

White paper

Quality in the food production chain

A holistic approach

Quality is high on the agenda across the food production chain. In today's world, raw material producers, consumer goods manufacturers, regulatory authorities and end consumers all care about quality. Breakdowns in quality can make media headlines across the world and recent scandals have undermined consumer confidence in the food, beverage and dietary supplement industry. To manage the complex interconnections in the global food production process, a holistic approach to quality management is essential: combining regulatory requirements and traditional quality standards in materials, production and packaging with consumer sensitivities and religious and ethical factors.

With increased focus on safety, people are paying increased attention to social, ethical, environmental and sustainability considerations. Greater emphasis is being placed on traceability and transparency, as consumers become more and more educated and sensitive about the origin of food and how it has been produced. Quality plays a key role in differentiating foods, beverages and dietary supplements, providing choices for consumers and encouraging those making purchasing decisions to choose a certain brand over competitors.

For food, beverage and dietary supplement manufacturers looking to improve the nutritional value of products, selecting the right ingredients is essential if exposure to risk is to be reduced. Pressure to deliver cost savings can create an incentive to cut corners on quality and sustainability, but

Micro-ingredients can have an impact on large production volumes

the use of cheap ingredients puts consumers and brand reputation at risk if it results in undesirable substances entering a product. This is particularly important when dealing with micro-ingredients such as vitamins, carotenoids and minerals, where the impact of quality on the value chain can be especially pronounced. For example, one kilogram of vitamin A could be used in the production of 400,000 – 1,000,000 cereal bars or eight metric tons of infant formula, reaching a minimum of 9,000 infants.

To earn consumers' trust, transparency throughout the supply chain is key. Here, DSM's **Manfred Eggersdorfer**, Senior Vice President – Nutrition Science & Advocacy and **Stephan Heck**, Senior Director – Global Quality Management, discuss the ways in which a holistic and sustainable approach to quality minimizes risks to manufacturers and explain how the

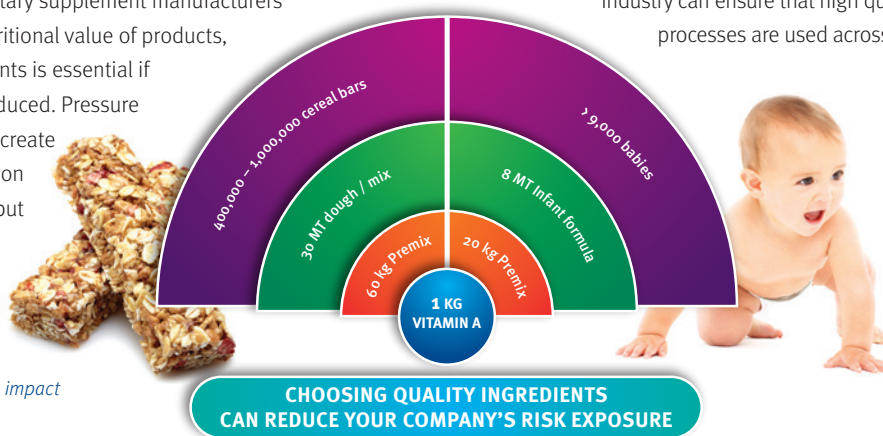
industry can ensure that high quality ingredients and processes are used across the complex value chain.



Manfred Eggersdorfer



Stephan Heck



Setting a benchmark for quality

So, what does quality mean when selecting a nutritional ingredient? There are a number of factors to consider: the ingredient must come from a supplier with a thorough understanding of good manufacturing practices (GMP) and strong record of compliance; and the product must be high in purity, with no cross-contamination; stable in time, with all performance characteristics guaranteed; and, in the case of premixes, homogeneous. But above all, safety is paramount and the ingredient must be safe for consumers, workers and the environment, as well as being appropriately packaged to ensure safe handling.

To protect consumers, the pharmaceutical sector has long been governed by strict guidelines on bringing products to market. With safety or quality issues having the potential to impact on large proportions of the population, legislation in the food industry has become much more stringent in recent years. New GMPs were introduced in 2007 by the United States (US) Food and Drug Administration (FDA) to help ensure the quality, purity, consistency and safety of dietary supplement products. These regulations specify manufacturers' responsibility to ensure dietary supplements are processed in a consistent manner and meet quality standards.

In January 2011, the FDA's Food Safety Modernization Act was signed into law. This aims to ensure that the US food supply is safe by shifting the focus away from contamination response and towards prevention. Based on a strong scientific foundation, US food safety standards now include hazard analysis and risk based preventive controls as mandatory. This addresses food safety through the analysis and control of biological, chemical, radiological and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the end product.

Outside of the US, the European Union leads the way with the European Food Safety Authority (EFSA) providing independent scientific advice on the risks associated with food production, as outlined in European Regulation 178/2002. It is worth noting that some have questioned the



DSM's quality policy – "First Choice" – aims to encourage all employees to prioritize process and consider the impact that actions have externally.

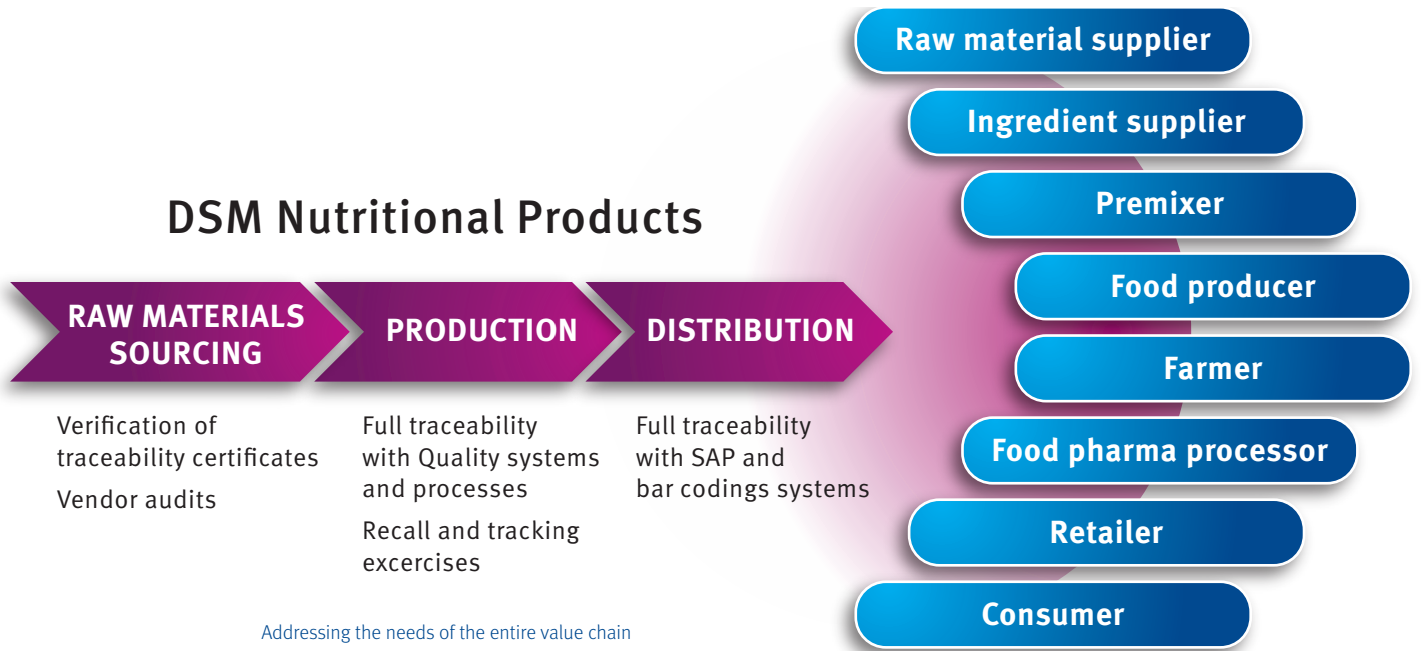


GMP production facility at DSM's site in Sisseln, Switzerland

impact that regulatory intervention alone can have on managing risk. Certain requirements, such as origin labelling, can be difficult to implement effectively and the authorities often face a challenge enforcing legislation, with only a small number of products actually tested despite an increased number of inspections.

Quality must be built – not tested – into the system and it is the responsibility of the entire value chain to ensure that the correct quality management procedures are in place to reduce the risk of contamination. To be truly

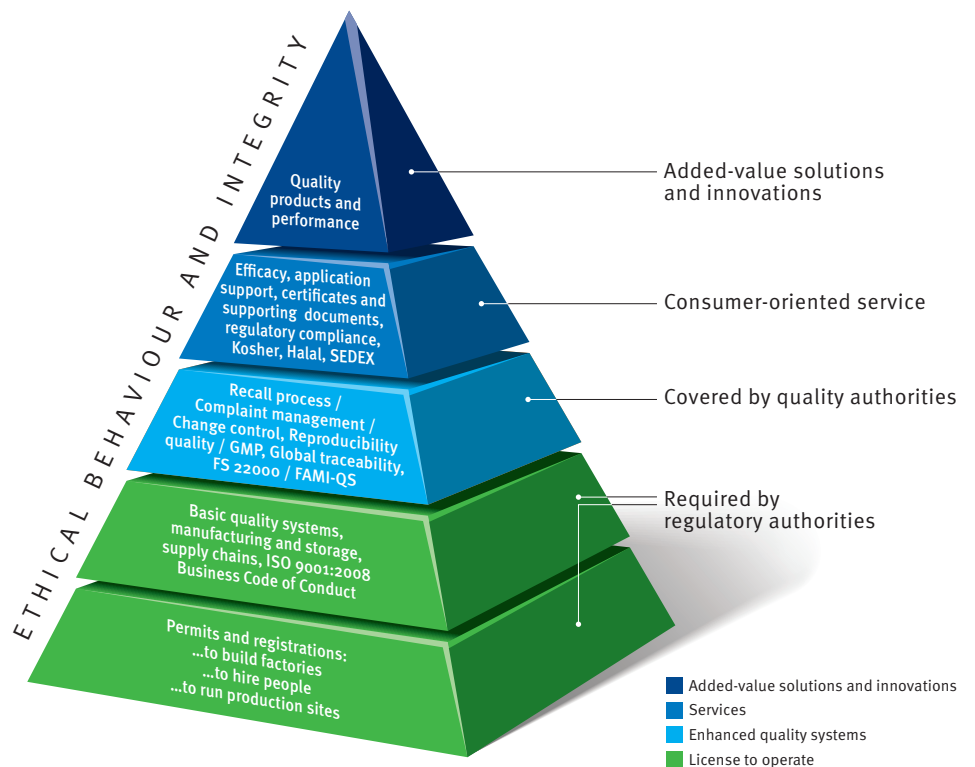
sustainable, environmental factors must be considered at every stage in the entire value chain and a holistic approach to quality follows the same rationale. From the raw material supplier - via the premixer, feed producer, farmer, food processor and retailer - to the consumer, quality must be front of mind to deliver a consumer product with added nutritional value at the end of the process. As a full portfolio player, DSM offers backward integration and assures quality throughout the food production process to deliver a consumer product with optimal benefits.



Safeguarding products and brands

For food, beverage and dietary supplement manufacturers, the best way to protect against contamination is to invest in quality ingredients from a trusted source. To achieve the highest quality and safety standards, quality management must go beyond regulatory requirements to follow a comprehensive approach that is based on sound and stringent processes. However, before considering internal controls, strict compliance with international and regional legislation is an essential starting point. FSSC (Food Safety System Certification) 22000:2010 has been in use for almost a decade and sets world class standards in food safety that are fully recognized by organizations such as the Global Food Safety Initiative (GFSI). ISO 9001:2008 determines commitment to quality management systems at every stage of the supply chain.

By applying globally recognized GMP to operations, every part of the process from sourcing to delivery is managed in order to ensure superior levels of process and product safety. As outlined above, quality compliance



Translating quality into ethical behavior and integrity

means much more than just safety. Covering labor standards, health and safety, environment and business integrity, membership of a globally-recognized organization such as the

Supplier & Ethical Data Exchange (SEDEX) shows commitment to driving improvements in responsible, ethical and social business practices.

How this works for Halal

Recent trends have shown the awareness for Halal Certified foods amongst producers and consumers. The demand for Halal food, beverages and dietary supplements is increasing tremendously, which brings challenges that need to be addressed by all players. These are mainly in the nature of their ingredients; do they meet the established Halal guidelines i.e. contain no pork, alcohol or any other ingredients not acceptable as Halal? The ingredients have to be clearly checked out for acceptance and stringent measures need to be enforced to monitor the “Halalness” of these ingredients. The certifying bodies have to analyze ingredients and if found to contain non-Halal ingredients, they are disqualified.

All ingredients that pass the criteria established by the certifying bodies should be allowed to be used as ingredients.

Much progress has been made in recent years towards ensuring ingredients meet the Halal requirements by concentrated efforts made by manufactures, consumers, and the certifying bodies. Frequent audits of manufacturing sites, to analyze and evaluate the ingredients, have helped achieve this objective. Quality has improved overall, but there is still room for improvement with increased frequency of visits and discussions with manufacturers on the importance of improving quality.

Halal food is increasingly available in main stream retail outlets throughout Europe. The growth of Halal food consumption is projected to grow stronger which will lead to an increase in trade potential either between European countries or between European and non-European countries. With processed foods in particular, quality is of paramount importance. Quality is the barometer of a product’s success. Throughout the supply chain, it is imperative that the product remains Halal from sourcing to distribution. At every stage, the main aspect to be inspected is the segregation of Halal and non-Halal good. The European Halal market is viable and still has untapped potential in the emerging Halal Market.

Quality as a way of life

Alongside external processes, commitment to internal quality management procedures is essential. It starts with strict safety controls and standards and has to incorporate everything from basic quality systems to application support. Backward integration throughout the supply chain provides quality assurance, from raw material sourcing and production through to distribution. Processes to follow include vendor audits, verification of certificates and the use of quality systems to maintain full traceability throughout production. Enterprise Resource Process systems (SAP) and bar coding systems then help to ensure that the ingredient that is delivered to the manufacturer is tracked and traced throughout the supply network.

Encompassing process validation, recall processes and complaint management, a multilayered quality management system means quality remains a priority. Once such an approach is in place, advanced automated process and material management systems can be used to precisely and rapidly track all products within the supply chain at any time and maintain the required information and documentation. In the case of an urgent

Vitamin C – an essential nutrient and food-additive used in supplements, foods and beverages

FOUND IN
Oranges, lemons, Rosehip, cauliflower.

FUNCTION
Biological antioxidant (free radical scavenger) stimulates the body’s defenses against infection, stabilizes dietary trace non-haeme iron, co-factor in metabolic reactions.

DEFICIENCY SYMPTOMS
Scurvy, weakness, fatigue, depression, increased susceptibility for infection, reduced wound-healing.

RECOMMENDED INTAKE
75 – 90 mg per day.

APPLICATIONS
Fortification for foods, supplements, multi-vitamin supplements, beverages.

The role of vitamin C in consumer products

ingredient investigation, it is important to make sure that the correct procedures are in place to establish what has happened immediately and inform those affected of the results of the investigation. DSM is proud to have a low complaint rate, but the entire value chain should always be ready to respond as quickly as possible and be fully committed to taking the necessary actions to minimize business interruption and safeguard the consumer.

Of course, consistency in quality is vital. To ensure standards are maintained when working with a global ingredients supplier, continuous investment in optimizing operations is required to deliver uniform product quality across all manufacturing sites. At the same time, it is important to monitor for changes in local



DSM's Vitamin C facility in Dalry, Scotland

regulations and maintain a close relationship with the relevant authorities, to make sure that products are compliant.

Quality procedures at DSM's premix capabilities illustrate how rigorous the approach must be: all facilities are audited regularly and frequently, up to 50 analytical tests are performed per premix batch and each batch is carrying a detailed certificate of analysis. To give another example, DSM's facility in Dalry, Scotland is the only western-based production site for vitamin C and its commitment to high quality standards is

reflected in the Quali[®]-C brand. Representing quality, reliability traceability and sustainability, the seal aims to ensure peace of mind for manufacturers and can be used to differentiate a product. To provide quality assurance, an effective quality management system is required and should define the procedures by which departments function and interact. The process is regularly audited to ensure that quality is maintained from batch-to-batch and the site continues to meet manufacturer demand for security of uninterrupted supply.

Conclusion

In recent years, significant progress in quality management systems has been made. Yet it will always be possible to make improvements to quality procedures and processes. To continue to maintain the highest standards of quality, on-going training and professional development of employees is fundamental. Quality must be part of the culture of the entire value chain because – above and beyond internal and external procedures and good manufacturing practices – it is trust and awareness that is the real differentiator.

As the world's premier quality nutritional ingredient supplier, quality has become a way of life for DSM. From product conception through manufacturing to after-sales support, the Quality for Life[™] seal of excellence aims to ensure that DSM's ingredients provide quality, reliability and traceability and are manufactured in a sustainable way. Quality for Life[™] means a culture of quality for manufacturers and consumers – ensuring product safety and the highest social, ethical and environmental standards in industry. The holistic approach that

has been adopted by DSM is the future of quality management and allows processes to be easily adapted to respond effectively to the changing needs of the market. For example, as the trend for targeted food, beverage and dietary supplement products continues to grow, social and cultural sub-groups will make specific requirements in regards to food quality.



Quality for Life[™] means quality for you

Launched in 2008, Quality for Life[™] consolidates a longstanding pledge to integrated risk management at DSM. With a multilayered quality management system at its core, Quality for Life symbolizes DSM's commitment to the environment, consumers, partners, people and the regulatory framework that governs operations. The first initiative of its kind to be introduced by an ingredient supplier, Quality for Life[™] is an instantly recognizable seal of excellence. Since its introduction, it has become a trusted symbol of high quality. Ultimately, this helps DSM's customers differentiate products and protect their brands.

Case study:

Quality control in infant formula production

To protect babies and ensure that infants are not put at risk, effective quality management that includes microbiological analysis and goes beyond standard parameters is needed. In many countries, legislation requires that thorough process controls are in place and a systematic risk-based approach, such as the Hazard Analysis and Critical Control Points (HACCP) must be followed.

The HACCP breaks the food manufacturing process down into rational steps, in order to identify possible physical, chemical and biological hazards at every stage in the production process. It is also important that quality management encompasses an integrated approach, such as the EU Commission's 'Farm to Fork' policy – which covers the entire food chain from feed production and food manufacturing to storage, transport and retail – or food defence as outlined in the latest US Food Safety Modernization Act.

To ensure a systematic implementation of quality-related legal and regulatory requirements, it is useful to follow certification standards. Potential concerns need to be detected as early as possible and before the finished product reaches the consumer. The longer it takes to detect and solve an issue, the more costs are generated and the greater the risk of adverse effects. It is crucial that a carefully considered, holistic approach to quality and safety is in place that allows the manufacturer to work with the Government, other food producers, marketers, academia, policy makers and consumers.



Quality and safety are of key importance for infant feeding and health. Infants carry particularly high risks for untoward effects of unbalanced diets or of harmful food components, because immaturity of many body functions leads to an increased susceptibility to adverse effects. Moreover, their rapid growth and tissue development requires high nutrient intakes, which only one single food product must be able to provide. Therefore, infant formula must meet even higher quality standards than other food products.

Berthold Koletzko, MD PhD, Professor of Paediatrics

Case study:

A sustainable solution for the Muslim community

With Islam the world's fastest growing religion, it is expected that Muslims will make up 26.4% of the global population by 2030 – making Halal food, beverage and dietary supplement products one of the fastest growing consumer segments in the world. Creating quality, sustainable solutions for the Muslim community presents a clear opportunity for manufacturers and DSM has begun the journey towards a full Halal ingredient range. With a commitment to delivering products that meet Islamic rules and a respect for Muslim people, recognition of their fundamental rights and belief in the power of diversity are part of the culture at DSM. As a result, Halal is now synonymous with quality and a Halal assurance system has been put in place to ensure DSM's nutritional ingredients meet Halal requirements. With Halal certified products, DSM has liaised with Halal certification bodies to develop and implement a Halal policy and a Halal assurance system. In addition, Halal raw materials are sourced and Halal is now a principle requirement for R&D projects, meaning Muslim requirements are taken into consideration from the earliest stages of the value chain. To maintain standards, internal audits against Halal guidelines are carried two times a year by a Halal audit coordinator.



Halal food producers have nothing to worry about if they are strictly compliant to the Halal standards because its guidelines are holistic. Halal policy is about adopting, refining and monitoring Halal guarantee at all levels of departments within the organization informing all parties about Halal guarantee existence. Quality assurance is a systematic process of checking to see if a product or service developed is meeting specified requirements. A quality assurance system is said to increase customer confidence and a company's credibility. Quality Control and Quality Assurance are not the same. Quality Assurance is meant to prevent problems. Quality Control cannot detect any problems that occur.

Prof. Dr. Mohamed Sadek, Chairman of the Halal Food Council of Europe

DSM Nutritional Products AG

Dr. Manfred Eggersdorfer

SVP Nutrition Science & Advocacy

P.O. Box 2676, 4002 Basel
Switzerland

Phone: +41 61 815 8196

Email: manfred.eggersdorfer@dsm.com

Dr. Stephan Heck

Senior Director Quality Management

P.O. Box 2676, 4002 Basel
Switzerland

Phone: +41 61 815 8174

Email: stephan.heck@dsm.com

www.dsm.com/human-nutrition



® For DSM, quality is a way of life. This is the core of **Quality for Life™**.

Quality for Life™ is the mark of **quality, reliability and traceability**. It means that DSM customers are getting the best ingredients, knowing the source on which they depend.

Quality for Life™ means **sustainability**. It symbolizes our commitment to our environment, consumers, our business partners, our people and the regulatory framework that governs our operations.

With the Quality for Life™ seal, we aim to ensure peace of mind for you and for your customers.

www.qualityforlife.com

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