الهيئة العامة للغذاء والدواء
Saudi Food & Drug Authority

Guideline for Establishing Research and Development Centers in Food and Feed Factories

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Introduction

The Saudi Food and Drug Authority (SFDA) launched its Fourth Strategic Plan (2023–2027), which focuses on three main pillars: product safety, local and international partnerships, and operational excellence. In an effort to enhance both local and international collaboration, the SFDA seeks to activate partnerships with local and international entities and universities within the Kingdom to support research and innovation in the fields of food and feed. The Authority also supports food and feed factories by aligning with the latest regulations, practices, and requirements, and by providing technical and scientific consultations, guidelines, training courses, and workshops to ensure the safety of food and feed products and to improve manufacturing processes, thereby promoting Research and Development (R&D) in the food and feed sectors.

Accordingly, this guideline has been prepared to assist in the establishment of R&D centres within food and feed factories.

Objective:

This guideline aims to assist food and feed factories in establishing research and development centres.

Scope:

This guideline is specific to practices applicable to the creation of R&D centres in food and feed factories.

Target Audience:

All local and international food and feed factories.

Definitions

The following definitions specify the words and phrases used in this Guideline, which considered as standard definitions, although they may have different meanings in other contexts or documents.

- **The Authority:**

  The Saudi Food and Drug Authority.

- **Innovation:**

  New methods or techniques that significantly diverge from traditional ones used in the production or development of products within the food and feed sectors.

- **Research and Development (R&D):**

  The generation of new knowledge and the application of scientific or engineering knowledge to link fields and concepts. R&D includes three types of activities: basic research, applied research, and experimental development.

- **Basic Research:**

  Experimental or theoretical work undertaken primarily to acquire new knowledge about the fundamental principles underlying observable phenomena and facts, without any immediate practical application or use.

- **Applied Research:**

  Original investigation conducted to acquire new knowledge, primarily directed toward a specific, practical objective with a long-term focus.

- **Experimental Development:**

  Systematic work based on existing knowledge gained from research and practical experience, aimed at producing new products or processes, or improving existing ones.

- **Food:**

  Any substance prepared for human consumption, whether raw, fresh, processed, or semi-processed. This includes any ingredient used in the manufacture, preparation, or treatment of food.

- **Feed:**

  Materials prepared to feed animals, whether composed of one material, mixed, processed, semi-processed, or raw, or a material used in the manufacturing, preparing, or processing of feedstuff, either from permissible animal or plant sources or from aquatic organisms.

- **Pilot Plant:**

  A small-scale industrial system operated to gather data on the behavior of the system for use in designing full-scale facilities. In the food industry, it is a scaled-down factory built to simulate food and beverage production practices, allowing for trial production under industrial conditions (batch sizes up to 1,000 litters).

The Role of R&D in Food and Feed Factories

Given the rapid developments in the food and feed industries, R&D serves as a key driver of progress. It plays a crucial role in promoting innovation, addressing emerging challenges, and exploring new opportunities. The sector's R&D capabilities are vital, as outlined below:

- **Product Safety:** R&D ensures compliance with technical regulations and standards, conducts risk assessments, and implements quality control measures, thereby reducing the incidence of foodborne illnesses and contamination.
- **Quality Assurance:** R&D focuses on testing and experimentation to maintain high standards across the food and feed supply chains. It improves formulations, textures, nutritional properties, shelf life, and more—enhancing consumer satisfaction and increasing demand.
- **Innovation:** R&D drives innovations by discovering new ingredients, technologies, and processes, resulting in unique and high-quality food and feed products and improved production efficiency.

The primary objective of R&D in this sector align with addressing key challenges and leveraging emerging opportunities. These objectives include:

- **Conducting market surveys:** to identify consumer needs and preferences, enabling factories to respond effectively to evolving demands and maintain competitiveness.
- **Improving manufacturing processes:** by enhancing efficiency, reducing costs, and increasing yields. This includes optimizing production workflows, adopting automation, and implementing advanced analytics for continuous improvement.

- **Developing products:** by creating innovative food products that meet changing consumer preferences and dietary trends. This involves formulating new recipes, improving existing ones, and utilizing advanced technologies to elevate product quality, taste, and nutritional value.

The continuous pursuit of innovation and excellence in research and development leads to numerous benefits for the food and feed industries. These benefits include ensuring the safety and improving the quality of products, increasing production efficiency, meeting market and consumer needs, and achieving economic and environmental sustainability in the industry. These outcomes are realized through partnerships with all relevant stakeholders, including government entities, factories, universities, and other influential parties in the food and feed sectors.

In an effort to support research and innovation across all food and feed factories, this guideline has been prepared to outline the established practices for setting up research and development centres in the food and feed industries — starting from organizational structure to the final product — thereby enabling continuous research and development.

Standards for Research and Development Activities

- Products must be **novel**
- Must be based on **creative** and fundamental concepts and hypotheses
- The outcome of product development must be **uncertain**
- A **systematic** plan and a clear budget must be established
- Results must be **transferable and/or reproducible**, i.e., suitable for replication or modification

Research and Development Practices in the Food and Feed Industries

Research and Development Management:

- Managing research and development in the field of food and feed requires mastery of several key aspects to ensure the success of development processes and achieve innovation in the food and feed industry. These include the following: Understanding the organization's context, including external (scientific, legal, social, economic) and internal (strategic vision, current management practices, organizational structure) factors, and available opportunities impacting innovation outcomes.
- Identifying the needs and expectations of relevant interested parties with influence within the organization, both current and future.
- Defining the scope of the innovation management system, according to several considerations such as offerings, processes, structure, functions, partners, collaborations, geographic coverage, and time, with the scope subject to review and modification when necessary, and the information shall be available and documented.
- Promoting a culture that supports innovation activities, such as fostering leadership commitment, enabling coexistence between creative mindsets and behaviours, and valuing researchers and innovators.
- Providing a motivating work environment characterized by encouraging feedback and suggestions, learning, creativity, risk-taking, communication, and collaboration.
- Establishing a management approach for internal collaboration such as: (departments and divisions within the organization) and external collaboration such as: (government agencies, universities, and the

private sector outside the organization). Developing a vision for the organization by describing the desired future state the organization aspires to achieve, implementing and maintaining it, in addition to preparing an innovation strategy that includes its objectives and plans to achieve them. Formulating an innovation policy that fulfils applicable requirements and ethical considerations, ensuring it is accessible and documented.

- Clearly assigning roles, responsibilities, and reviewing performance regularly.
- Maintaining the necessary infrastructure to implement its innovation management system, such as: buildings, laboratories, tools, legal and regulatory requirements.

Administrative Structure for Research and Development:

The administrative structure for research and development aims to organize and coordinate innovation-related activities and resources, as well as product development, in a systematic and efficient manner. It encompasses the responsibilities and functions that support the achievement of research and innovation objectives effectively, thereby contributing to progress and success in the market.

- To establish the administrative structure, the following steps can be taken:

1. Ensure the presence of relevant and adaptable organizational structures capable of delivering the desired outcomes.
2. Promote the coexistence of creativity, exploration, dissemination, efficiency, and integration within the organization.
3. Custom organizational structures can be created based on the size of the organization, considering the following:

- Innovations should be radical in relation to current offerings or in competition with them.
- There may be a need for different leadership styles, incentives, performance indicators, or environments.
- Specific support, including resources, should be made available for research and development activities.

- **Example of a Simplified Research and Development Structure:**
  1. Research and Development Director
  2. Component Division — includes proteins, fats, carbohydrates, and others
  3. Technology Division — includes drying, extraction, and grinding
  4. Safety and Quality Division
  5. Engineering and Other Technical Disciplines
- **Example of Specialized Teams and Groups**: Marketing Teams, Analytical Teams, Formulation and Processing Teams, Sensory Evaluation Teams, Packaging & Filling Teams, Microbiology Teams, Quality Control Teams
- **Example of Scientific Specializations:**

  A multidisciplinary team of scientists and technicians is often required, such as:
  - Food science specialists, microbiologists, chemists, physicists, engineers
  - Animal nutritionists for productive animals (e.g., ruminants, poultry, aquaculture)
  - Nutritionists for unproductive animals (e.g., pets)
  - Insect nutrition specialists
  - Product development experts
  - Process engineering specialists
  - Consumer science experts

- **Example of Successful Functional Roles in Research**

People-Oriented Roles:

1. Resource Investigator: Uses their curiosity to explore ideas and bring them back to the team.
2. Team Worker: Supports the team by completing tasks that may have been left unfinished.
3. Coordinator: Focuses on the team's goals and guides team members while appropriately delegating tasks.

Roles Directed Toward Thinking:

1. Plant: Tends to be creative and skilled at solving problems in unconventional ways.
2. Monitor-Evaluator: Uses logic to make impartial decisions and lead the team in a specific direction.
3. Specialist: Provides the team with in-depth knowledge in a specific field.

Roles Directed Toward Action:

1. Shaper: Provides the necessary motivation to ensure the team and stays focused.
2. Implementer: Plans executable strategies and works efficiently.
3. Completer-Finisher: Plays a role at the end of tasks to ensure quality and detect errors.

Tools and Methods Used in Innovative Partnership:

Innovative partnership is considered a powerful tool used by entities to achieve innovation and develop their products and services. They rely on collaboration among various parties to exchange knowledge, resources, and expertise in order to achieve common goals. The following should be considered:

- Understanding the innovation strategy, objectives, capabilities, and available resources.
- Ensuring diversity of experiences, specializations, competencies, and viewpoints.
- Existence of methodologies, rules, and various agreements for external collaboration.
- Protection of intellectual property rights.
- Regular review and alignment with the strategic objectives of the partnership.
- Importance of mutual respect, transparency, and trust among all parties involved.

Innovation can be realized through a structured framework for the development and management of innovation partnerships, as demonstrated in the table below:

Steps	First: Entering Innovation Partnership	Second: Selecting a Partner	Third: Aligning with the Partner	Fourth: Communication Between Partners
Objective	Making the decision whether or not to enter into an innovation partnership	Identifying, evaluating, and selecting an innovation partner	Establishing mutual understanding between the partner and the innovation initiative through proposed opportunities	Describing the nature of cooperation between partners
Implementation Mechanism	Conducting a gap analysis to identify capabilities and resources	Create a list of partners	Drafting a mutual understanding between the partner and the innovation initiative	Drafting the innovation partnership agreement
Application Example	Performing analysis by identifying internal strengths and weaknesses to fill gaps, and partnering where needed. Partnership criteria may include: learning opportunity, risk reduction, new capabilities, etc.	Preparing a decision matrix to select partners based on defined and matched criteria. Examples: technicians, clients, laboratories, standards organization, investors, etc.	Using a memorandum of understanding or other approaches to define benefits for clients and partners, expected outcomes, and an action plan	Drafting a formal innovation partnership agreement including: maintaining data confidentiality, programs, partnership objectives., implementation, management, governance, continuous improvement, funding and resources, roles, responsibilities and authorities, intellectual property rights, compensation and warranties, and termination.
Output	A list of required capabilities and resources	Final list of partners to address gaps in capabilities and resources	A written mutual understanding of the proposed opportunity to achieve a shared innovation outcome	Innovation Partnership Agreement

Planning and Designing Research and Development Facility:

The nature of laboratory work requires specialized workspaces with defined and movable partitions. Researchers and innovators working in these areas need a space that allows for high concentration and easy team interaction. Acoustic technologies and visual signals are also used in the design to connect different spaces together. The key principles in planning and designing a research and development facility include:

1. Collaboration:

- Establishing key areas of convergence and communication to enable spontaneous interaction and collaboration among researchers and innovators.
- Focusing the design on workspaces that promote innovation, knowledge transfer, collaboration, and efficiency, while providing a motivating work environment.

2. Health and Safety:

- Meeting the safety requirements for food or feed factory.
- Ensuring that equipment and tools are designed and installed in a way that prevents health hazards and allows for easy cleaning and sterilization.
- Implementing safety and industrial protection measures for equipment and tools with sharp edges.
- Equipping the building with proper ventilation to prevent heat build-up, vapor condensation, dust accumulation, and odours, and to remove polluted air in areas where food contamination may occur. Airflow direction shall not go from contaminated areas to clean areas, and production rooms shall be equipped with internal ventilation systems.

- If non- bottled drinking water approved by the relevant authorities is used for other purposes, it must not be mixed or used with bottled drinking water intended for human consumption.

3. Adaptability:

The new laboratory shall be flexible and adaptable, allowing for rapid reconfiguration based on scientific needs. Adaptability includes the ability to expand easily to accommodate reconfigurations and other changes, enabling a variety of uses. Adaptable laboratories allow universities and R&D centres to meet changing future needs while minimizing renovation costs and avoiding operational downtime. Key principles for establishing adaptable R&D laboratories include:

1. Flexible Laboratory Interiors:

Bench Areas: These are included in the initial design to accommodate either fixed or movable benches.

2. General Laboratory Equipment:

Mobile Laboratory Furniture: This may include movable tables and base cabinets. It allows researchers to set up and equip the lab based on their needs, rather than adjusting to predefined fixed benches.

- The building shall be spacious and adequately sized to serve its intended purpose without overcrowding equipment, personnel, or materials. Sufficient workspace shall be provided to perform tasks properly, and adequate storage must be available for raw materials and tools.
- The size of machines and benches shall be compatible with the available space and shall be easy to clean and maintain.

4. Sustainability:

Sustainability means meeting our own needs without compromising the ability of future generations to meet theirs. This involves developing new technological, operational, and behavioural approaches to enhance

environmental performance, creating spaces that are safe, inclusive, and well-connected, while maintaining sound economic practices. Laboratories are centres of scientific discovery and innovation, housing both critical research and the scientists and equipment behind it. However, all of this scientific activity requires energy and highly ventilated spaces. To address this challenge, it is essential to implement workplace strategies that reduce the environmental footprint of our laboratories and transform them into eco-friendly homes for the science of tomorrow.

Pilot Plants in the Food and Feed Industry:

A pilot plant for food or feed production is a scaled-down facility designed to produce food or feed in testable quantities (up to 1,000 liters). These facilities are used to develop and trial new products in industrial-like environments. Pilot plants serve as a bridge between product development and large-scale commercial production. They play a crucial role in process development, providing vital information that can later be applied in industrial applications. In the food industry, pilot plants are indispensable tools offering detailed insights into processes such as oil production, dairy and meat processing, among many others. This knowledge is essential for key factors like flavor, nutritional value, and the quality of final products. Whether in research or education, pilot plants enable the achievement of results and the conducting of detailed studies on specific process stages and/or products. Additionally, in the food and feed industry, these systems are critical for improving conversion efficiency—from raw material reception all the way to packaging.

Key Features of the Pilot Plant:

- Process data collection
- Testing of materials and equipment
- Production of useful food products
- Possible long-term alternative for small-scale production

The pilot plant is characterized by flexibility, compliance with regulatory and quality requirements, and scalability, including the following :

- The plant design applies sanitary methods with smooth flow in the production lines, from raw material receipt to the final product, ensuring separation of operations that might cause cross-contamination.
- Storage areas are suitable based on the product and designed to prevent pest entry and facilitate cleaning.
- Raw materials are stored according to storage guidelines under conditions that protect them from contamination and rapid spoilage.
- Raw materials comply with the approved technical regulations for food products.
- Packaging materials do not contain any substances that cause undesirable sensory changes in the product, and they are processed in a way that does not lead to poisoning or affect the food that comes into contact with.
- Packaging materials are non-absorbent, tasteless, and odorless, ensuring protection of the product from contamination.
- The packaging process must be carried out under appropriate hygienic conditions. Ensuring product preservation methods that protect it against contamination, spoilage factors, infection, and any factors that may pose a risk to public health.

You can also refer to the Technical Regulation SFDA.FD/GSO 21 Titled "Hygienic regulation for food plants and their personal"

New Product Development:

The process of developing a new food product is considered one of the fundamental fields in research and development, contributing to the improvement of traditional products and the production of high-quality, sustainable food products, including the development of the ingredients used in food product formulation. Developing new food products requires companies to plan on a large scale, work diligently, and conduct extensive research over a long period before starting a new development project, it is essential to establish goals and timelines that define the future direction of the work. Companies pursue new product development with various goals, such as: acquiring new customers, or expanding into new geographic markets, or increasing profits, or enhancing brand impact, or gaining greater market share.

The new product development process involves several essential stages, which can be summarized into five phases: idea generation, research and investigation, feasibility study, market testing, and marketing. Below is a brief overview of each stage of new product development.

1. Idea Generation: The marketing team may be tasked with the initial development of ideas in collaboration with the research and development department. Ideas may also come from consumer feedback. Idea generation shall be informed by information about trending ingredients and consumer preferences through attending trade shows, monitoring new product releases from other companies, reviewing research articles and trade publications, and observing food product shelves.

2. Research and Investigation: Once the idea is generated, the product development steps begin. Research and investigation are the most important phases in the product development project. Comprehensive evaluation of product concepts helps decide whether to invest time and money in the project or to abandon it. Project ideas must align with organizational goals, as project managers review ideas throughout all stages of the development project to assess market acceptance of the concept, availability of necessary ingredients and equipment, and feasibility of regulatory procedures. Small companies may outsource assistance in this area.

Collaboration between departments during the research and investigation phase helps evaluate key factors in product development, including financial and legal considerations, availability of processes and equipment, purchasing power and ingredient accessibility, market shifts, and consumer perceptions.

3. Feasibility Study: Business feasibility considerations include reviewing technical regulations and standard specifications for food and feed products, which can be obtained from the Standards Store – [link]. It is also essential to confirm the availability of raw materials, equipment, facilities, and processes required for manufacturing the product. Additionally, it is important to develop an estimate of manufacturing and marketing costs, including fixed and variable costs.

4. Market Testing and Consumer Research: These are fundamental parts of the product development process. Consumer testing is essential; without it, companies have no way to understand consumer needs, preferences, willingness to purchase. Market testing provides valuable information for subsequent marketing plans. Consumer research is conducted by producing small quantities of the developed food product to study consumer preference. This is often done through home visits where

consumers perform sensory evaluations and express their liking or disliking of the product. Marketing staff within the company can assist by using their expertise to interpret evaluation results.

5. Marketing: Marketing can begin after completing site establishment, building, equipment, facilities, and staffing. Consumer feedback collected during market testing shall be considered. Common methods to market new products include billboards, television advertisements, and social media platforms.

Example of a New Product Development Stage Model:

The Stage-Gate platform model contains five basic stages:

- **Stage 1 – Scope:**
  A quick, inexpensive preliminary investigation to define the project scope; it is considered theoretical research.
- **Stage 2 – Design:**
  Detailed investigation including initial research (customer, market, technology), which leads to a business case that defines the product and project, project justification, and the proposed development plan.
- **Stage 3 – Development:**
  Actual detailed design and development of the new product and design of the required production processes for large-scale final production.
- **Stage 4 – Scale-up:**
  Laboratory, pilot plant, and market tests to verify the proposed new product, branding/marketing, and production or operational plans.
- **Stage 5 – Launch:**
  The start of full-scale operations, production, marketing, and sales.

Performance Evaluation and Improvement:

Focusing on quality improvement is essential, which involves maintaining quality factors by monitoring the product during processing, distribution, and display. This can be achieved by:

- Defining performance indicators for monitoring and measurement to ensure accurate results, whether related to outputs such as the number of ideas, number of innovation initiatives, or productivity measures such as experiment speed, collaboration effectiveness, or outcomes such as the number of implemented ideas, return on innovation investment.
- Analysing and evaluating innovation performance and verifying the effectiveness and efficiency of the management system.
- Conducting internal audits at planned intervals to ensure performance effectiveness and improvement.
- Identifying and selecting improvement opportunities and implements any necessary actions and changes to the management system, taking into account performance evaluation results.
- Maintaining documented information as evidence of results.

Summary

Research and development in the food and feed industries continuous to evolve to ensure product safety and quality improvement. It plays a vital role in growth and advancement in this field through product innovation and process enhancement. It is important for food and feed factories to have dedicated research and development management to keep pace with these developments and changes by employing practical expertise and modern technology. This contributes to meeting consumer needs and achieving public health by providing safe and healthy food solutions.