India has enacted forms of legal protection for animals that are absent in some highly industrialised countries (Panjwani 2004). Nonetheless, the prosperity of a country may well limit the level of investment available to implement animal welfare standards. For example Arhin (2004) noted how humane animal control measures in Ghana were impeded by a lack of basic facilities, medicines and staff. However, even in prosperous countries a regulatory approach may fail to provide an effective animal welfare assurance program if insufficient resources are devoted to its implementation. For example, some US-based chain restaurants implemented their own animal welfare assurance programs partly because they perceived the enforcement of existing humane slaughter regulations to be insufficient; and enforcement of animal welfare law in parts of Canada is left almost entirely to humane organisations that have to rely on charitable donations to fund their law enforcement activities.

In some jurisdictions, the scope for government regulation is limited by constitutional law. In Canada, Australia and the US most responsibility for agriculture falls at the state or provincial level, and the national government appears to have little jurisdiction to regulate on-farm animal production methods. National regulations may still apply in specific situations; in Canada, for example, the national government regulates slaughter plants that export products across provincial or national borders. In most cases, however, animal welfare regulations would need to be created state-by-state or province-by-province (Wolfson & Sullivan 2004), and a consistent national program might be nearly impossible to achieve through a regulatory approach. In such cases, corporate and other non-regulatory options have obvious appeal.

Finally, involvement in international trade in animal products may influence what kind of animal welfare assurance program suits the needs of a jurisdiction. With the current move toward international standards, countries

wishing to export animal products to certain other countries may require a 'competent authority' (eg a chief veterinary officer) to certify what standards are in place. This may be more easily achieved by a regulatory program than by non-mandatory guidelines or programs that apply only to some products or sales channels.

Animal welfare implications

Animal welfare assurance programs include different formats and different types of requirements, each with certain strengths and weaknesses. These provide opportunities to identify options suited to a given jurisdiction, industry or organisation depending on its particular needs, cultural factors, market and economic situation, and level of engagement with animal welfare as an area of social concern.

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