Quality function deployment in the organic animal food sector: application to poultry meat

Simona Naspetti,1 Francesco Alberti,2 Francesco Solfanelli2

1Dipartimento di Scienze e Ingegneria della Materia, Università Politecnica delle Marche, Ancona, Italy
2Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università Politecnica delle Marche, Ancona, Italy

Abstract

This study presents the results of an Italian investigation into the development of food quality for poultry meat in the organic sector, using the quality function deployment technique. The results show that among the characteristics of poultry, meat consumers assign greater importance to those that are strictly related to animal welfare issues. Price and product appearance (i.e., colour, presence of fat) come in second. To meet these needs, producers can effectively operate along the supply chain by acting on poultry housing type, genotype lines, and stocking density. Information about these issues should then be shared with the consumers (i.e., clear product labelling).

Introduction

Over recent decades, food quality perception has changed considerably, as it has become a more multidimensional and dynamic concept. Researchers distinguish four quality dimensions that affect food choice: sensory attributes, food health, convenience, and process characteristics (Bruno et al., 2002). An understanding of consumer food preferences can help to create new opportunities for food producers and to attain a competitive advantage by adding value to the product (Grunert, 2011). However, as quality perception is based on subjective perception, the quality depends on the eye of the beholder. According to Brunso and colleagues (2002), at least two different points of view have been postulated when analysing food quality: an objective quality that is product-oriented or process oriented, and a subjective quality, as a user-oriented quality. The first of these deals with quality control and certification, and therefore it can be objectively assessed by measuring the physical and/or chemical characteristics of a product (e.g., the starch content in potatoes, the protein content in durum wheat, or the fat content of meat) and determining the production process (e.g., without pesticides and chemical additives, organic production), and it also covers the control of the standards (e.g., the EUROP classification of meat) and quality certification (e.g., International Organisation for Standardisation 9000, Protected Designation of Origin, Protected Geographical Indication). The user-oriented quality, on the other hand, is the perceived quality (Steenkamp, 1989). This can be objectively measured only with an adequate measurement system and by considering both the intrinsic and extrinsic quality cues that consumers use when they evaluate a product. For meat products, for example, the quality perception can be analysed by focusing on taste, appearance and healthiness, as intrinsic characteristics of the meat quality, and/or on price, convenience and process characteristics, as extrinsic quality cues, that are not physically part of the product.

Supply chain members have the difficult task to set the standards and guidelines and to adapt the products to the changing needs to satisfy the wishes of the consumer. In the case of meat, consumers usually demand tasty and tender meat (Parasuraman et al., 1985), and just recently they have started to ask for differentiation in terms of quality levels. On the other hand, producers appear more interested in limiting the biological variation (Grunert, 2011). Most of the factors that affect poultry meat quality are complex, but they can be controlled throughout the whole supply chain, during the production stages, with the slaughter and the meat processing phases. The most relevant factors that are known to impact on poultry meat quality include bird age, gender, nutrition and management, and bird density, harvesting method, environmental conditions, and handling (Baracho et al., 2006).

Through the participation of the members of the chain, the quality function deployment (QFD) method allows the definition of the consumer needs, to translate these into specific actions, to produce the relevant goods and to meet these needs (Vatthanakul et al., 2010). Four different phases are tradition-
including market research data, surveys, focus groups, in-depth interviews, and observation (Hauser and Griffin, 1993). Once identified, consumer needs are expressed in the consumer language and reported in the HoQ, together with the measure of importance that the consumers assigns to each requirement. The relative importance coefficients are obtained from quantitative market research (e.g., choice experiments, Likert scales). This activity helps in the definition of the priorities in the product development process and the allocation of the necessary resources (Costa et al., 2000). This is a very delicate and critical phase of the QFD process. The main risk is confusion in the definition of the consumer requirements, through the collection of inaccurate data. This is especially the case when the consumer responses are difficult to classify as needs, or when the consumer needs are misunderstood in terms of the product features (Hauser and Griffin, 1993).

Once the consumer needs are identified, it is necessary to understand how these attributes relate to the processing requirements, to be able to satisfy the consumer preferences. In the HoQ, the processing-characteristic requirements - as the quality functions or design requirements (also known as the voice of producer) - are listed at the top, in columns (Figure 1). These can be used to objectively improve the product quality. The process characteristics to satisfy the consumer needs are established using measurable parameters that translate the consumer language into the technical language of the production companies. These houses can affect more than one item, and can be jointly affected by different consumer needs (Hauser and Clausing, 1988).

Relationships between specific requirements of the consumer and how these might relate to parameters along the supply chain can be indicated by symbols or numbers in the relationship matrix. The degree of the relationship (e.g., strong, moderate, weak) is reported in almost all of elements of the matrix, to attempt to answer the question: To what extent do the product specifications (houses) affect the quality expected by the consumers (whats) in terms of their satisfaction? (Franceschini, 1998). To build the matrix and to fill the cell values with the relationships (scores) where applicable, an expert team is involved. The expert team looks for an agreement by discussing on the strength of the relationship between - how much - the product characteristics and the process parameter affect consumer quality perception. Determination of the intensity of the correlation between the consumer needs and the specifications of the product can also be problematic, because of both the inefficiency of the complex process, and the risk of missed opportunities (Hauser and Griffin, 1993).

The relative weight given in the last row of the HoQ reports the technical importance ratings (how much; Figure 1). The technical importance is a weighted sum of the relationship scores for each process characteristic that is included in each column in the matrix, and the related consumer need score, which is produced by normalising the final score (i.e., the absolute weight) (Vatthanakul et al., 2010). This helps the priorities and offers guidelines for the determination of possible improvements to the production process phases. The top triangle of the HoQ (the correlation roof; Figure 1) is dedicated to the representation of the interrelations between the production characteristics. The correlation roof is positioned at the top of the HoQ, and it describes the interactions between the technical quality characteristics of the product and the production process, through distinctive symbols that code the positive and negative relationships, and the intensity of each correlation. These can help to determine the combined effects that can develop from the improvement of a specific product feature on the other attributes, and can highlight possible opportunities for innovation. The interactions between the determinants of the production process are also evaluated by expert assessment.

The last section of the HoQ (the competitive assessment on the right side; Figure 1) is dedicated to the competitive positioning strategy, and this is a useful tool to understand where the production company and its competitors stand in terms of satisfying the requirements of the marketplace (Costa et al., 2000).

Not many studies have applied QFD to food products (Costa et al., 2000; Erraich et al., 2014; Vatthanakul et al., 2010), and in particular to meat production (Dalen, 1996). The application of QFD to the food industry shows that the advantages and capabilities of this technique are rarely used to assess new food-product development. The strategic importance of the product development process might explain the reluctance of a production company to share information during a QFD, and might partly explain the absence of reported examples (Charte, 1993; Govers, 1996). A deep analysis of this limited literature on meat quality shows that most QFD food studies do not go beyond the HoQ matrix (Dalen, 1996).

This study applied the QFD approach to visually measurable attributes of poultry meat, to facilitate the food-product quality-development process through integration of consumer needs with animal breeding and processing characteristics. Consumer attitudes towards the quality of poultry meat and expert assessment opinions about the interactions between the quality characteristics and the determinants of the production process were collected. By focusing on the interactions among the different phases of the production process, the QFD method encourages communication along the supply chain and between the supply-chain members (Benner et al., 2003). It helps to exploit the dynamic and heterogeneous consumer demands for food quality.

The aims of this study were: i) to identify the current gaps between product characteristics and consumer expectations; and ii) to analyse the crucial points in product development through integration of consumer needs and supply-chain requirements, to improve poultry meat quality.

Materials and methods

To establish connections between what the consumer needs from a product and the performance measures planned to improve poultry meat, the consumer opinions on what they need and require when buying poultry breast meat were analysed. The experiment was carried out in two stages. First, a choice experiment was undertaken, to study the voice of the consumer. Secondly, expert assessments were applied to investigate the voice of the producer, and to build the correlation matrix.

The voice of the consumer

Data collection took place in Autumn 2008, with a sample size of 150 consumers. The consumer panel was geographically balanced. Poultry meat buyers were recruited in similar percentages in three different Italian locations: Udine (the main town in the region of Friuli Venezia Giulia, in northern Italy); Ancona (the main town in the region of Marche, central Italy); and Potenza (the main town in the region of Basilicata, southern Italy). These buyers were selected from among consumers who reported to be knowledgeable about organic issues. Only consumers who report consumption of chicken at least once or twice a month and who purchased organic products occasionally were recruited. The quota criteria were chosen to ensure that the sample resembled the actual Italian population, in terms of the distribution of those aged >20 years. Inclusion in the study was voluntary, and respondents were given a €20 petrol voucher for their participation in a two-stage
interviewing process. This study is part of a larger investigation that is aimed at a deeper understanding of the quality perception of some organic animal products. The survey also determined the effects of information on the product liking and the consumer willingness to buy the product (Napolitano et al., 2013).

At the end of the empirical phase, the survey data that were ready for the analyses were distributed as indicated in Table 1. The selected consumer panel consisted of 150 organic and poultry meat consumers. The sample was evenly distributed in terms of income levels. Most of the consumers in the selected consumer panel had a university degree (43.3%), while 38.0% had only high-school education, and 18.7% had only compulsory school education. This bias towards well-educated respondents is quite typical in organic consumption surveys, and especially in those that require a lot of time and high consumer involvement in the product selection. The level of knowledge of organic products was not very high (Zanoli and Naspetti, 2002): 32.0% of respondents correctly answered <2 questions out of the seven questions in the knowledge test, while around 0.7% of the sample (i.e., 1 of the 150 consumers) answered all five questions correctly.

To establish the consumer needs through the conversion of the product attributes into the voice of consumer, the previous literature was analysed. The literature available on meat products and our own expertise on consumer research were used to construct a list of these consumer needs. The consumer requirements were selected through thinking about those cues that the consumers perceive and what they ask when they select poultry meat at the point of purchase, not after a tasting experience. Therefore, in the present study, the perceived quality was investigated through a focus only on some intrinsic and extrinsic quality cues (Darby and Karni, 1973; Nelson, 1970). Among the intrinsic cues, the QFD approach was applied to two visual measurable (sensory) attributes: the colour of the meat, and the presence of fat. These attributes of the product investigated represent what the consumers perceive and ask when they select poultry meat at the point of purchase, not after a tasting experience. Among the extrinsic cues, the product attributes that the consumers perceive as related to food safety and sustainability were of interest: the farming system, the welfare of the animals, and the product origin. Price was also added in, to investigate the product quality perception and consumer willingness to pay. Table 2 gives the consumer needs, their definitions, and the relative levels (choices) of each product quality cue.

After pretesting, the experiment was planned as two different tests. The first included a choice experiment and a preference data questionnaire. The data were collected through a paper and pencil questionnaire that simulated a real buying situation. Each respondent was presented with 12 different choice tasks, where each choice included two cuts of chicken breast with a different combination of the six product attributes. In the second test, the preference data (i.e., elicitation of attribute attendance) were investigated (Zanoli et al., 2012). Data acquisition on ranking of the consumer needs for chicken took place at the end of the choice experiment, the results of which are not included in the present study (Scarpa et al., 2013). The stated choices in the poultry meat selection were used for the empirical application of the present study.

The consumers were asked to self-declare how much they felt they relied on each of the attributes during their choice experiment. They had to rate the frequency of selection of each quality cue, as the colour and presence of fat, the farming system, the welfare of the animal, the product origin, and the price, using a 9-point Likert scale (9, always; 1, never). The mean value of each attribute is reported in the weight/importance column on the left of the HoQ (Figure 2) (Vatthanakul et al., 2010).

The voice of the producer and the relationship matrix

We used opinions of experts to determine the product and process requirements, as the voice of producers, combined with the investigation of how the process characteristics of the poultry supply chain affected the consumer needs (the relationship matrix). In Autumn 2009, a meeting was held with an interfunctional expert team (Hauser and Clausing, 1988). Seven experts were recruited from among researchers, producers and technicians, as the expert panel, to discuss and set up the relevant breeding features and the processing requirements for the poultry meat. The relevant literature on this topic was also considered (Castellini, 2005; Baracho et al., 2006; Mikulski et al., 2011). After extensive discussion, the strength of the effects of the relationships (the how much) between the product characteristics and the process parameters on the consumer perception of the quality are identified through consensus of an expert team (Hauser and Clausing, 1988).

The product requirements (hows) of the processing characteristics for the poultry meat supply chain were classified into three main categories or phases: production; pre-slaughter; and slaughter and meat processing. The production phase consisted of 8 different production steps that can impact on poultry meat quality: genotype lines, bird gender, age and weight at slaughter, feed composition, bird management and density, and disease control. The pre-slaughter phase included handling, transport conditions, and pre-slaughter time. The slaughter and meat processing phase was the last stage, and it included the stunning methods, portioning management, packaging, and transport temperature. The lighting quality in the supermarket and the labelling are also important factors that affect poultry meat quality, and these were also grouped in the meat

Table 1. Socio-demographic data of the sample.

| Characteristic                  | Sample grouping     | Proportion, % |
|--------------------------------|---------------------|---------------|
| Gender                         | Male                | 36.0          |
|                                | Female              | 64.0          |
| Age, years                     | 20-44               | 35.3          |
|                                | >44                 | 64.7          |
| Education, years of school     | No formal education | 6.7           |
|                                | <12                 | 12.0          |
|                                | 13 (secondary school)| 38.0          |
|                                | ≥18 (university degree) | 43.3          |
| Income per household, € member/year | <10,000     | 21.6          |
|                                | 10,000-30,000      | 61.9          |
|                                | 30,000-50,000      | 14.9          |
|                                | >50,000             | 1.6           |
| Organic product knowledge      | Low (<2 correct answers) | 32.0          |
|                                | Medium (2-4 correct answers)| 67.3          |
|                                | High (≥5 correct answers) | 0.7           |

*aConsumer product knowledge of organic products was measured using standardised knowledge test of a reliable 7-item scale, as tested in a previous study (Zanoli and Naspetti, 2002).
processing phase. The lists of definitions of each product quality cue and the process requirements as agreed by the experts are reported in Table 3.

The expert panel was also asked to consider the relationships between each product quality cue (i.e., the consumer need; j) and each processing characteristic (i) for the poultry breast meat, and then to rank the strength of these relationships as three levels (scoring; 9, strong; 3; medium; 1, weak). In the interrelationships matrix (Figure 2), these are expressed through symbols (e.g., the relationship between animal welfare and genotype lines was moderate, the relation between colour and genotype lines was strong).

The final weight (W) for each processing characteristic (PW) was computed to detect the most relevant producer priorities (Vatthanakul et al., 2010), as follows:

\[
W_i = \sum_{j=1}^{m} (PW_j \times X_{ij})
\]  

(eq. 1)

where PW is the j-th product quality characteristic weight, X is the correlation coefficient between the j-th product quality characteristic and the i-th processing characteristic, and i = 1,….,n (n, total number of processing characteristics) and j = 1,…,m (m, total number of product characteristics). The normalised mean value of each attribute is reported in the product weight column of the HoQ.

The relative weight is reported in the last row of the HoQ, for the i-th processing characteristic, and it can be normalised as follows:

\[
RW_i = \frac{w_i}{\sum_{i=1}^{n} w_i}
\]

(eq. 2)

The priorities for the product requirements are estimated by multiplying the impact value of the technical requirements for the consumer satisfaction performance on each need by the normalised raw weight of the consumer needs (Vatthanakul et al., 2010). As an example, the genotype lines relative weight is calu-

| Product characteristic | Definition | Choice |
|------------------------|------------|--------|
| Colour                 | Colour of the chicken breast as sold on the supermarket shelves | Pink - red |
| Fat                    | The (yellow) fat presence on the chicken breast as sold on the supermarket shelves | Pink - yellow |
| Farming system         | The farming techniques adopted to raise chickens | Organic farming |
| Animal welfare         | Chance for the chickens to have access to the outside | Outdoor access |
| Origin                 | The country of origin of the chickens | Italy |
| Price, €/kg            | Selling price | Outside Italy, EU |

Table 2. Consumer needs for poultry meat, and choice definitions (sobats).

| Technical characteristics | Definition |
|--------------------------|------------|
| Phase 1 Production       | Genotype lines |
|                          | Gender |
|                          | Age |
|                          | Final weight |
|                          | Feed composition |
|                          | Genetically modified ingredients |
|                          | Free-range housing type |
|                          | Natural ventilation system |
|                          | Stocking density |
|                          | Vaccination |
| Phase 2 Pre-slaughter    | Bad handling conditions before transport |
|                          | Bad transport conditions |
|                          | Journey duration |
|                          | Pre-slaughter time |
| Phase 3 Slaughter and meat processing | Dissection |
|                          | Mixtures of gases |
|                          | Low transport temperature |
|                          | Shelf illumination |
|                          | Additional labelling |

QFD in organic poultry production
lated as follows: $6327 / (6327 + 1793 + 4822 + 6218 + 5012 + \ldots + 6494) = 7.4\%$.

The interactions between the determinants of the production process, which form the roof of the HoQ, were also determined by expert assessment, through an exploration of the potential correlations between the different processing characteristics. The correlation between the processing characteristics was computed in a qualitative way, and the data collected were not used in the weighting process. Three types of correlation were used: positive correlation (+), i.e., the improvement of one processing characteristic involves the improvement of the other; negative correlation (−), i.e., the improvement of one processing characteristic involves the worsening of the other; and no correlation (blank).

Results and discussion

The HoQ planning matrix for the poultry meat shows how the most important quality attributes that consumers ask (Figure 2, left column of the HoQ) when selecting poultry meat from the shelves are predominantly related to the characteristics of the production process. Animal welfare (PW = 8.37), origin (PW = 8.36) and farming system (PW = 8.07) were the characteristics that the consumers mostly used when they evaluated the poultry meat quality. The visual characteristics of the poultry meat (i.e., meat colour, presence of fat) and the price level, were occasionally inspected, with the reported product weights of 5.83, 6.37 and 6.81, respectively.

The most relevant producer priorities for poultry meat are those that have the highest normalised contribution, as positioned at the bottom of the HoQ as the absolute or relative weight (Figure 2). The relationship scores between the consumer requirements and the processing characteristics are higher for the chicken production phase than the poultry pre-slaughter/slaughter and the meat processing phases. The production characteristics that are strictly related to the issue of the welfare of the animals have the highest normalised contribution (RW). The free-range housing type (RW = 7.8), final bird weight (RW = 7.3), and high stocking density (RW = 6.1) are all characteristics that significantly affected the perceived quality, and hence the consumer willingness to pay for the poultry meat. Poultry producers are often prone to reduce the welfare of their animals by cutting down on housing equipment and labour costs. They should also take into account that especially in organic production systems, free-range birds, low stocking density, and low final weight are synonymous with adequate welfare and a favourable environment for the birds. Our data also confirm previous findings that have shown that information about animal welfare issues, such as the housing type and the stocking density, influence the consumer acceptability of meat, and increase the consumer willingness to pay for the animal product (Napolitano et al., 2013; Di Pasquale et al., 2014). Also, free-range housing is strictly related to animal well-being, and it

![Figure 1. Product planning planning matrix.](image1)

![Figure 2. Interrelationship matrix.](image2)
can have a positive impact on carcass quality, by reducing abdominal fat (Wang et al., 2009).

Genotype lines (RW=7.4) is another important producer requirement that affects the perceived meat quality. Visual attributes, such as meat colour and presence of fat, are the most relevant consumer attributes related to this aspect (Figure 2). Consumers ask for pink-red chicken breast and for the absence of (visible) yellow fat, characteristics that are usually obtained from fast-growing genotype lines. To meet the consumer demands, producers can effectively operate by acting on the genotype lines. However, fast-growing genotype lines that are intensively selected for their high growth rate and feed conversion can lead to animal welfare problems. According to Castellini et al. (2002, 2006), fast-growing genotype lines manifest feed inefficiencies and physical problems, especially if the chicken are reared outside. Only slow-growing genotype lines, which are characterised by a very high degree of adaptation, can fully benefit from an organic rearing system (e.g., outdoor access, pasture availability, older age) (Reiter and Bessei, 1998; Castellini, 2005).

As the growth rate of the fast-growing genotype lines is much higher than that of slow growth, the high minimum length of the slaughtering age for organic poultry (81 days) would mean that the animals reach their highest body weights while manifesting both feed inefficiencies and physical problems, like leg problems and arthritis (Castellini et al., 2002). As a consequence, fast-growing genotype lines should not be recommended for free-range systems, nor under organic conditions (i.e., low nutritional value, pasture availability, older age at slaughter). The importance of having slow-growing genotype lines in low-input and organic production systems should be better recognized also by the stakeholder. The final weight (i.e., slaughter weight) can also have a strong effect on the consumer quality perception. The data show a strong relationship between final weight and the relevant consumer needs, such as the presence of fat, the farming system, and the welfare of the animal. However, producers should pay attention when choosing the most appropriate final weight, as this aspect is strictly linked to relevant consumer needs concerning the presence of fat, the farming system, and the welfare of the animal. According to the data reported in the correlation roof in Figure 2, the body weight of the chickens at slaughter had a positive strong correlation with the genotype lines (fast growth), and a strong negative correlation with the housing type (outdoor, free range). As a consequence, both of these attributes affect the farming system, the presence of fat, the welfare of the animal, and the price level. Fast-growing genotypes that are intensively selected for feed conversion grow very rapidly and reach a high final weight at slaughter. Nevertheless, these animals do not perform well under extensive farming conditions (i.e., free range, organic), as they suffer from their limited foraging ability and poor adaptation to outdoor conditions in general. Fast-growing genotype lines are therefore usually reared indoors, while slow-growing genotype lines are preferred in free-range and even organic farming systems (Mikulski et al., 2011).

The relationships between the final weight and the consumer requirements in terms of price is also important. Mainly due to the scarce efficiency of feed conversion and the low final weight reached at slaughter, the slow-growth genotype lines reared under free-range conditions can result in very high production costs. Our analysis also showed that labelling is a key factor for the consumer, who wants to get additional information on the poultry supply chain. Along the meat processing phase, additional labelling is the only relevant characteristic (RW=7.6). To allow the consumers to identify the relevant information, the quality features the consumers require should be clearly described on the label. The consumers needs related to the credece attributes, such as animal welfare, housing type, production system, absence of genetically modified ingredients in the animal diet, and the rearing conditions, can be important information tools for consumers of chicken breast. The correlation roof matrix in the HoQ (Figure 2) indicated some other interesting relationships. The presence of genetically modified ingredients in the feed composition and the use of vaccination for diseases and infections were the least relevant attributes in terms of the relative weight. Both genetically modified ingredients and vaccines related only to the farming system, and not to the other consumer requirements, explain this relative low weight. Nevertheless, the use of chemical substances and genetically modified feed in the livestock production process has recently increased consumer concerns and their attention towards the meat quality. The consumers asks for poultry meat free from chemical, biological, and physical contaminants, even though legislation has imposed numerous limits on the meat supply chain. Due to food-safety concerns, demands for healthy and safe meat are still strong consumer requirements (Zanoli et al., 2012). According to EU Reg. CE 834/07, organic production systems must reject the use of both genetically modified ingredients and allopathic pharmaceuticals. There are other restrictive protocols, but these are not regulated at the EU level or have not been widely adopted.

Conclusions

Two main conclusions can be drawn from the QFD method applied in the present study. First, our analysis shows that to meet consumer needs, the poultry meat sector should focus on more extensive production systems, such as integrated or organic systems. Animal welfare needs should be considered as an added value by the producers. The adoption of animal welfare standards such as outdoor access, low stocking density, and slow-growing genotypes, and consequently a lower bird weight at slaughter, can affect the consumer requirements. Secondly, the relevant required product characteristics should be clearly described on the label, to allow consumers to identify the quality features. Additional claims about the above-mentioned processing characteristics (e.g., housing type, production system, absence of genetically modified feed in the dietary composition, rearing condition in general) give consumers important tools to make an informed choice. Nowadays, many consumers are aware of the different quality schemes, and for this reason, the poultry industry should work more on offering clear information. The determinants that affect poultry meat quality are complex. Further work is needed, in particular, in terms of the analysis of the interdependency between the producer parameters (e.g., implementation of the correlation roof). It is reasonable to assume that some products and/or processing characteristics will have other potential interactions, which might influence the whole producer strategy. The integration in the QFD of other product quality attributes, such as the sensorial aspects, can also be considered as an interesting option to more deeply investigate the role of processing requirements on perceived poultry quality.

References

Baracho, M., Camargo, G., Lima, A., Mentem, J., Moura, D., Moreira, J., Nääs, I., 2006. Variables impacting poultry meat quality from production to pre-slaughter: a review. Rev. Bras. Cienc. Avic. 8:201-212.
Benner, M., Linnemann, A. R., Jongen, W.M.F., Folstar, P., 2003. Quality Function [Ital J Anim Sci vol.14:2015]
Deployment (QFD): can it be used to develop food products? Food Qual. Prefer. 14:327-339.

Brunsø, K., Fjord, T., Grunert, K., 2002. Consumers' food choice and quality perception. Working Paper No. 77. The Aarhus School of Business Publ., Mapp, Denmark.

Castellini, C., Dal Bosco, A., Mugnai, C., Pedrazzoli, M., 2006. Comparison of two chicken genotypes organically reared: oxidative stability and other qualitative traits of the meat. Ital. J. Anim. Sci. 5:29-42.

Castellini, C., 2005. Organic poultry production system and meat characteristics. pp 47-52 in Proc. 7th European Symp. on the Quality of Poultry Meat, Doorwerth, The Netherlands.

Castellini, C., Mugnai, C., Dal Bosco, A., 2002. Effect of organic production system on broiler carcass and meat quality. Meat Sci. 60:219-225.

Charteris, W., 1993. Quality function deployment: a quality engineering technology for the food industry. Int. J. Dairy Technol. 46:12-21.

Costa, A.I., Dekker, M., Jongen, W.M., 2000. Quality function deployment in the food industry: a review. Trends Food Sci. Tech. 11:306-314.

Dalen, G.A., 1996. Assuring eating quality of meat. Meat Sci. 43:21-33.

Darby, M.R., Karni, E., 1973. Free competition and the optimal amount of fraud. J. Law Econ. 16:67-88.

Di Pasquale, J., Nannoni, E., Del Duca, L., Adinolfi, F., Capitainio, F., Sardi, L., Vitali, M., Martelli, G., 2014. What foods are identified as animal friendly by Italian consumers? Ital. J. Anim. Sci. 13:3582.

Erraach, Y., Sayadi, S., Gómez-Muñoz, A.C., Carlos, P.L., 2014. Valoración de prácticas innovadoras en el sector andaluz del aceite de oliva: una aplicación de la técnica QFD (Quality Function Deployment). Cuad. Estud. Agroaliment. 9:101-124.

Franceschini, F., 1998. Quality Function Deployment: uno strumento concettuale per coniugare qualità e innovazione. Il Sole 24 Ore Libri Ed., Milano, Italy.

Gios, G., Clauser, O., 1996. La qualità nel sistema agroalimentare: gli aspetti economici. In: P. Berni and D. Begalli (eds.) I prodotti agroalimentari di qualità: organizzazione del sistema delle imprese. Il Mulino Ed., Verona, Italy, pp 37-102.

Govers, C.P.M., 1996. What and how about quality function deployment (QFD). Int. J. Prod. Econ. 46/47:575-585.

Grunert, K.G., 2011. How changes in consumer behaviour and retailing affect competence requirements for food producers and processors. Agr. Res. Econ. 63:22.

Hauser, J.R., Clausing, D., 1988. The house of quality. Harvard Bus. Rev. 63:63-73.

Hauser, J.R., Griffin, A., 1993. Note on the voice of the customer. Marketing Sci. 12:1-27.

Mikulska, D., Cielej J., Jankowski, J., Majewska T., Mikulska, M., 2011. Growth performance, carcass traits and meat quality of slower-growing and fast-growing chickens raised with and without outdoor access. Asian Austral. J. Anim. 24:1407-1416.

Napolitano, F., Castellini, C., Naspetti, S., Piasentier, E., Girolami, A., Braghieri, A., 2013. Consumer preference for chicken breast may be more affected by information on organic production than by product sensory properties. Poultry Sci. 92:820-826.

Nelson, P., 1970. Information and consumer behaviour. J. Polit. Econ. 78:311-329.

Parasuraman, A., Zeithaml, V.A., Berry, L.L., 1985. A conceptual model of service quality and its implications for future research. J. Marketing 49:41-50.

Reiter, K., Bessei, W., 1998. Effect of locomotor activity on bone development and leg disorders in broilers. Arch. Geflugelkd. 62:247-253.

Scarpe, R., Zanoli, R., Bruschi, V., Naspetti, S., 2013. Inferred and stated attribute non-attendance in food choice experiments. Am. J. Agr. Econ. 95:165-180.

Steenkamp, J.B.E.M., 1989. Product quality: an investigation into the concept and how it is perceived by consumers. Van Gorcum Ed., Assen/Maastricht, The Netherlands.

Vatthanakul, S., Jangchud, A., Jangchud, K., Therdthai, N., Wilkinson, B., 2010. Gold kiwifruit leather product development using Quality function deployment approach. Food Qual. Prefer. 21:339-345.

Wang, K.H., Shi, S.R., Dou, T.C., Sun, H.J., 2009. Effect of a free-range raising system on growth performance, carcass yield, and meat quality of slow-growing chicken. Poultry Sci. 88:2219-2223.

Zanoli, R., Naspetti, S., 2002. Consumer motivations in the purchase of organic food. Brit. Food J. 104:643-653.

Zanoli, R., Scarpe, R., Napolitano, F., Piasentier, E., Naspetti, S., Bruschi, V., 2012. Organic label as an identifier of environmentally related quality: a consumer choice experiment on beef in Italy. Renew. Agr. Food Syst. 28:70-79.