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The development and application of impact evaluation and project formulation methods in capacity building of food control systems in developing countries

Thèse

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Résumé

La sécurité sanitaire des aliments est un défi majeur pour de nombreux pays, qui restreint leur accès au plein potentiel économique et social qu'ils pourraient avoir. La bonne marche et la performance de haut niveau des systèmes de contrôle des aliments dans les pays développés sont le fruit de décennies d'investissements de l'ordre de milliards de dollars dans le renforcement des infrastructures et des capacités des acteurs de la sécurité sanitaire des aliments. Les pays en développement ne peuvent se permettre un processus aussi coûteux et un progrès aussi lent dans la construction de leurs systèmes de contrôle des aliments, en raison des innombrables conséquences négatives pouvant affecter la santé publique et le manque à gagner potentiel du secteur de production alimentaire et agro-alimentaire, souvent considéré comme secteur vital d'économies émergentes comme celles de ces pays, notamment du fait de sa contribution aux exportations et donc à la balance commerciale. Malgré le fait qu'une grande partie de l'aide internationale est acheminée vers l'amélioration des capacités et des pratiques en matière de sécurité sanitaire des aliments dans ces pays, les résultats sur le terrain restent peu visibles, et rarement durables, notamment en ce qui a trait à la performance des programmes règlementaires qui sous-tendent les systèmes de production alimentaire de ces pays. L'étude des conditions d'amélioration et d'optimisation de l'efficacité des investissements en matière de renforcement des capacités en sécurité sanitaire des aliments dans les pays en développement n'implique pas seulement la nécessité de définir de meilleures directives sur la formulation des projets et l'évaluation de l'impact, mais doit passer par l'élaboration de nouvelles approches, notamment des approches décisionnelles ancrées dans l'analyse de données factuelles du terrain, afin d'identifier et de définir les contours des investissements nécessaires. Pour relever ce défi, ce travail a procédé à une revue critique des approches et outils actuels appliqués par les agences de développement, actives dans le domaine de la sécurité sanitaire des aliments. Cette revue a permis l'identification de critères de succès et des bonnes pratiques appliquées au sein de ces organisations, notamment en matière de gouvernance et de gestion des activités de renforcement des capacités en sécurité sanitaire des aliments. Une étude comparative a suivi deux pays sélectionnés sur la base de critères définis : le Pakistan et le Viet Nam, en analysant les approches d'investissement dans le renforcement de la sécurité sanitaire des aliments et leurs retombées dans chacun de ces pays. Les leçons apprises et les recommandations tirées

de ces analyses ont été mises à profit dans le développement et la proposition de nouveaux outils et directives à appliquer dans les initiatives de renforcement de capacités en sécurité sanitaire des aliments, tout au long du cycle de vie de ces initiatives. Enfin, ce travail a conduit à l'élaboration d'une approche ancrée dans l'analyse des données pour guider le processus décisionnel de la conception, de la mise en œuvre et de la surveillance de projets de renforcement de la sécurité sanitaire des aliments. Cette approche tient également compte des sections pertinentes des directives du Codex Alimentarius et d'autres retombées de recherches associées à la prise de décision dans les politiques publiques, fondées sur l'analyse de données. Il est attendu que la nouvelle approche proposée par cette recherche ouvre des perspectives nouvelles vers une meilleure efficacité et efficience des investissements actuels et futurs en matière de renforcement des capacités en sécurité sanitaire des aliments.

Abstract

Food safety remains a challenge for many countries, limiting their ability to maximize the economic and social potential and attain their objectives of human and economic development. The high-level performance of robust food control systems in developed nations has resulted from decades of experience and billions of dollars' investments in building infrastructures and capacities of food safety stakeholders. Developing countries cannot afford such a costly and lengthy process due to the negative consequences of unsafe food affecting their public health and agri-food trade. Although a large sum of international aid is being channeled towards the upgrade of food safety capacities and practices in these countries, results on the ground can often be invisible and struggle with sustainability issues, particularly for enhancing the performance of food control systems. Investigating the possibility of improving the "value for money" of these investments in developing countries entails setting better guidelines on project formulation, impact assessment and approaches in food regulatory decision-making. As outlined in this research, the latter can be further explored by better using data for the evidence-based identification of required capacity building investments and their prioritization. This research examines and recommends an integrated approach with short- and long-term solutions to achieve such a goal. It also offers a review of current technical methods and strategies followed by development agencies active in food safety and identifies current best practices applied by such agencies, especially related to food safety capacity building. This research relies on a comparative analysis of food safety capacity building programs targeting two countries, namely Viet Nam and Pakistan, selected based upon defined criteria. The lessons learned and recommendations gained from these analyses were used to develop a new set of proposed guidelines for project formulation, implementation, and evaluation. Development agencies and competent authorities could adopt these guidelines to improve their capacity building practices. As a long-term solution for identifying capacity building needs and performance assessment of food control systems, a data-driven food regulatory decision-making approach was discussed as a possible way forward for regulators. This system was structured based on the relevant sections of Codex guidelines and other research, focusing on using data for public services. It is expected that the application of the recommendations stemming from this research will help shape a new way for food safety capacity development, improving the efficiency and

effectiveness of investments in this area, with a potentially positive impact on other development areas.

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Abbreviations

API	-	Application programming interface
CCFICS	-	Codex Committee on Food Import and Export Inspection and Certification Systems
COAG	-	Committee on Agriculture, FAO
Codex	-	Codex Alimentarius Commission
DAC	-	Development Assistance Committee
DALY	-	Disability-adjusted life year
EFSA	-	European Food Safety Authority
FAO	-	Food and Agriculture Organization of the United Nations
FBO	-	Food business operator
GAP	-	Good Agriculture Practice
GFSP	-	Global Food Safety Partnership
GFSI	-	Global Food Safety Initiative
GMP	-	Good Manufacturing Practice
HACCP	-	Hazard Analysis and Critical Control Points
IFAD	-	International Fund for Agricultural Development
IICA	-	Inter-American Institute for Cooperation on Agriculture
IPPC	-	International Plant Protection Convention
ITC	-	International Trade Centre
JEFCA	-	Joint FAO/WHO Expert Committee on Food Additives
LMICs	-	Low- and middle-income countries
ODA	-	Official development assistance
OIE	-	World Organization for Animal Health
PPI	-	Policy priority inference
PVS	-	Performance of veterinary services
SDG	-	Sustainable Development Goal
SPS	-	sanitary and phytosanitary

STDF	-	Standards and Trade Development Facility
UNIDO	-	United Nations Industrial Development Organization
WHO	-	World Health Organization
WTO	-	World Trade Organization

Lexicon

Activity: "action taken or work performed through which inputs, such as funds, technical assistance and other types of resources, are mobilized to produce specific outputs" (UNDG, 2011).

Baseline: the "information gathered at the beginning of a project or programme against which variations that occur in the project or programme are measured" (UNDG, 2011).

Big data: a large volume of data received at a high velocity and in various areas to support understanding of trends and characteristics of a specific domain.

Capacity development (or capacity building): the process by which individuals, groups and organizations, institutions, and countries develop, enhance and organize their systems, resources, and knowledge; all reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives.

Competent authority: a governmental body involved in the operation of the food control system.

Conditions for success: best practices in the form of recommendations that can improve the likelihood of achieving project objectives.

Data-driven food regulatory decision-making: food regulators make scientific evidence-based regulatory and policy decisions, using reliable and big data gained on the performance of a food control system.

Donor: a national, regional, or intergovernmental entity that provides financial support to developing countries to improve their economic and social conditions.

Evaluation: an assessment, conducted as systematically and impartially as possible, of an activity, project, program, strategy, policy, topic, theme, sector, operational area or institutional performance. It analyses the level of achievement of both expected and unexpected results by examining the results chain, processes, contextual factors, and causality using appropriate criteria (UNDG, 2010).

Food control system: a system developed by national governments and competent authorities to protect consumer health and facilitate enhanced trade by ensuring the safety and wholesomeness of food products.

Food safety capacity building: enhancing technical capacities and practices of the industry or the competent authorities to ensure and promote better food safety outcomes.

Food safety culture: A Technical Working Group (WTG) of the Global Food Safety Initiative (GFSI) used the definition of food safety culture developed by as "shared values, beliefs and norms that affect mindset and behavior toward food safety in, across and throughout an organization" (Griffith, Livesey and Clayton, 2010).

Food safety life cycle: the changing correlation between the economic burden of food safety and the development level of countries (Jaffee *et al.*, 2018).

Goal: a specific end result desired or expected to occur as a consequence, at least in part, of an intervention or activity. It is the higher-level objective that will assure national capacity building to which a development intervention is intended to contribute (UNDG, 2011).

GovTech: digital technology to improve the performance of public authorities, using big data.

Impact: "changes in people's lives which include transformation in knowledge, skill, behavior, health or living conditions for children, adults, families or communities. Such changes are positive or negative long-term effects on identifiable population groups

produced by a development intervention, directly or indirectly, intended or unintended. These effects can be economical, socio-cultural, institutional, environmental, technological or of other types" (UNDG, 2011).

Impact assessment: the comparison between the effect of food safety capacity building initiatives with their expected outcomes envisaged during the project formulation phase

Logical framework or logframe: a project management tool that contains the results chain, the project performance indicators supported by a source of verification, and assumptions to achieve higher level targets.Results framework in some places referred to as logical framework (World Bank Group, 2012) in other documents as results matrix (UNDG, 2010, 2011) which showcase the different forms and applications of RBM within the UN family.

Marketability: the level of interest shown by food safety competent authorities and donors to endorse the capacity building initiative, demonstrated through a financial commitment by the donor and buy-in by the recipient organizations and program partners.

Outcomes: "changes in the institutional and behavioral capacities for development conditions that occur between the completion of outputs and the achievement of goals" (UNDG, 2011).

Outputs: changes in skills or abilities and capacities of individuals or institutions or the availability of new products and services that result from the completion of activities within a development intervention within the organization's control. They are achieved with the resources provided and within the time specified.

Performance indicator: "a unit of measurement that specifies what is to be measured along a scale or dimension but does not indicate the direction or change. Performance indicators are a qualitative or quantitative means of measuring an output or outcome, intending to gauge the performance of a programme or investment" UNDG, 2011).

Productivity loss: the aggregated cost of the people's inability to work and additional public expenses caused by foodborne diseases.

Project formulation: design of a capacity building or technical assistance initiative;

Project life cycle: it encompasses project formulation or design, implementation, and finally evaluation. The monitoring of results is considered a continuous process from the beginning of the implementation until the project ends.

Result: a describable or measurable change in state which is derived from a cause-and-effect relationship (UNDG, 2011)

Results-based management: "a management strategy by which all actors, contributing directly or indirectly to achieving a set of results, ensure that their processes, products and services contribute to the achievement of desired results (outputs, outcomes and higher level goals or impact)" (UNDG, 2011).

SMART-checklist: the abbreviation of Specific (specification of measurement in a concise manner), Measurable (quantitative or qualitative measurement based on agreed expectations and criteria of performance and accompanied by feasible methodologies and resources), Appropriate (relate to the project goals and objectives), Realistic, and Temporal or Time-bound (measurable within the project timeframe) (Van Der Werf, 2007).

Target: "a particular value that an indicator should reach by a specific date in the future" (UNDG, 2011).

I would like to thank everyone who has encouraged me to achieve this milestone. I particularly would like to thank my wife, Yasmine, my family, and friends for their support. Without the effortless help of the PARERA team, it would not have been possible to conduct this research. Finally, Samuel, who was the best mentor I could wish for this research, encouraged me to think out of the box.

Introduction

Foodborne illnesses cost around US$ 110 billion in productivity loss and medical costs in low- and middle-income countries (Jaffee *et al.*, 2018), not to mention the adverse effects on businesses due to recall procedures and border confiscation. Unexploited trade opportunities create further economic development issues for developing countries. To overcome these challenges, governments of developed countries and international development agencies offer their support through official development assistance (ODA) to build national and regional food control systems of their less developed partners. Setting up a food control system entails multiple specializations and a long-term collaborative culture among development agencies that can only be offered by international development partners mandated to serve this duty. At the same time, technology offers new opportunities for developing countries to accelerate their endeavors in improving their food safety capacities and becoming a robust system in a faster manner than more developed nations have in the past.

Throughout its evolution, humankind became more and more knowledgeable about the critical implication of the production and consumption of safe food and the benefits of a healthy and nutritious diet. Improved practices in terms of volume, safety, and quality allowed tackling challenges related to food security, as also mentioned in the 1996 World Food Summit declaration. However, changing global consumption trends and nutrition landscapes supported by access to safe food also caused the appearance of the double burden of malnutrition, adding obesity to the list of nutritional issues in emerging markets and developed countries.[1] Subsequently, it is self-evident that food systems are affected by multiple social, economic, environmental, and biological factors at the national and global levels. Hence the constant effort by many governments to tackle these issues most efficiently and appropriately remains a priority in their economic development agenda. Reaching the stage of robust practices in food safety also contributes to economic development and better public health in developing countries regardless of the gross national income linked to agricultural production and food processing. Improved food safety practices translate to

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[1] According to the website of WHO on nutrition, "in 2014, more than 1.9 billion adults worldwide, 18 years and older, were overweight while 462 million were underweight. More than 600 million obese." Link to the website: https://apps.who.int/nutrition/double-burden-malnutrition/en/index.html

improved public health and productivity by reducing the number of foodborne illnesses and related health care costs.

Today, it is perceived that no shortcut can be taken to reach an adequate stage of development and become a robust food control system. As indicated in the *Trade and Food Standards* report (FAO and WTO, 2017), "planning for capacity development must not only involve cross-sectoral consultation to identify and prioritize weaknesses to be addressed, but also consider the conditions necessary to ensure that investments lead to improvements in the system that can be sustained." Impactful and sustainable investments must consider best practices based on the lessons learned from previous initiatives. If a capacity building initiative has not reached its objectives, development partners can still retrieve valuable information during the evaluation stage to avoid such problems in the future. This can be communicated to other right stakeholders through adequate channels providing valuable information.

Nevertheless, international development agencies have received criticism for their effectiveness and ability to collaborate and support countries in achieving their own development goals. To further improve the marketability and efficiency of investment practices through ODA, identifying best practices in food safety capacity building is inevitable. Marketability refers to the level of interest shown by food safety competent authorities and donors to endorse the capacity building initiative and demonstrated through a financial commitment by the donor and buy-in by the recipient organizations and program partners.

This research introduces a novel approach for project formulation and evaluation of food safety capacity building initiatives, increasing their likelihood of success and achieving their foreseen outcomes. As part of this, new practical tools for developing and evaluating these initiatives are offered, which could be deployed by competent authorities and international development agencies quickly. The research also conceptualizes a system for developing countries to allow them to accelerate the development of their food safety capacities and practices by utilizing data and new digital solutions in a socially and economically inclusive manner. A data-driven food regulatory decision-making system may also support more

accurate identification of the required capacity building investment needs through a more robust performance monitoring framework.

1. Hypothesis

Developing countries will require more development assistance and technical support to establish national food control systems, and thereby the research hypothesis was defined as follows: **Integrated and synergized food safety capacity building initiatives have a higher likelihood of achieving their intended impact and long-term sustainability than separate initiatives planned and implemented by different agencies**.

A systematic review was conducted on the current concepts and principles in food safety capacity building and the different approaches and tools used and developed by international organizations to thoroughly investigate the hypothesis. Thereafter, a comparative analysis of two selected case studies scrutinizes former food safety projects in two countries. This analysis is followed by a review of current food safety capacity building practices along the project life cycle, leading to the design of new tools for project formulation and evaluation in food safety capacity building.

As a corollary of this work, the last chapter discusses how food safety capacity building initiatives can become more marketable and improve their likelihood of success by deploying or going beyond and applying a data-driven approach among food regulators. This decision-making mechanism will allow for better monitoring and evaluation of capacity building outcomes and even seamlessly identifying the required investments to achieve or maintain the robustness of food control functions. For instance, current project design practices require comprehensive assessments, system evaluation, and negotiations among beneficiaries, donors and development agencies, taking from 6 to 24 months until the project implementation begins. The application of data-driven decision-making mechanisms could significantly reduce the efforts during the project design phase and enable the identification of investments with the highest priority by reducing the duplication of review processes in project formulations and having a more robust performance monitoring system.

2. Research objectives

To adequately address these points, the research has four outputs:

Output 1. Current food safety capacity building approaches and tools of relevant organizations are mapped and analyzed to identify current practices applied by international organizations in developing countries

Output 2. A methodology is developed to identify and select comparable country case studies, where food safety capacity building initiatives are identified, analyzed, and their outcomes compared based on a set of conditions for success.

Output 3. Building on lessons learned from the comparative analysis complemented by international best practices applied by development partners, guidelines for capacity building project formulation and evaluation are designed for competent authorities and development practitioners to improve the likelihood of success for investments made in food safety.

Output 4. A data-driven food regulatory decision-making system is conceptualized to allow its establishment and the monitoring of its performance. When adopted, this approach would lead to seamless identification of food safety capacity building needs and to develop more structured, relevant, and marketable investment opportunities.

3. Research structure

To verify the hypothesis and associated objectives, this research has adopted the following structure:

- **Chapter 1** of the research will be devoted to an systematic review of international organizations' mandates, strategies, approaches, and capacity building tools applied in food safety capacity building. This systematic review covers international organizations as they are the only bodies that can provide food safety-related technical assistance in a structured manner. International organizations tend to follow a more organized conceptual framework than consulting agencies; it is easier to evaluate the tools developed and applied for food safety capacity building. The research will provide a short description of food safety-specific services of the organizations, their relevant existing strategies, and policies as well as tools utilized in food safety. The publications developed by international organizations to build food safety capacities, such as capacity evaluation and assessment tools, will be mapped and organized in a catalog (Annex 1).

- **Chapter 2** will encompass a methodological aspect with the initial development of criteria for selecting the case studies used for the comparative analysis. Based on the methodology, the countries and corresponding investments will be identified, analyzed and compared based on a set of lessons learned which can serve as a condition for success. One of the selected countries is covered by multiple food safety capacity building investments implemented by several development agencies, and the other country features one major investment initiative in food safety.

- **Chapter 3** aims to harness the comparative analysis's findings described above and develop enhanced guidance and new tools to achieve a higher likelihood of success and impact of planned food safety capacity building initiatives. The chapter starts with a theoretical review of results-based management and previously identified international best practices in food safety capacity building, which will be used together with the results of the comparative analysis to introduce a quickly deployable and more robust approach in planning and executing food safety initiatives in developing countries. Then it will provide practical guidelines in the form of tools for project development and evaluation. To better execute these evaluations, the research will look into evaluators' required competencies, thus ensuring better and more in-depth feedback for the improvement of practices and identification of complementary interventions.

- **Chapter 4** will focus on fostering an innovative approach for food safety capacity needs assessment, project planning, formulation, and evaluation, relying upon a data-driven approach. This chapter will describe the overall conceptual framework of a data-driven food regulatory decision-making system that could lead to using new digital solutions as an engine and data as a fuel to create more effective capacity building initiatives. In addition, this mechanism can enhance the monitoring of the performance of a food control system, identify and prioritize capacity building needs. This chapter will open the perspective of the information technology (IT), and artificial intelligence (AI) mediated tools that can be developed to support the consistent operation of data-driven food regulatory systems. This research ultimately re-emphasizes the multidisciplinary nature of food safety and, therefore, the cross-over of various areas of expertise to be integrated when developing food safety

capacity building interventions. This is a crucial consideration for the establishment of guidelines in project development and evaluation. A comprehensive approach accounting for all the relevant disciplines involved in food safety and their inter-dependencies was followed throughout the research.

The results of this research will allow food safety development practitioners to improve the likelihood of success and efficiency of capacity building investments. In addition, the research also offers a conceptual approach to food regulators to enhance their practices benefiting from the opportunities of new technologies. A lexicon was also developed, which provides definitions for the terminologies used throughout this research.

Chapter 1. Global governance in food safety capacity building

Safe food entails the presence of effective organization of shared responsibility among stakeholders in a food control system. Competent authorities, consumers, and the food industry have to fulfill their specific duties in the form of the "from farm to fork" continuum, where businesses have the ultimate duty to ensure food safety. When interventions are needed to address obsolete practices or underperformance in food safety, actors can be categorized into four groups, offering capacity building services in a developing country:

　　1) international organizations
　　2) private enterprises or consulting firms
　　3) national and regional competent authorities from developed countries
　　4) academia.

Although each group has an added value, the present research only focuses on international organizations as they provide structured and systematic technical assistance compared to other parties. This chapter will offer a systematic review of the most pertinent concepts and trends in food safety capacity building.

1. Methodology

The review results from a search using the keywords of "capacity building" and "food safety" in Scopus and Web of Science databases. Some of the academic articles were very much focusing on the trade-aspect of food safety and sanitary and phytosanitary (SPS) compliance (Henson and Jaffee, 2006; Büthe, 2008; Henson and Masakure, 2012; Ferro, E., Wilson, J.S., 2013; Kang and Ramizo, 2017) and others (Henson, 2003; Unnevehr, 2015; Vipham, Chaves and Trinetta, 2018) on food safety from a development perspective. Even though these research activities discussed food safety capacity building, they did not touch upon the review of existing actors in food safety capacity building. An additional search was performed to identify publications developed by international organizations (OECD, 2003; FAO, 2007; STDF, 2011; Jaffee *et al.*, 2018), which usually are not available on the aforementioned academic databases despite their importance and depth of research. Publications and analytical reports were collected from the official websites of these organizations. These will be used as literature for the comparative analysis of case studies conducted in the second chapter.

The following international organizations are mandated to provide technical assistance services in food safety to developing countries: the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), the International Finance Corporation (IFC) of the World Bank Group (WBG), the World Organization for Animal Health (OIE), the United Nations Industrial Development Organization (UNIDO), the International Fund for Agricultural Development (IFAD), the International Trade Centre (ITC) and Inter-American Institute for Cooperation on Agriculture (IICA). The Codex Alimentarius Secretariat and the International Plant Protection Convention must be mentioned due to their standard-setting role, even though they do not provide capacity building services to their member states. Together with the OIE, they are known as the Three Sisters and have the mandate to develop relevant standards from a food safety and SPS perspective. However, unlike the other two organs, the OIE also provides certain capacity building services to countries. In addition to the development agencies, public and private sector-led international platforms are relevant actors, such as the Standards and Trade Facility Development (STDF) or the Global Food Safety Initiative (GFSI). This chapter elaborates on the food safety-specific services of these organizations, their current strategies on food safety, and the existing capacity building tools developed by them through a systematic review. As an additional outcome, a catalog or mapping of capacity building tools will be developed, which will make these tools more accessible to beneficiaries and practitioners involved in this field. Finally, it must also be noted that some tools and guidelines might be obsolete in terms of content; their detailed review is out of the scope of this research and should remain the responsibility of agencies.

2. Basic principles and concepts in food safety capacity building

2.1. Food safety in the food paradigm

Having access to safe and nutritious food is a human right. Within the food paradigm, humanity faces multiple challenges nowadays to achieve the second sustainable development goal (SDG) of the United Nations called Zero Hunger, *inter alia*, food safety, food quality, food fraud, food insecurity, and food defense and malnutrition. These challenges can occur in any country, regardless of its economic development level. They are often also linked to each other, which, among others, derives from inadequate preventive control measures of competent authorities to enforce relevant regulations related to food. The proper development

and implementation of food safety standards can address many of these issues by positively contributing to the safety and quality of the product from organoleptic and nutritional aspects. "This distinction between safety and quality has implications for public policy and influences the nature and content of the food control system most suited to meet predetermined national objectives" (WHO, 2015b).

2.2. Investment challenges in food safety capacity building

A recent study (GFSP, 2019) indicated that 323 food safety capacity building projects received US$ 383 million of investments in Africa over the period 2010-2017, mainly funded by the European Commission, the United States of America (USA), FAO, and WHO (GFSP, 2019). These investments in enhancing the national capacities of a food control system are a fundamental necessity (FAO and WTO, 2017) to improve public health and facilitate enhanced trade. To join the global agri-food trade and therefore conform with the requirements of its legal regime embedded in the SPS and Technical Barriers to Trade (TBT) Agreements in the WTO, food safety is an enabler for developing countries but often also an obstacle. The lack of expertise in food safety creates a scientific obstacle to fulfill the obligations stipulated in international trade agreements. Due to the complexity of a food control system's conceptual framework, FAO and WTO publication split it into three broad areas: 1) legislative, institutional, and policy frameworks; 2) the scientific evidence-based risk analysis to support food control decision-making; and 3) technical capacities for program implementation and monitoring (FAO and WTO, 2017).

Closely linked to the improvement of food control systems, Roberts & Unnevehr (2005) have identified seven globally accepted and predominant trends in setting food safety regulatory systems which should be considered during the formulation of capacity building initiatives:

1. The growing use of risk analysis;
2. Establishing public health as the primary goal of food safety regulation;
3. Emphasizing a farm-to-table approach in addressing food safety hazards;
4. Adopting the Hazard Analysis and Critical Control Point (HACCP) system to regulate microbial pathogens in food;
5. Increasing the stringency of standards for many food safety hazards;
6. Adding new and more extensive regulations to handle newly identified hazards, and;

7. Improving market performance in food safety through the provision of information.

To introduce these practices based on the global trends, development agencies deliver food safety capacity building interventions through different approaches and tools developed by them based on their mandates. These agencies work in silos in some countries without proper coordination, negatively affecting their interventions' results.

These inefficiencies led to the rising criticism of aid effectiveness among the donor community, which requested evidence-based capacity building approaches throughout the project cycle (Marschall, 2018), improving global dialogue on evaluation practices, and adopting standardized indicators for further results aggregation (Bamberger, Rao and Woolcock, 2010; Holzapfel, 2014). For this reason, there is an emerging interest from the development community, including donor organizations, to improve their impact evaluation (Garbarino and Holland, 2009) and periodically review the relevant international guidelines and principles based on the lessons learned.

2.3. Definition of food safety and SPS measures

The primary purpose of food safety is to ensure the **safeness** of food for consumption, which can only be achieved through proper practices "from farm to fork" and a well-performing national food control system. Food safety is a shared responsibility among industry, competent authorities, and consumers, where the food businesses have the ultimate duty to ensure the safety of food throughout its production process.

Although there is no globally agreed definition, food safety is generally defined by academia as "the biological, chemical or physical status of a food that will permit its consumption without incurring excessive risk of injury, morbidity or mortality" (van der Meulen, 2010). The Food and Agriculture Organization (FAO) defines food safety as "the absence, or safe, acceptable levels, of hazards in food that may harm consumers' health. Foodborne hazards can be microbiological, chemical or physical in nature and often invisible to the bare eye; bacteria, viruses or pesticide residues are examples". A more natural science-driven definition, showing the interlinkages of each step from "farm-to-fork" was given by the World Health Organization (WHO) (2015b) by referring to food safety as

> limiting the presence of those hazards, whether chronic or acute, that may make
> food injurious to the health of the consumer. Food safety is about producing,

handling, storing, and preparing food in such a way as to prevent infection and contamination in the food production chain and to help ensure that food quality and wholesomeness are maintained to promote good health.

All three definitions show the importance of a preventive approach to avoid the occurrence of any hazards that may threaten (or impact) the safe and suitable consumption of food. The UN and food regulators emphasize the importance of adequate practices at each stage of the "from farm to fork" continuum.

In order to ensure food safety and avoid any impediments to trade, robust national regulatory systems need to be in place which follow international guidelines and principles in its operation and develop or adopt food standards, benefiting all consumers. The establishment of the *Codex Alimentarius Commission* serves to fulfill this goal. It allows the harmonization of food standards around the world in conjunction with the Sanitary and Phyto-Sanitary (SPS) [2] and Technical Barriers to Trade (TBT) Agreement of the World Trade Organization (WTO). Multiple studies were conducted on the potential negative consequences of the SPS and TBT Agreement (Henson *et al.*, 1999; Büthe, 2008; Gruszczynski, 2010) which can be further retain its potential when it is used as a trade protectionist tool (Kang and Ramizo, 2017). In a more specific manner, "SPS capacity refers to a country's ability to design, disseminate and implement SPS measures so as to achieve the appropriate level of protection (ALOP) against the risk faced, and to meet the SPS requirements of trading partner countries" (STDF and OECD, 2010). A robust food control system entails the capacity of "a strong management process of planning, organizing, monitoring, coordinating and communicating. To integrate these activities, a solid structure has to be in place, consisting of: i) institutions that cover the different required management activities; ii) individuals who are capable and willing to execute the necessary tasks correctly" (Van Der Werf, 2007). A range of SPS-related activities was identified and structured in a hierarchical system (World Bank, 2005).

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[2] The Annex A of the SPS Agreement of the WTO defines SPS measures as "measures intended to protect human, animal or plant life or health against risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms, or to protect human or animal health against risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs; or otherwise to prevent or limit damage from the entry, establishment or spread of pests".

2.4. Food safety as a multidisciplinary field

In the past decades, food safety became a multidisciplinary field by going beyond the classical food science discipline. Figure 1 attempts to categorize and list the different fields directly or indirectly linked to food safety, thus showing its transcendence from the original definition. A better understanding of its complexity emerged from the increased amount of research, reports, and discussions among regulators, international organizations, and academia.

Figure 1. Other scientific and non-scientific fields linked to food safety

Underlining the complexity of this field, a report produced during a Joint WHO/EURO-FSAI meeting stressed the importance of multidisciplinary teams, "including many specialists such

as public health practitioners, veterinarians, food scientists, environmental health specialists, microbiologists, public relations and personnel" (WHO and EURO-FSAI, 2001). As safe food can translate to better public health and economic development through enhanced trade, other scientific and non-scientific fields started to be explicitly applied to food safety. This classification (scientific and non-scientific) could also serve as the most fundamental difference.

As an academic field, food safety was initially considered an applied study within food science, focusing on chemistry, microbiology, and food technology. However, the non-scientific fields of food safety, such as quality management or food law, became fundamental to ensure adequate food safety and hygiene practices through regulatory measures.

2.5. Historical origin of food safety

As a constantly evolving multidisciplinary field, food safety started to gain attention among countries at the end of the 19th century. In the early 1970s, two decades after the establishment of the Codex Alimentarius Commission, a new international consensus was reached on reforming the food safety systems by improving national control mechanisms based on "the need for risk-based, scientifically supported policies that prevent food contamination and foodborne illness through integrated risk management from farm-to-table" (Hoffmann and Harder, 2010). Despite this widespread agreement, developing countries found themselves in a difficult situation. They struggled to enhance their control systems to match those of more industrialized nations (Unnevehr and Ronchi, 2014) due to the scarcity of natural, financial, and human resources. Many countries are still facing challenges accessing clean water which is elementary to ensure hygiene practices. Countries with limited financial resources cannot invest in building capacities of their private and public sector. In addition, there is a limited number of local experts and decision-makers in the public sector with a holistic understanding of the complexity and importance of food safety capacities. With a lack of food safety culture, all these limitations will pose challenges to developing countries catching up with Organisation for Economic Co-operation and Development (OECD) countries in terms of economic growth and public health.

2.6. Economic consequences of food safety issues in developing countries

Even though the socio-economic and health impact of foodborne diseases were known to the development community, its global magnitude was first presented in 2015 by the Foodborne Disease Burden Epidemiology Reference Group of the WHO in its report called *WHO Estimates of the Global Burden of Foodborne Diseases* (2015a). This report was the outcome of WHO Consultation to Develop a Strategy to Estimate the Global Burden of Foodborne Diseases in 2006 (WHO 2007). Summarizing the most critical statistics revealed by this report, 31 global hazards caused around 600 million foodborne illnesses and 420,000 deaths in 2010, resulting in 33 million disability-adjusted life years (DALY), from which 40 percent of the disease burden was among children below the age of five. The unequal distribution of foodborne diseases originates from the highest incidence and death rate and the most significant DALYs rate in Asia and Sub-Saharan Africa. Low- and middle-income countries (LMICs) "in South Asia, Southeast Asia, and Sub-Saharan Africa, which make up 41 percent of the global population, are estimated to account for 53 percent of all foodborne illnesses, 75 percent of foodborne disease (FBD)-related deaths, and 72 percent of FBD-related DALYs" (Jaffee *et al.*, 2018).[3] In economic terms, the World Bank (2018) estimated that the domestic costs of foodborne illnesses on the basis of productivity loss would be around US$110 billion for LMICs which "measured by gross national income per capita and associated with disability or premature death captured in DALYs." Even among developed countries, people below the poverty line often have more difficulties accessing safe and nutritious food. These estimates quantify food safety's economic and social importance. Further elaborating on the areas covered by food safety economic development, recurring research topics include (Unnevehr and Ronchi, 2014):

> 1) economies of scale can lead to a small firm or small farm exclusion due to the high investment cost to upgrade food safety management practices;
> 2) positive and negative impact of standards as a barrier or catalyst for trade;
> 3) food safety is one among many quality requirements (safety, appearance, nutritional content, convenience, or sustainability aspect); and
> 4) public-private partnerships in the form of co-regulation.

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[3] It is important to mention that these data are estimates and the 95 percent certainty interval can decrease or increase the calculated results by 5 percent. Furthermore, there are countries where a population census on was conducted long-time ago.

Showing interest in this research area, Unnevehr and Ronchi (2014) provide a literature review on best practices to address food safety challenges among food insecure communities in developing countries and highlight the different emerging trends in food safety, such as risk analysis framework or private certification. *The Safe Food Imperative* offers a more comprehensive revision and introduces the concept of the food safety life cycle (Figure 2), which categorizes food safety challenges and their economic burdens based on the level of economic development from low- and middle-income countries (LMICs) through emerging to developed markets. This comprehensive theoretical approach on the development level of food safety systems allows the prioritization of investments in a more structured and gradual manner by identifying potential food safety issues.

Figure 2. Food Safety Life Cycle With Levels of Economic Development
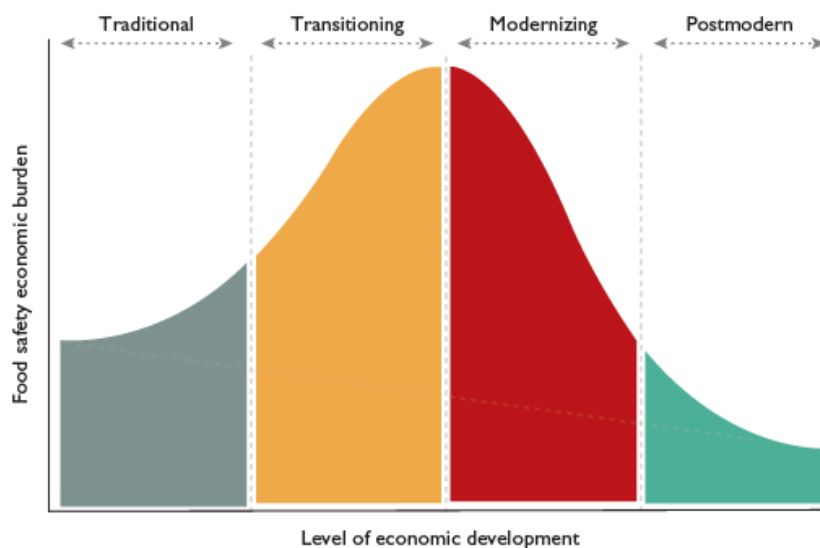
Source: Jaffe, S. et al. (2018) The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries. Washington D.C.: World Bank, p. 16

The scale and types of food safety burdens and the sources of chemical, microbiological and physical foodborne hazards change around the food safety life cycle, as shown in Figure 3. In the case of preventive food safety policy frameworks, regulators will not only be able to prioritize risks based on their market development level but prepare for emerging issues, such as food allergens. It is worth noting that food allergens, as a major global health concern, are not indicated in this categorization even though it impacts around 240-550 million people based on the World Allergy Organization's estimate (WAO, 2013). Food containing traces

of allergens without properly labeling information for consumers about their presence can have as severe consequences as food hazards.

Food control systems in developing countries are also highly impacted by inadequate policies as well as underinvestment by the public and private sector, and thereby they are very often considered as "weak food safety systems in terms of scientific evidence, necessary infrastructure, trained human resources, food safety culture, and enforceable regulations" (Jaffee *et al.*, 2018).

Figure 3. Sources of Foodborne Hazards by Stage of the Food Safety Life Cycle

Foodborne hazard	Stage of food safety life cycle			
	Traditional	Transitioning	Modernizing	Postmodern
Naturally occurring food toxins	Significant	Significant	Moderate	Minimal
Livestock zoonoses	Major	Significant	Significant	Minimal
Microbial pathogens	Moderate	Major	Significant	Moderate
Veterinary drug residues	Minimal	Moderate	Moderate	Minimal
Pesticide residues	Minimal	Moderate	Moderate	Minimal
Industrial contaminants	Minimal	Moderate	Moderate	Minimal
Food adulterants	Minimal	Moderate	Moderate	Minimal
Aquatic zoonoses, parasites, and toxins	Moderate	Significant	Moderate	Minimal
Contaminated or adulterated feed	Moderate	Significant	Moderate	Minimal
Food additives	Minimal	Moderate	Moderate	Minimal
Heavy metals	Minimal	Moderate	Significant	Minimal

Source: Jaffe, S. et al. (2018) The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries. Washington D.C.: World Bank, p. 17

Consequently, the shared responsibility mindset as part of the food safety culture tends to be lacking among the main stakeholders, namely the consumers, the industry, and the competent authorities, without a clear allocation of roles and responsibilities. This partially originates from the common misconception in many developing countries that competent authorities should show leadership and ensure safe food through its testing capacities. For this reason,

food safety capacity building initiatives need to support a culture change and promote and disseminate best practices among the targeted stakeholders. These will also allow developing nations to overcome some restricting circumstances related to SPS measures, vital for food trade. Unless new approaches are quickly applied by them, more decades will pass before they reach the same level of food control as the most industrialized nations. As an interim solution to benefit from international trade, many companies operating in countries with less-developed food control systems follow the requirements of private food safety assurance and certification programs. The negative implication of this situation is that these businesses often do not sell their safe products in the local market due to increased profit margin from the export markets.

Even though certain food safety training activities can be outsourced to the food safety service sector, much of the investment in control remains the government's responsibility. However, the required experience and know-how, including a solid scientific base offered by a developed educational system, are also lacking.

To overcome development challenges by adopting international best practices in food safety, governments rely on international development aid and related technology and knowledge transfer. These financial and technical assistances contribute to establishing enhanced national food control systems, local food safety services, and piloting food safety management systems in the private sector.

2.7. Definitions related to food safety capacity building

Starting with general concepts in international development, OECD (2007)[4] defines capacity development (or capacity building) as "the process by which individuals, groups and organizations, institutions and countries develop, enhance and organize their systems, resources, and knowledge; all reflected in their abilities, individually and collectively, to perform functions, solve problems and achieve objectives." Capacity building goes beyond human capital development to address underperformances in any system. Accordingly, four approaches of capacity building can be identified: organizational, institutional, systems, and

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[4]Access to the online glossary: https://stats.oecd.org/glossary/detail.asp?ID=7230

participatory (Vallejo and Wehn, 2016). FAO (2006) defines capacity building in food safety and quality as

> the process through which relevant stakeholders from farm to table (including government agencies, food enterprises, and consumers) improve their abilities to perform their core roles and responsibilities, solve problems, define and achieve objectives, understand and address needs, and effectively work together in order to ensure the safety and quality of food for domestic consumption and export.

The definitions of food safety capacity building successfully built on the general terminologies, adding the enhancement of existing practices and capacities in this regard, contributing to consumer safety locally and abroad. Furthermore, capacity building in food safety should be a continuous process to ensure adequate practices at all levels without limiting it to one area or one specific group of actors. These actors can be from the public and private sector, consumers, and academia, each having roles and responsibilities in the "farm-to-table" continuum. If any of them falls behind in this by not having adequate capacities, disequilibrium can emerge in the food safety systems, leading to more food safety issues and more protective measures and regulations. It is necessary to differentiate food safety capacity building undertaken in developing countries from those in the most developed nations since the developed nations usually have the required financial and technical resources to manage their challenges by themselves. Due to the lack of resources, developing countries rely on foreign aid and expertise to establish previously non-existing institutions or improve under-functioning capacities. The improvement of practices requires investments from food business operators, and export often provides a motive through higher income (Jaffee *et al.*, 2018). It does not necessarily mean that local consumers will have access to high-quality products, who then face the same public health issues as before.

Investing in national food control systems and industry development requires a structured approach supported by Codex guidelines and food standards, resulting in improved public health, trade, market access, and agricultural development (FAO and WTO, 2017). The World Bank report (Jaffee *et al*., 2018) provides recommendations and good practices in different segments of the food control system to improve food safety outcomes at different levels, as summarized in Table 1. Some of these recommendations should be considered already at the project formulation stage to ensure the required outcomes.

Table 1. Good practices for food safety capacity building in developing countries

Segment of the food control system	Good practices
Regulatory decision-making through risk-based robust evidence	- Transparency in legislation and operating procedures - Clearly defined institutional roles and responsibilities - Consistency and impartiality in the application of controls - Harmonized standards, guidelines, and recommendations - Recognition of other food control systems, including equivalence, among trading partners
Establishment and implementation of a more effective policy framework	Establishment of policy framework: - Adopt a food safety system perspective and an inclusive concept of food safety management - Shift the focus from hazards to risks and address risks at every stage of the agri-food chain - Shift from a reactive to a preventive orientation that anticipates risks and opportunities - Adopt a more structured and consistent approach to prioritized decision making Implementation of a policy framework: -Reform food safety regulatory practice, shifting from policing to facilitating compliance - Invest smartly in essential public goods for effective food safety management - Institutionalize a structured approach to food safety risk management

Capacity building programs to induce behavior change of the industry	- Education and awareness-raising for vendors, consumers, and government inspectors.
	- Providing basic food preparation equipment, which is sometimes accompanied by training and support for self-help groups
	- Registering, licensing, and rating vendors and their premises for food safety risks
	- Surveillance involving routine and seasonal checks by inspection teams; can involve using mobile test kits and checklists for raw materials, food handling, personal hygiene, and environmental surroundings
	- Infrastructure upgrades that improve access to potable water supply, access to electricity, and waste disposal systems; sometimes involve relocating vendors/operators

Source: Jaffee, S. *et al.* (2018) *The Safe Food Imperative: Accelerating Progress in Low-and Middle-Income Countries*. Washington D.C.

Food safety capacity building investments delivered by development agencies or specialized consulting companies and universities might follow different approaches. The approach might differ depending on the targeted beneficiaries and the scope. As a best practice, these projects should first raise awareness of a small, selected group of beneficiaries on international best practices and then establish a food safety culture by supporting carefully chosen stakeholders with the required.

Since food safety should be ensured in the farm-to-fork continuum, for instance, in the case of a specific food commodity, the value chain approach provides a potential solution by piloting the compliance capacities at each stage of the production and manufacturing. Many larger-scale capacity building interventions target enhancing the performance of a food control system while simultaneously piloting improved compliance capacities for a selected food commodity. The ultimate intervention approach should always be adjusted to the institutional, organizational, and regulatory system's development level and actors' ability to transform their practices. Before further exploring the different food safety capacity building

approaches followed by the different international development agencies, it is necessary to briefly outline how the governing forum of food safety standards and guidelines functions.

3. Codex Alimentarius Secretariat
3.1. Brief description of Codex

In the 19th century, food safety and hygiene-related laws and regulations started to emerge among the most industrialized nations, initially focusing on the establishment of protective measures for the sake of consumers, for instance, the Victorian Public Health Act of 1854 in Australia and New Zealand (van der Meulen, 2010) or 1906 Pure Food and Drug Act and the Meat Inspection Act in the United States (US FDA, 2017). As van der Meulen (2010) described, some legislative frameworks in Europe and Japan were reactions to random incidents or outbreaks, and others to fraudulent activities, sometimes impacting food trade. During this period, policymakers in the Austrian-Hungarian Empire has developed the first collection of standards and product descriptions called the *Codex Alimentarius Austriacus* between 1897 and 1911 (FAO and WHO, 2016).

The post-World War II period gave rise to increased international political and economic cooperation among countries, contributing to establishing the United Nations framework, and within that the Food and Agriculture Organization (FAO) in 1945 and World Health Organization (WHO) in 1948. From the early days of the agencies, technical collaboration through joint expert meetings on nutrition and other areas was established, which resulted in the initiation of the international food standards program in 1961 (Albert, 1995). In 1963, the Sixteenth World Health Assembly approved the formerly mentioned Joint FAO/WHO Food Standards Programme and agreed to establish the *Codex Alimentarius Commission* (CAC) or Codex as its principal organ. As a result, members states of FAO and WHO decided that the CAC has a dual role by protecting consumers' health, and ensuring fair practices in the food trade (Godefroy, 2014), filling a gap in the regulation and harmonization of food safety practices following empirical evidence and risk-based approach.

The Codex provides an annual platform for members to develop standards and related texts through its eight-step approach. These Codex standards, whether general or specific, could be usually distinguished into three types: 1) General Standards, 2) Guidelines, and 3) Code of Practice. The guidelines developed by the different committees of Codex are the most

pertinent documents to establish adequate practices or enhance the performance of food control systems.

3.2. Codex guidelines related to the national food control system and its functions

The Codex Guidelines providing general guidance to the appropriate design and adequate implementation of a national food control system and its different functions can be categorized as follows: guidelines 1) on the operation of a food control system; 2) on food trade-specific control measures, and 3) guidelines on international regulatory co-operation. Table 2 provides a collection of the most relevant Codex guidelines for food safety competent authority's control functions. However, these guidelines are not capacity building tools and therefore not included in Annex A.

Table 2. Codex Guidelines and their categorization based on their scope

Scope of guidelines	Specific guide from the Codex Alimentarius
Operation of a food control system	- *Working Principles for Risk Analysis for Food Safety for Application by Government (CAC/GL 62-2007)* by Codex Committee on Food Hygiene (CCFH); - *Principles and Guidelines for National Food Control Systems* (CAC/GL 82-2013) by CCFICS; - *Principles and Guidelines for Monitoring the Performance of National Food Control Systems* (CAC/GL 91-2017) by CCFICS.
Food trade-specific control measures	- *Principles for Food Import and Export Inspection and Certification (CAC/GL 20-1995)* by the Codex Committee on Food Import and Export Inspection and Certification Systems (CCFICS); - *Guidelines for the Design, Operation, Assessment and Accreditation of Food Import and Export Inspection and Certification Systems* (CAC/GL 26-1997) by CCFICS; - *Guidelines for the Assessment of the Competence of Testing Laboratories Involved in the Import and Export Control of Food* (CAC/GL 27-1997) by Codex

	Committee on Methods of Analysis and Sampling (CCMAS) (Adopted in 1997. Revision: 2006);
	- Guidelines for Food Import Control Systems (CAC/GL 47-2003) by CCFICS (Revision: 2006);
International regulatory co-operation	*- Principles and Guidelines for the Exchange of Information in Food Safety Emergency Situation* (CAC/GL 19-1995) by CCFICS (Adopted in 1995. Revision: 2004, 2016. Amendment: 2013);
	- Guidelines for the Exchange of Information between Countries on Rejections of Imported Foods (CAC/GL 25-1997) by CCFICS (Adopted in 1997. Revision: 2016);
	- Guidelines for the Development of Equivalence Agreements Regarding Food Imports and Export Inspection and Certification Systems (CAC/GL 34-1999) by CCFICS;
	- Guidelines on the Judgement of Equivalence of Sanitary Measures associated with Food Inspection and Certification Systems (CAC/GL 53-2003) by CCFICS (Appendix adopted: 2008)

In terms of capacity building activities, the Codex Secretariat, in collaboration with FAO, provides advisory support to competent authorities from developing countries through workshops organized at the regional level on food standards and the role of Codex. In order to support developing countries in their activities related to the full and effective engagement in Codex, the FAO/WHO Codex Trust Fund was established, and a small number of countries were already selected for technical support on a periodical basis.

4. Food and Agriculture Organization
4.1. Brief description of FAO's food safety related to activities
FAO has the lead role and mandate among international organizations when it comes to food and agriculture. In order to support developing countries in this regard, FAO member states have pledged 1) "to raise the levels of nutrition and the standards of living of their people, 2) to improve the production and distribution of all food and agricultural products, and 3) to

improve the condition of the rural population" (FAO, 1999). Besides its capacity building initiatives, FAO also hosts the Joint Secretariat of the Codex through its relevant division. Based on its official website, FAO assists Member Countries in building national food regulatory control systems through (FAO, 2019):

- Assisting national authorities to formulate evidence-based, enabling, and coherent policies;
- Helping governments review and update food legislation;
- developing institutional and individual capacities to perform risk-based food inspections, sampling, and analysis, risk-communication and food safety management;
- Working with local food producers to develop measures to prevent or minimize food and feed safety risks;
- Hosting the joint FAO/WHO Codex Alimentarius Commission, the global food safety and quality standard-setting body;
- Providing independent, broad-based scientific advice to Member Countries and Codex through expert bodies on Food Additives (JECFA), Microbiological Risk Assessment (JEMRA), and Pesticide Residues (JMPR);
- Contributing to food chain intelligence and foresight on food regulatory issues;
- Guiding countries on emerging issues such as antimicrobial resistance, whole-genome sequencing, and nanotechnology;
- Facilitating access to information through relevant platforms, databases, and tools to support food safety assessment and management;
- Promoting food safety emergency preparedness through the FAO Emergency Prevention System for Food Safety (EMPRES Food Safety) and rapidly sharing information during food safety emergencies through the International Food Safety Authorities Network (INFOSAN).

Since multiple development agencies are supporting countries based on their mandate, a mapping of services offered by key players would create a better understanding of the scope of services offered in food safety.

4.2. FAO strategies in food safety

FAO is currently in the process of developing its new organizational strategy, including food safety. In its most recent organizational strategic direction titled *Strategic Framework 2010-2019*, FAO has identified food safety as one of the most critical domains in rural development and agriculture. This strategy outlined eleven Strategic Objectives from which Strategic Objective D (sometimes referred to as Strategic Objective 4), called *Improved quality and safety of food at all stages of the food chain* (FAO, 2009), is the most pertinent from a food safety perspective. The objective aims (FAO, 2009)

to help ensure that internationally agreed standards and recommendations for food safety and quality are developed for continuous improvement of food systems globally, and assistance is provided to national governments to establish institutions capable of ensuring that national food safety and quality policies and regulations are in line with international recommendations.

As per this goal, there are four organizational results stated in the strategy:

- D1 - New and revised internationally agreed standards and recommendations for food safety and quality that serve as the reference for international harmonization;
- D2 - Institutional, policy, and legal frameworks for food safety/quality management that support an integrated food chain approach;
- D3 - National/regional authorities are effectively designing and implementing programs of food safety and quality management and control, according to international norms;
- D4 - Countries establish effective programs to promote improved adherence of food producers/businesses to international recommendations on good practices in food safety and quality at all stages of the food chain and conformity with market requirements.

Before the development of this organizational strategy, the Committee on Agriculture (COAG), one of FAO's Governing Bodies, has endorsed *FAO's Strategy for a Food Chain Approach to Food Safety and Quality: A framework document for the development of future strategic direction* (FAO, 2003), to provide further guidance on food safety. FAO (2003) defines the food chain approach "as recognition that the responsibility for the supply of food that is safe, healthy and nutritious is shared along the entire food chain – by all involved with the production, processing, trade, and consumption of food." The document also outlines five inter-related needs to support the food chain approach to food safety: (1) food risk analysis and institutional separation between science-based risk assessment and risk management; (2) tracing techniques (traceability); (3) harmonization of food safety standards; (4) equivalence in food safety systems; and (5) ex-ante risk avoidance or prevention at source. *FAO's Strategy for Improving Food Safety Globally* (2014) complements the efforts included in the food chain approach, outlining five key elements of this strategy for its achievement. Table

4 summarizes the strategic focus, outcome, and primary areas of the five key elements to understand the approach and expected outcomes better.

Table 3. 5 key elements of FAO's Strategy for Improving Food Safety Globally

A. Strengthening national food control regulatory capacities and global trade facilitation	
	Strategic focus: Provide leadership in supporting countries in the assessment and progressive development of food control systems.
	Outcome: Increasing numbers of countries are able to demonstrate improved capacities for food control that support national food safety goals and market access.
	Primary areas: Supporting steady improvement of national food control systems; Supporting the global trade facilitation agenda.
B. Supporting science-based food safety governance and decisions	
	Strategic focus: Provide sound scientific advice to underpin food safety standards.
	Outcome: Timely setting of risk-based standards that address current and emerging food chain issues and consumer confidence in a global food system based on sound science.
	Primary areas: Scientific advice to Codex; Scientific advice to countries and partners, Effective participation in Codex;
C. Enhancing food safety management along food chains	
	Strategic focus: Support developing countries to apply risk-based food safety management along food chains that are appropriate for national and local production systems and in compliance with Codex texts.
	Outcome: Reduced trade disruption due to non-compliance with food safety requirements.
D. Providing food safety platforms and databases	
	Strategic focus: Provide mechanisms that support networking, dialogue and access to information and facilitate effective communication internationally on key food safety issues.
	Outcome: Efficient communication and effective collaboration internationally on food safety issues.
	Primary areas: Databases supporting food safety management; platforms for communication.
E. Developing food safety intelligence and foresight.	
	Strategic focus: Play a major role in the collection, analysis, and communication of food chain intelligence.
	Outcome: Countries are better prepared for emerging food chain issues, and sustainability of food systems is promoted.

4.3. Revision of FAO thematic evaluation

Objective 4 from the FAO's Strategic Framework 2010-2019 has also undergone a thematic evaluation (FAO, 2017e) where further reference was made to the *Strategy for Improving Food Safety Globally*. The thematic evaluation covered FAO's intervention logic and its comparative advantage, the assessment of contributions based on the five key elements mentioned above, and finally, emerging areas of work related to food safety. During 2014-2017, FAO had 92 food safety projects, including 67 national, nine regional, and 16 global, with a total of $ 75.8 Million (FAO, 2017d). Despite the promising results found in all areas of its food safety strategy, the report also shared concerns regarding the limited capacities of the Organization to fulfill the demand in the forms of requests from countries to build their food safety capacities, address emerging issues, such as food fraud, and provide scientific advice concerning Codex standards (FAO, 2017d).

The thematic evaluation contains a mapping (Table 4) of development agencies, bilateral cooperation agencies, donors, and development finance institutions engaged in food safety capacity building and SPS compliance. According to the evaluation (FAO, 2017e), FAO is the only agency that has the complete specialization, competence, and mandate to address needs and gaps through a holistic approach, including the application of international standards setting (along with WHO); sanitary and phytosanitary (SPS) measures; as well as trade facilitation. Regardless of this broad scope of services, other agencies complement these and show significant contributions through their services in SPS and food safety compliance, quality infrastructure development, institutional and value chain performance development, and trade facilitation. The document also outlines the limited role FAO might play in these areas due to its regional/country office capacities to mobilize funds for formulating and implementing interventions. This report has also pointed out the difference between the intervention scope of development agencies. For instance, "UNIDO's principal target is the export-oriented food processing industry and trade practitioners, while the majority of FAO's interventions have targeted policymakers and institutions connected to food safety legislation and implementation mechanisms, especially related to aspects of food safety risk management" (FAO, 2017e).

Table 4. FAO comparative advantage mapping in food safety

Trade related Capacity Needs	Other Key Players	FAO strengths/constraints
International Standards Setting	WHO OIE - in cases where there are inter-relations with animal health	Unique positioning- from mandate
Surveillance, monitoring and crisis control in food chains	WHO, OIE	Technical strengths, presence at country level and active international networks.
SPS-related legislation and regulatory frameworks	WTO, World Bank, United Nations Industrial Development Organization (UNIDO), International Trade centre (ITC), European Union, European Union member states, United States Agency for International Development (USAID), Canada, Japan	Unique combination of expertise that covers all of the SPS domains, institutional entry points. However, bilateral cooperation linked to regional trade agreements, free trade agreements and funding sources determine selection of agencies
SPS compliance and quality infrastructure development	World Bank, Asian Development Bank (ADB), UNIDO, European Union, Japan, USAID, European Union member states, Global Food Safety Partnership (GFSP)	Unique combination of expertise that covers all SPS domains. Role limited by country-level strengths and ability to sign and implement extra-budgetary-funded projects
Technical capacities in institutions and value chains	European Union member states, USAID, UNIDO, ITC, United Nations Development Programme (UNDP) World Food Programme (WFP)	Role limited by country-level strengths and ability to sign and implement extra-budgetary -funded projects

Source: FAO (2017) *Evaluation of FAO's Contribution to Strategic Objective 4: Enabling Inclusive and Efficient Agricultural and Food Systems - Review of the implementation of FAO's Strategy for Improving Food Safety Globally.* Rome

4.4. Capacity building tools by FAO

FAO utilizes its scientific evidence-based training tools and publications to assist its Member states in managing food safety and quality by providing its scientific advice on food safety and food control measures[5]. Through its technical tools, FAO aims to enhance the capacities of food safety practitioners working in national food safety control systems, such as scientists, academics, regulators, trainers, food chain operators, and others and address a range of topics, which are:

- Assessment of food safety capacity building needs;
- Building effective food safety systems;

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[5] Most of the tools and publications developed by FAO listed on the following website:
http://www.fao.org/food/food-safety-quality/publications-tools/food-safety-publications/en/

- Enhancing participation in Codex activities;
- Good Hygienic Practices and Hazard Analytics / Critical Control Points (HAACP) systems;
- Food inspections;
- Food safety risk analysis;
- Origin-linked quality.

Thirty-four FAO publications were collected in this research, including manuals, guidelines, handbooks, tools, and methodologies intended for capacity building purposes of food control systems. Fourteen of them, particularly those related to food standards and food hazard risk analysis, were developed in collaboration with the WHO (Annex A). In addition, some consultation reports were also considered since these documents are the collection of best practices available for developing countries. However, documents and reports on the conduct of scientific risk assessment for a specific hazard are not considered for this part of the research since their objective is not to build the capacities of stakeholders. As part of the review, it was observed that not all documents were revised and recently updated despite increasing scientific evidence.

5. International Plant Protection Convention
5.1. Short description of IPPC

FAO also oversees the International Plant Protection Convention's (IPPC) operation, a multilateral treaty, aiming "to secure coordinated, effective action to prevent and control the introduction and spread of pests of plants and plant products." IPPC also contributes to the achievement of FAO Strategic Objective (SO) 2, "Make agriculture, forestry, and fisheries more productive and sustainable," and SO 4 on "Enable inclusive and efficient agricultural and food systems."[6] 183 countries, like contracting parties, govern the IPPC through the Commission on Phytosanitary Measures (CPM), which contains three major oversight bodies along with other subsidiaries: (i) CPM Bureau as a guiding organ to the IPPC Secretariat on strategic decisions, management, and cooperation; (ii) Standards Committee to oversee the standard-setting processes; and (iii) Implementation and Capacity Development Committee

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[6] More information about the IPPC's governance structure available on the https://www.ippc.int/en/core-activities/governance/

to oversee the implementation of technical assistance programs. As an integrated approach with the inclusion of natural flora and plant products protection, the Convention also contains other factors from transportation and storage to soil and other materials that can mitigate pests' spread. International cooperation, harmonization, and technical exchange are addressed through its framework and forums. The Convention also supports the adequate application of phytosanitary measures, resulting in the phytosanitary certification required to attest the compliance of products with international requirements. The standards developed by IPPC are recognized in the SPS Agreement of the World Trade Organization (WTO) as scientific benchmarks. IPPC also partners with other development agencies in the Standards and Trade Development Facility (STDF).

5.2. Tools developed by IPPC

Based on the mandate mentioned above, the IPPC has developed nineteen capacity building tools for its beneficiaries in institutional capacity building, market access, or electronic certification. The majority of these documents are guidelines (12) or training kits (6) to build the local capacities (Annex A). An assessment tool with related training materials was also developed, making it different from the other assessment tools.

6. World Health Organization (WHO)

6.1. Short description of WHO's food safety-related activities

The WHO aims to tackle food safety from a public health perspective based on its mandate. The 53rd World Health Assembly in 2000, as the main decision-making body of the WHO, urged the WHO "Member states to recognize food safety as an essential public health function and to help reduce the burden of foodborne disease" (WHO, 2014b). The WHO "aims to facilitate global prevention, detection and response to public health threats associated with unsafe food" (WHO, 2019b). To ensure consumers' confidence in their food supply being safe and their trust in the authorities, the WHO provides support to countries in building capacities for prevention, detection, and foodborne risk management by (WHO, 2019b):

- providing independent scientific assessments on microbiological and chemical hazards that form the basis for international food standards, guidelines, and recommendations, known as the Codex Alimentarius, to ensure food is safe wherever it originates;

- assessing the safety of new technologies used in food production, such as genetic modification and nanotechnology;
- helping improve national food systems and legal frameworks and implement adequate infrastructure to manage food safety risks. WHO and FAO supported the establishment of the International Food Safety Authorities Network (INFOSAN) to share information during food safety emergencies rapidly;
- promoting safe food handling through systematic disease prevention and awareness programs, through the WHO Five Keys to Safer Food message and training materials; and
- advocating for food safety as an important component of health security and integrating food safety into national policies and programs in line with the International Health Regulations.

6.2. WHO's Strategic Plan for Food Safety

WHO's food safety strategy called *Advancing Food Safety Initiatives: The Strategic Plan for Food Safety, Including Foodborne Zoonoses 2013-2022* was developed based on the World Health Assembly resolution WHA63.3, setting as its mission "to lower the burden of foodborne disease, thereby strengthening the health security and ensuring sustainable development of Member states" (WHO, 2014b). To achieve these goals, WHO (2014b) promotes proactive and efficient national food safety systems and maintain an international framework to support national systems through three strategic directions:

1. **Science-based decision-making:** provide the science base for measures along the entire food chain to decrease foodborne health risks;
2. **Cross-sectoral collaboration:** improve international and national cross-sectoral collaboration, and enhance communication and advocacy;
3. **Leadership and technical assistance:** provide leadership and assist in developing and strengthening risk-based, integrated national systems for food safety.

Based on these three strategic directions, WHO identified corresponding outcomes and performance indicators, activities, and actions. Like FAO, WHO's strategic actions mainly focus on the technical support to the competent authorities, paying limited attention to raising awareness of consumers or building compliance capacities of the industry. Table 5 summarizes the different strategic directions along with outcomes and corresponding indicators.

Table 5. Summary of WHO's Strategic Plan for Food Safety 2013-2022

<table>
<tr><td colspan="3">Strategic direction 1. Science-based decision-making: provide the science base for measures along the entire food chain to decrease foodborne health risks</td></tr>
<tr><td colspan="3">Outcome: Increased provision of scientific advice and development and implementation of food safety standards, guidelines, and recommendations</td></tr>
<tr><td colspan="3">Performance Indicator: Number of international food safety standards, guidelines, recommendations, and tools provided that enable Member states to implement prioritized actions and interventions to reduce foodborne health risks</td></tr>
<tr><td colspan="2" rowspan="2">a) Provide the scientific basis for decision-making in policy development and risk management</td></tr>
<tr></tr>
<tr><td rowspan="5">Strategic actions</td><td>i. Carry out independent international risk assessments for priority food hazards, including evaluation of the health impact of new technologies</td></tr>
<tr><td>ii. Develop guidance for a systematic approach for the development of rapid risk assessment advice for emerging and emergency issues, including a tiered approach to risk assessment ("fit for purpose")</td></tr>
<tr><td>iii. Develop an evaluation framework that allows—in addition to safety—the inclusion of other considerations, such as health benefits and socioeconomic consequences</td></tr>
<tr><td>iv. Continue the development of internationally harmonized risk assessment methodology reflecting the state of the science</td></tr>
<tr><td>v. Enhance awareness and understanding of the inter/linkages and relevance of food safety in the context of food security and promote systematic integration of food safety into policies and interventions to improve nutrition and food availability</td></tr>
<tr><td colspan="2">b) Establish international standards and recommendations and promote their implementation and importance in public health</td></tr>
<tr><td rowspan="5">Strategic actions</td><td>i. Strengthen the public health leadership of international standard-setting bodies such as the Codex Alimentarius Commission and advocate for the wide implementation of international standards</td></tr>
<tr><td>ii. Continue WHO's involvement in and support of the Codex Alimentarius Commission</td></tr>
<tr><td>iii. Ensure that the independent scientific advice from FAO/WHO expert meetings form the key evidence base for Codex standards</td></tr>
<tr><td>iv. Develop recommendations, guidelines, and/or guidance to inform policy decisions for emerging and emergency issues</td></tr>
<tr><td>v. Support effective participation of developing and transition economy countries in the work of the Codex Alimentarius Commission</td></tr>
<tr><td colspan="2">c) Establish new approaches to systematically collect, analyze and interpret data and other information to better guide risk analysis and underpin policy decisions</td></tr>
<tr><td rowspan="3">Strategic actions</td><td>i. Develop databases and tools to collect, improve access to and interpret relevant data and other information</td></tr>
<tr><td>ii. Establish and map links between different data sources to facilitate the application and interpretation of combined data and increase efforts to share data among agencies and Member states</td></tr>
<tr><td>iii. Strengthen links with national public health systems to integrate health surveillance and food monitoring data and improve understanding of their attribution to foodborne health risks</td></tr>
<tr><td colspan="2">d) Provide a comprehensive framework for determining the burden of foodborne diseases</td></tr>
<tr><td>Strategic action</td><td>i. Strengthen the capacity of countries in generating baseline and trend data on foodborne diseases</td></tr>
</table>

		ii. Encourage food safety stakeholders to utilize such estimates in analyses of the cost-effectiveness of interventions as well as the development of food safety standards and policies
		iii. Provide baseline and trend estimates on the global burden of foodborne diseases for a defined list of causative agents of microbial, parasitic and chemical origin

Strategic direction 2. Cross-sectoral collaboration: improve international and national cross-sectoral collaboration, and enhance communication and advocacy

Outcome: Increased participation in cross-sectoral networks for reduction in foodborne health risks, including those arising from the animal–human interface

Performance Indicator: Number of Member states that successfully increased their participation in national and international cross-sectoral networks for reduction in foodborne health risks, including those arising from the animal–human interface

a) Promote cross-sectoral collaboration and information sharing to optimize the response to foodborne health risks, including outbreaks

Strategic actions	i. Facilitate rapid exchange of food safety information among INFOSAN members and provide technical support to improve response to international foodborne outbreaks and food safety emergencies
	ii. Share technical information on foodborne health threats to allow identification of data gaps and for integrated risk assessment, prevention and control
	iii. Establish cross-sectoral linkages among human and animal surveillance systems to minimize duplication of monitoring, reporting and delivery systems and facilitate integrated risk assessments
	iv. Develop an efficient capacity building mechanism to better integrate disease and epidemiological data with laboratory surveillance data
	v. Establish and foster global frameworks and mechanisms to ensure strategic alignment and collaboration with other sectors, particularly the agriculture and animal health sectors

b) Ensure risk communication and health promotion/education in support of foodborne disease prevention

Strategic actions	i. Develop specific messages and information for policy-makers, risk managers and end users to promote food safety along the farm-to-table continuum, including integration of food safety in nutrition and food security programs
	ii. Advocate and ensure that the results of scientific assessments are communicated in an easily understandable form to permit dialogue among stakeholders, including consumers
	iii. Empower women through food safety education

Strategic direction 3. Leadership and technical assistance: provide leadership and assist in the development and strengthening of risk-based, integrated national systems for food safety

Outcome: Increase in the number of Member states with a risk-based food safety system and enforcement structures in place

Performance Indicator: Number of Member states assisted in the implementation of a risk-based food safety system with enforcement structures in place

a) Assist countries in building and strengthening risk-based regulatory and institutional frameworks

Strategic actions	i. Assist countries in analyzing and improving their systems and legal frameworks, including infrastructure for food safety; the cross-linkages and gaps in or constraints to communication; and collaboration between administrative levels and among sectors
	ii. Develop and provide practical tools to ministries for strengthening cross-sectoral collaboration to address foodborne health threats at the national level
	iii. Work with the animal health sector and other relevant partners in regions and countries to assess and strengthen food safety systems and legal structures between organizations and institutions

	b) Increase countries' capacity to manage food safety risks in emergency and non-emergency situations	
Strategic actions	i. Assist countries in implementing Codex and other adequate standards at the national level	
	ii. Assist countries in the establishment and refinement of systems to monitor, assess and manage food safety incidents and emergencies	
	c) Assist countries in the development and strengthening of enforcement structures	
Strategic actions	i. Implementation of food inspection and control services with qualified personnel	
	ii. Development of laboratory capacity at national and regional levels	
	iii. Introduction of modern information management systems and information sharing	

Due to its organizational structure, the WHO regional offices can develop their own publications and strategies. The comprehensive review of these regional strategies is not part of this research. As an example for regional strategies, the WHO Regional Office for South-East Asia has developed its *Regional food safety strategy* (WHO, 2014a) to encourage its Member states to "initiate, develop and sustain multisectoral approaches and measures for the promotion of food safety among all population groups." WHO did not conduct any food safety-specific thematic evaluation or publicly share documents related to their projects. The information on their existing intervention is almost non-existent, and there is also no reference to them in their *Draft Programme budget 2020-2021 – WHO results framework: an update* (WHO, 2019a).

6.3. Food safety-related tools developed by WHO

Since WHO covers the scientific and toxicological aspects of hazards in food, it has developed guidance on specific hazards. Like in the case of FAO, hazard-specific risk assessment topics, for instance, *Guidance for identifying populations at risk from mercury exposure* or *Guidelines for predicting dietary intake of pesticide residues,* are not part of this collection (Annex A) as their purpose is not capacity building in nature. As mentioned before, fourteen publications resulted from the collaborative scientific work of FAO and WHO are included in the catalog of Annex A. Most of these guidelines focus on improving the structure and various functions of national food control systems.

7. World Organization for Animal Health (OIE)

7.1. Short description of OIE's food safety-related activities

The World Organization for Animal Health (OIE) was established through an agreement in 1924 and started its operation in 1928, creating an international body to improve sanitary oversight. The establishment of the WHO and FAO questioned the relevance of OIE in the

50s. These issues of different mandates were later resolved by having an official agreement between OIE and FAO. The 1995 Agreement on the Sanitary and Phytosanitary Measures of the WTO has further strengthened the position of OIE by referring to it as an international standard-setting body. As one of the Three Sisters[7] in food safety, OIE's standard-setting activities concentrate on eliminating potential hazards present before the slaughtering of animals and during the primary processing of animal products. Therefore, OIE "has a SPS responsibility for elaborating standards and related texts for the prevention, control and eradication of animal diseases and zoonoses" whereas "the Codex elaborates standards and related texts for both safety and suitability aspects of food control" (OIE, 2006). The OIE Working Group on Animal Production Food Safety (APFS), operating between 2002 and 2017, has built a program to improve the effectiveness of veterinary services (veterinary administration, veterinary authorities, and professionals approved by a veterinary statutory body) related to food safety at national and international level (OIE, 2006). 85th General Session in 2017 has decided to institutionalize this Working Group and include it in the OIE structure.

Food safety and animal welfare are among the six main objectives of the organization. Based on OIE's website, its objective aims to "provide a better guarantee of food of animal origin and to promote animal welfare through a science-based approach." As part of extrabudgetary contributions given by the OIE Member states, the World Animal Health and Welfare Fund is the mechanism to fund capacity building initiatives. At this stage, standard-setting and capacity building activities are not functionally separated within the OIE Governance Structure. OIE also provides awareness-raising and policy support activities to decision-makers on "global public good outcomes associated with investments in the improvement of animal health and welfare and veterinary public health" (OIE, 2015).

7.2. OIE's Strategic Vision 2016-2020

OIE aims to reinforce its global leadership in sanitary measures and support its member states in building adequate practices, including veterinary services of governmental bodies. To put

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[7] The 'Three Sisters' name refers to the three international standard setting bodies in food safety, namely the Codex Alimentarius Commission, the International Plant Protection Convention and the World Organization for Animal Health.

in practice its vision protecting animals; preserving our future, the following strategic objectives were outlined for the period 2016-2020 (OIE, 2015):

- Securing animal health and welfare, the sanitary safety of animals and animal products and food derived from animals, and reduction in the transmission of diseases by managing risks at the human-animal-environment interface;
- Establishing trust between stakeholders, including trading partners, in the cross-border exchange of animals, animal products, and foods derived from animals by transparency and good communication of the occurrence of diseases of epidemiological significance, and in OIE processes and procedures;
- Enhancing the capacity and sustainability of national veterinary services.

The first strategic objective focuses on improved food security and safety by developing scientifically-based standards for animal health, and guidelines and recommendations for managing, controlling, and eradicating diseases. As part of the third strategic objective, OIE offers direct support and technical advice to the member states thus enabling their application and compliance with OIE standards and guidelines and execution of the recommendations made through the performance of veterinary services (PVS) missions. Similarly to FAO, OIE emphasizes the dissemination of the latest scientific knowledge among its member states and provide advice on implementing "veterinary public health measures, including the control of zoonoses in animals, animal production, food safety controls and the prudent use of antimicrobial agents" (OIE, 2015). The OIE regional offices are in charge of delivering these capacity building activities.

7.3. OIE's capacity building tools

OIE monitors compliance with the voluntarily adopted health standards and regulations by applying its PVS Pathway. This tool is a robust mechanism for the continuous improvement of national veterinary services through an evaluation and planning framework, which has four main stages: 1) Orientation; 2) Evaluation, 3) Planning, and 4) Targeted Support (Figure 4). The document *Strengthening Veterinary Services through the OIE PVS Pathway* (2018) describes the tool's approach and provides concrete case studies to promote additional investments for more robust veterinary services.

As a first step, the tool commences with the engagement of national stakeholders by delivering orientation training and performance review workshops. Afterward, it conducts an evaluation of the management practices based on 46 criteria and defines follow-up mechanisms in the form of self-assessments or missions by experts.

Figure 4. PVS Pathways Cycle process
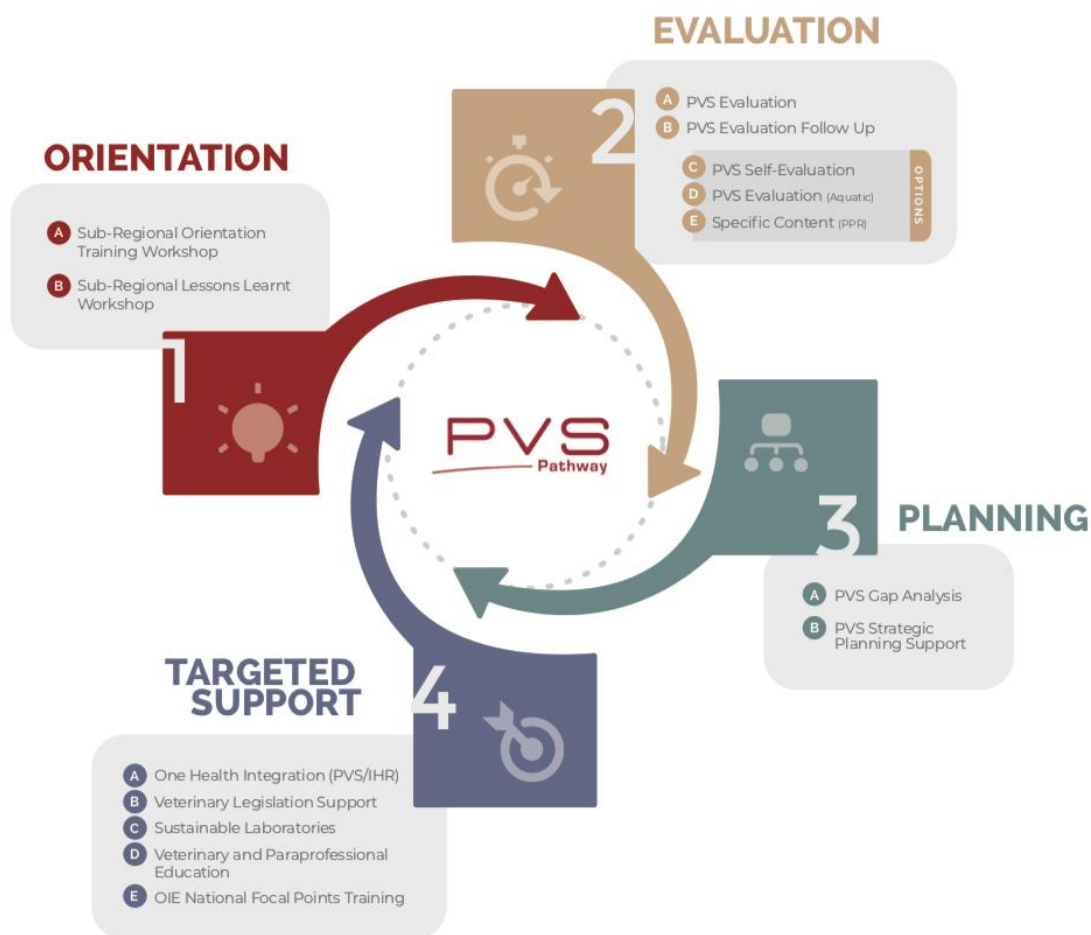
Source: OIE (2018) *Strengthening veterinary services through the OIE PVS pathway: investment case and financing recommendations*. Paris. p. 19 Available at: http://www.oie.int/fileadmin/Home/eng/Media_Center/docs/pdf/SG2018/PVS_BUSINESS _CASE_FINAL.pdf.

In collaboration with national veterinary services, OIE performs a gap analysis to determine the priority goals, strategies, activities, and investments during the planning stage. Using the outcome of the PVS Gap Analysis report, a national strategic planning template is developed

through the organization of a workshop. At the final stage, OIE usually provides targeted support in the following areas:

- One Health Integration (in collaboration with WHO) International Health Regulations (IHR) PVS National Bridging Workshops aims to facilitate coordination between sectors and address major zoonotic health risks by using a structured approach and incorporating material;
- PVS Pathway Veterinary Legislation Support Programme (VSLP);
- PVS Sustainable Laboratory Support, including Veterinary Laboratory Twinning Projects;
- Veterinary and Veterinary Paraprofessional Education;
- Workforce Development through OIE National Focal Points Trainings.

The PVS Pathway measures the activities through qualitative and quantitative indicators organized in a predefined internal database (OIE, 2018) to guide participating countries in enhancing their services' impact. Annex A lists all the manuals, guidelines, and guides related to the improvement practices within the national food control system, except for guidelines related to specific zoonoses.

8. United Nations Industrial Development Organization (UNIDO)

8.1. Short description of UNIDO activities in food safety capacity building

UNIDO is the specialized agency of the United Nations that promotes industrial development for poverty reduction, inclusive globalization and environmental sustainability. In 2013, the Lima Declaration defined UNIDO's current mandate: "to promote and accelerate inclusive and sustainable industrial development (ISID) in its member states." As a specialized agency in the United Nations, UNIDO provides a wide range of technical assistance services to its member states, covering food safety, SPS and Technical Barriers to Trade (TBT) measures, and trade facilitation.

Unlike most other agencies, UNIDO's projects are publicly accessible through its Open Data Platform, thus allowing a better understanding of the types of capacity building activities related to food safety. As per the review of UNIDO's official website, it was observed that the initiatives implemented by UNIDO are either focusing on trade capacity building,

national quality infrastructures, agri-food businesses, and other related supporting systems and institutions. Some trade-related projects have followed an agri-food value chain approach, focusing on enhancing compliance capacities and establishing conformity assessment services (inspection, testing, and certification practices). Conformity assessment service is a terminology used in quality infrastructure that refers to enforcement and testing functions of a food control system and third-party quality assurance services. Internationally recognized national quality infrastructure (QI) systems are prerequisites for a robust national food control system, and thereby, UNIDO's work directly impacts improving food safety capacities.

UNIDO intervenes through its food safety capacity building projects at four levels: 1) development and revision of relevant policies, including quality policy (QP), 2) establishment of adequate food safety control practices by establishing conformity assessment services and related laws and legislations, 3) creation of support services in food safety for the industry through the development of capacities of institutions, and 4) promotion of compliance capacities among agri-food and food business operators. UNIDO defines QP in the document titled Quality Policy (2018) as "the policy adopted at national or regional level to develop and sustain an efficient and effective quality infrastructure…These policies typically deal with industrial development, enhancement of export trade, environmental controls, food safety, animal and plant health, and/or security, science and technology development and similar issues." After reviewing past projects in food safety, UNIDO shows ample experience in conformity assessment services and value chain performance development by implementing standards, focusing on eliminating different impediments faced by the industrial sectors to reach their full potentials.

Its convening power to collaborate with industry enables UNIDO to engage with various stakeholders at a national, regional, and global level. In the case of the food industry, UNIDO has successfully collaborated in some initiatives with the Global Food Safety Initiative (GFSI) and, as a result, signed a Memorandum of Understanding (MoU) (GFSI, 2016) for further collaboration. This also shows its ability that as an organization in charge of industrial development, it can cooperate with private associations related to food and beverages. Being a member of several multi-stakeholder platforms, such as the Global Food Safety Initiative

(GFSI) and the Standards and Trade Development Facility (STDF), UNIDO is a recognized partner in food safety capacity building.

8.2. UNIDO's Food Safety Approach

The UNIDO Food Safety Approach aims to execute its mandate related to ISID by centering its capacity building initiatives, advisory, and convening power around three key pillars, building blocks, and targeted interventions (Table 6). As the main difference with other development partners, the intervention approach of UNIDO also focuses on the establishment of meso-level food safety services, which are essential for the industry as a source of knowledge. As competent authorities have limited ability to deliver capacity building activities to the industry, meso-level conformity assessment bodies or consulting agencies must ensure food safety compliance.

Table 6. The intervention approach outlined in UNIDO's Food Safety Approach

Pillar 1. Enable sustainable business through effective food safety capacity building	
Building block 1.1. Tailored and Scalable Food Safety schemes adopted by value chain operators	
Targeted interventions	Support less-developed food and agri-food businesses gain market access, and buyers trust by implementing relevant schemes such as UNIDO's Sustainable Supplier Development Program (SSDP) through public and private partnerships.
	Assist small and medium food businesses to comply with recognized food safety schemes relevant to their market needs.
	Design and implement supply chain-driven safety and quality assurance schemes, covering all supply chain actors, e.g., growers, collectors, packers, processors, distributors, traders, etc.
Building block 1.2. Enhanced and Sustained Local Food Safety Competencies along value chains	
Targeted interventions	Enhance food safety educational and/or training programs and curriculums to secure the availability of a qualified workforce along the food/agri-food supply chain, including the development of personnel certification schemes in partnership with relevant academic networks, organizations, and institutions.
	Build sustainable food safety competency through the development of human capital (i.e., advisors, assessors, auditors, mentors, practitioners, etc.) and institutional structures (i.e., training centers, educational institutions, consultancy services/firms, etc.).
	Establish and upgrade centers of excellence in food safety, directly serving food and agri-food businesses, e.g., packaging service centers, food technology centers, food safety certification centers, e-learning platforms, R&D and training centers, etc.
Pillar 2. Enable favorable food safety environment	
Building block 2.1. Collaborative Interagency Environment to support Food Safety regulatory frameworks	

	In collaboration with international organizations involved in standard-setting, support the development of a predictable and trusted food safety regulatory environment for food and agri-food businesses in member states by establishing and strengthening food safety legal and regulatory capacities and infrastructure.
Targeted interventions	Integrate the food safety standards development environment with the needs of the food and agri-food businesses for practical guidance and market access development.
	Support compliance of food and agri-food businesses with national and international standards and regulations through the provision of technical assistance in food safety certification (i.e., awareness-raising, human resource capacity-building, certification, etc.).

Building block 2.2. Tailored food safety-related conformity assessment services developed to enhance food safety compliance	
Targeted interventions	Establish and upgrade national quality systems (i.e., quality policy, legal framework, and institutional structures) adapted to the new principles of the international trade regime, specifically the WTO's Agreements (TBT / SPS).
	Upgrade the national metrology and accreditation systems to enhance compliance and competitiveness of the food and agri-food sector, as well as to improve the credibility, efficiency and international recognition of a country's food control system.
	Promote and develop laboratory capacities for food safety testing and support their international accreditation.
	Strengthen other food safety related conformity assessment bodies, such as inspection and certification bodies, towards their international accreditation and recognition.

Pillar 3. Foster food safety advocacy and partnerships

Building block 3.1. Private Sector Engagement facilitated in Global, Regional and National Food Safety Partnerships	
Targeted interventions	Empower food and agri-food businesses and private sector actors to engage in National Food Safety initiatives and programs through their contribution in their design, delivery and implementation, in partnership with other stakeholders.
	Enhance the engagement of food and agri-food private sector actors in food safety standards setting and regulatory development initiatives at the national and regional level.
	Advocate for a stronger and effective participation of food and agri-food private sector actors in global food safety forums, especially those pertaining to framing the future of the food safety capacity development and regulatory environment.
	Develop engagement approaches and convene tailored forums to support public/private partnerships devoted to food safety promotion in support of business development opportunities.

UNIDO's Food Safety Approach also integrates other intervention methods applied in different food safety-related capacity building initiatives, such as the Sustainable Supplier Development Programme (SSDP), value chain performance development, and the establishment of conformity assessment services. The approach also provides a strategic

framework for how UNIDO (2018) aims "to structure its food safety-related interventions and integrate them within its overall industrial development agenda in order to achieve safer food for sustainable and resilient businesses." In addition, it informs the development sector and governments on possible services without obligating the organization actually to report on outcomes thematically.

8.3. UNIDO capacity building tools in food safety

Many of the publications used as capacity building tools or thematic approaches indirectly improve food safety-related practices. Some documents were developed in collaboration with other standard-setting organizations in QI, such as the International Organization of Legal Metrology (OIML), International Laboratory Accreditation Cooperation (ILAC), and International Accreditation Forum (IAF). As conformity assessment services are strongly linked to positive food safety outcomes, they were also included in the catalog in Annex A.

9. International Trade Centre (ITC)

9.1. Short description of ITC's food safety-related interventions

The International Trade Centre (ITC) is a joint agency created as a joint commitment between the United Nations and the World Trade Organization. The organization's vision is that ITC is "fully dedicated to supporting the internationalization of small and medium-sized enterprises (SMEs)" (ITC, 2014). Through this mandate, ITC aims to expand trade opportunities for SMEs, thus fostering sustainable development. Enhanced trade in food products requires adequate practices among competent authorities and food business operators, with a particular focus on conforming with the requirements of the SPS and TBT Agreement.

ITC has substantial experience conducting surveys and assessing non-tariff measures (NTMs)[8] to help SMEs tackle impediments and reach export markets. Like UNIDO, ITC also offers quality infrastructure services to upgrade conformity assessment services of countries,

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[8] ITC defines NTMs in its online training as "official policy measures on export and import, other than ordinary customs tariffs, that can potentially have an economic effect on international trade in goods, quantities traded, and/or prices. These consist of mandatory requirements, rules, or regulations that are legally set by the government of the exporting, importing, or transit country. There is no single, specific type of NTM. Rather, they form a constellation of different types of regulations that accompany products throughout their life cycles." Some examples of NTMs are testing requirements for imported food products or quality requirements of the products.

thus enabling better food safety practices for enhanced trade. ITC has not conducted any thematic evaluation on its food safety and compliance-related interventions, and the number of projects showcased on its website is limited.

9.2. ITC's Strategic Plan 2018-2021

Since ITC did not develop a food safety-specific strategy or approach, the research reviewed its organizational strategy to highlight how the organization contributes to improved food safety outcomes. Facilitating the implementation of its mandate, ITC's *Strategic Plan 2018-2021* sets out the following goals:

> 1) improved national business and trade environment for Micro, Small & Medium Enterprises (MSMEs);
>
> 2) improved performance of trade and investment support institutions to offer high-quality, sustainable business services to MSMEs; and finally
>
> 3) improved international competitiveness of MSMEs.

The strategic goals re-emphasize the organizational focus on small and medium enterprises (SME) competitiveness, which was also elaborated along with the linkage of its intervention logic on improved competitiveness as a key to reach export markets (ITC, 2014). This integrated solution is set on three pillars, one of those called adding value to trade. The programmatic approach that aims to implement this objective has the same name. This approach helps SMEs connecting to international value chains through compliance with technical/quality requirements and technical regulations, including SPS measures, organizing after-sales services, and supporting them to obtain internationally recognized certification (ITC, 2019).

Even though ITC's mandate concentrates on SME support towards export markets, several other agencies, such as FAO, UNIDO, and the International Finance Cooperation, have overlapping activities or mandates regarding agri-business development and provide similar technical assistance services in developing countries. Six intervention areas were identified from its current strategy as a comparative advantage (ITC, 2018) (Table 7).

The national quality strategy, regulatory frameworks, and value added to trade are linked with food safety from these intervention areas mentioned above. The QI-related services aim to strengthen national standards and quality infrastructure or conformity assessment services,

and the latter promotes quality and safety culture among enterprises by supporting them to comply with SPS and TBT standards.

Table 7. Intervention areas outlined in ITC's Strategic Plan 2018-2021

1. Globally accessible trade and market intelligence	
Key initiatives	Global Trade Helpdesk
	Non-Tariff Measures
	SME Competitiveness Outlook
	SME Trade Academy
2. A conducive business environment	
Key initiatives	Trade facilitation reforms
	Investment facilitation
	National quality strategy and regulatory frameworks (strengthening national standards)
	Trade and investment development strategies
3. Stronger trade and investment support institutions	
Key initiatives	Strengthening a broader base of institutions
	Understanding and strengthening business support ecosystems
	Foreign trade representatives in the digital age
	Impact assessment for TISI services
4. Connection to international value chains	
Key initiatives	Value-added to trade (Compliance with technical / SPS regulations)
	Alliances for Action
	E-commerce
5. Inclusive and green trade	
Key initiatives	SheTrades
	Building youth entrepreneurship
	Poor communities and trade
	Transparency and traceability in supply chains

	Better measuring socio-economic impact
6. Regional economic integration and South-South trade and investment	
Key initiatives	Catalyzing regional trade and investment
	South-South trade and investment routes

9.3. ITC tools related to food safety

In terms of tools developed for food safety-related capacity building interventions, ITC has designed three solutions, two of which can be used by trade authorities and enterprises, namely the NTM Business Survey and the Sustainability Map. However, only the tool developed based on the GFSI Global Markets Programme (GMP) has the clear objective to improve existing practices and capacities in terms of food safety and quality compliance. Two solutions also tap on the opportunities furnished by data and digitalization (Annex A).

10. The World Bank Group

10.1. Short description of the World Bank Group's food safety-related interventions

The World Bank Group (WBG), as the most significant development finance institute, is composed of five inter-connected institutions, the International Bank for Reconstruction and Development (IBRD), the Multilateral Investment Guarantee Agency (MIGA), the International Finance Corporation (IFC), the International Development Association (IDA), and the International Centre for Settlement of Investment Disputes (ICSID). As an international finance institute, the WBG can leverage its ability to either provide non-repayable grants and loans at preferential rates for its member states, depending on their economic development level. As the private sector in these countries might have limitations borrowing money to upgrade their operations as part of other capacity building investments, the WBG can create transformative change for the food sectors. WBG highlights in its strategy the importance of collaborating with other development partners to build food systems through improved food security and safety and the promotion of nutrition-sensitive agriculture.[9] As part of these endeavors, the World Bank also used to host the Global Food Safety Partnership (GFSP), a public-private platform, which aimed to support and promote global cooperation for food safety capacity building in low- and middle-income countries,

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[9] The World Bank website further describes the foreseen activities to fulfill its strategy, which can be read on the following link: https://www.worldbank.org/en/topic/food-security

providing expertise and resources from multinational enterprises, academia, and robust, competent authorities.

The World Bank's Food and Agriculture Global Practice leads the collaborative research efforts in food safety capacity building through its Agriculture and Food Series journal. Two of the most recent publications, *The Safe Food Imperative: Accelerating Progress in Low- and Middle-Income Countries*[10] and *Food Safety in Africa: Past Endeavors and Future Directions*[11], aimed to present the collective knowledge in terms of current practices and concepts in food safety capacity building as well as provided recommendations to advocate the prioritization of food safety-related investments and to enhance future investment outcomes. Such comprehensive research, which includes contributions from development agencies in food safety, allows identifying future capacity building needs from a global perspective and new tools required for improved outcomes.

According to De Haan (2000), the main food safety-related intervention areas of the WBG include 1) policy dialogue to define the efficiency of the food safety system, 2) institution-building support to strengthen public- and private sector institutional capacities, and finally 3) equipment and infrastructure to food business operators (FBOs), depending on their development level. *The Investment Climate Reforms: An Independent Evaluation of World Bank Group Support to Reforms of Business Regulations* (World Bank, 2015) has distinguished agribusiness, agricultural trade[12] , and agricultural industry-related investments. The agricultural industry projects focus on reforms addressing "the main regulatory and policy constraints hindering priority commodities (national produces) that aim to improve input market and storage capacity and modernize food safety…" (WBG, 2015). In terms of investments, the IBRD/IDA commitments to the agriculture and food sector have

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[10] The full report is available on the following link:
https://openknowledge.worldbank.org/handle/10986/30568

[11] This report serves as an example of collaborative effort between the World Bank and the GFSP. The full document is available on the following link: https://www.gfsp.org/resources

[12] The document mentioned three ways of support: (i) simplification of regulatory instruments and requirements for trade facilitation and logistics; (ii) reforms in the shipping methods to remove anticompetitive regulations and promote competition, such as shipping association certification for chartering of foreign vessels for deployment in domestic routes, and (iii) a project agenda usually being facilitated through a focused public-private dialogue platform on agribusiness trade logistics, and transport, which is a structured stakeholders dialogue to improve policy design, increase ownership and sustainability of reforms, and, ultimately reform effectiveness.

reached US$ 6.8 billion in 2018, which included 93 projects benefiting 5.6 million farmers with agricultural assets and services. In IFC, investments worth $4.5 billion supported agribusiness, food companies, and banks through investments in improved productivity, climate-smart production, and the introduction of food safety practices. Due to the strong relationship among its institutions, the WBG can develop large-scale programmatic interventions compared to other agencies. As an example of such an initiative, IFC launched the Global Food Safety Advisory Program, which primarily focused on mid- and large-sized enterprises, creating a monetary and economic impact by improving 200 companies' food safety management practices. This has resulted in a US$ 478 million increase in client sales and US$564 million investments attracted by client companies.

10.2. World Bank strategy related to food safety

The WBG's organizational approach contributes to achieving the SDG targets through their so-called 'global practices.' Food and agriculture are also part of a global practice that considers food safety as a relevant element to be addressed through their programs.[13] The WBG has conducted extensive research to identify key challenges for food systems, such as, *Ending Poverty and Hunger by 2030: An Agenda for the Global Food System.* The organization does not have a publicly available strategy or approach related to food safety or how it aims to streamline its services to cover the requests of developing countries.

10.3. Capacity building tools developed by the World Bank

Since WBG encompasses several institutions and private-public platforms, the research has not differentiated among the different institutions and their identified tools. The different branches of the organization, mainly IFC, have only developed three solutions (Annex 1) to build the capacities of relevant actors in food safety. As an added value compared to the different guidelines developed by FAO and WHO, two publications (Food Safety Toolkit

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[13] As indicated on its website, the World bank supports countries to have a food and agriculture sector which:
- Is Climate-Smart: more productive and resilient in the face of climate change while reducing emissions, both for crops and livestock;
- Improves livelihoods and creates more and better jobs, including for women and youth;
- Boosts agribusiness by building inclusive and efficient value chains; and
- Improves food security and produces enough safe, nutritious food for everyone, everywhere, every day.

Information available on the following website: https://www.worldbank.org/en/topic/agriculture/overview#2

and Food Safety Handbook) also offer practical examples, allowing users to learn from previous experiences.

11. Standards and Trade Development Facility (STDF)

11.1. Brief description of STDF

The WTO's SPS Agreement envisaged the need to support developing countries in their endeavors related to the formulation and application of SPS measures, thus fulfilling their legal obligations. Since conformity with international best practices in food safety relates to SPS measures, most food safety capacity building projects implemented by international organizations aim to provide technical assistance to developing countries from this angle. Focusing on putting into practice WTO's SPS Agreement, STDF is a global partnership coordinating and financing initiatives to enhance SPS capacities in developing countries by implementing international guidelines, standards, and recommendations to gain and maintain market access. STDF was established by FAO, WHO, OIE, the World Bank Group, and the World Trade Organization. As a convening power in knowledge sharing and networking, STDF offers a platform for donors, experts from developing countries, development agencies, and other non-governmental organizations carrying out SPS capacity building. The secretariats of the Codex and IPPC also participate in this platform allowing its members to exchange information, collaborate and find synergies in food safety capacity building. As a trust fund for SPS capacity building initiatives, STDF partners with development agencies and experts to deliver initiatives in developing countries, allowing them to comply with the SPS measures of WTO. According to its website, STDF has three main organs: 1) the Policy Committee, consisting of high-level representatives of partners, donors, and selected experts from developing countries to decide on the organization's strategy and policy as an oversight body to the Working Group; 2) the Working Group which reviews and approves the STDF's work programs and requests and monitors the operation of the Secretariat; and finally, 3) Secretariat as the implementer of the STDF's work program.

STDF's projects undergo a limited evaluation and meta-evaluations that provide lessons learned from previous initiatives (STDF, 2019). The most recent meta-evaluation called *Beyond Results: Learning the lessons from STDF Projects* (Andersson, 2018) indicated that 61 STDF projects were completed between the beginning of STDF (established in 2006) end of September 2017. Using the original five criteria of the Development Assistance

Committee (DAC)[14] for this meta-evaluation, the analysis found the reviewed STDF projects to score very high on relevance, effectiveness, and efficiency while performing lower on sustainability and planned impact, which future initiatives need to address. The thematic evaluation also found that "sector development projects demonstrate greater contribution to impact and sustainability than technical assistance and institution building projects, since the sector development projects can work with various stakeholders through the whole value chain and, importantly, reach out directly to small producers" (Andersson, 2018). [15]

As part of its mandate related to developing tools for SPS capacity building, STDF also conducts reviews on applying different capacity building tools and improving their applicability through its projects. For instance, the project called *Global Phytosanitary Manuals, Standards Operating Procedures, and Training Kits*[16] set the goal to improve the capacity of National Plant Protection Organizations by developing technical resources, including website, training, and manual kits based on the existing IPPC tools. As another example, STDF aimed to enhance the evaluation of investment opportunities in their SPS capacity. The STDF Secretariat has designed the *Prioritizing SPS Investments For Market Access* (P-IMA) framework[17] , which (STDF, 2016) "offers an evidence-based approach to inform and improve SPS planning and decision-making processes" through SPS investment planning. For the deployment of this tool, STDF applied a multi-criteria decision analysis (MCDA) approach supported by D-Sight computer software. STDF also funds initiatives for international organizations to develop new tools and solutions in SPS, for instance, in e-certification and good regulatory practices.

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[14] The five criteria (Relevance, Effectiveness, Efficiency, Impact and Sustainability) were presented first in the DAC Principles for Evaluation of Development Assistance. In 2019, the DAC Network on Development Evaluation has revised, redefined and complemented the five criteria and added sixth criteria called Coherence. These criteria and their relevance for impact assessment of food safety capacity building initiatives will be discussed later.

[15] As part of the evaluation, Andersson (2018) indicated that "Technical assistance and institution building projects may be more appropriate for testing tools and approaches in multi-country settings, but they would have to be designed carefully to be able to demonstrate any contribution to impact or sustainable results. Isolated technical assistance generally has very limited and intangible effects if not embedded in wider structures or processes".

[16] The STDF website provides detailed project documentation on the project outcomes, evaluation etc. This is accessible on the following link: https://www.standardsfacility.org/PG-350

[17] More information on the tool, including its application in different countries, are available on the following link: http://www.standardsfacility.org/prioritizing-sps-investments-market-access-p-ima

11.2. STDF mid-term strategy (2020-24)

The STDF mid-term strategy (2020-24) follows the overall vision of "sustainable economic growth, poverty reduction, and food security" and the subsequent program goal of "increased and sustainable SPS capacity in developing countries" (STDF, 2020). To achieve these targets above, STDF's expected outcomes are creating "more synergies and collaboration driving catalytic SPS improvements in developing countries" and "greater access to, and use of, good practices and knowledge products at a global, regional and national level" (STDF, 2020). In terms of vision and goals, the current strategy of STDF remains similar to its previous five-year strategy.

The operationalization of this strategy is elaborated in annual work plans to define the planned activities, the monitoring and evaluation plan with baseline and target indicators, and the annual budget. This document also serves the purpose of supporting the design and evaluation of SPS capacity building and the development of required tools.

11.3. SPS Capacity building tools developed by STDF

STDF's mandate and strategy support the development and evaluation of capacity building and needs assessment tools for future interventions. This in turn allows enhancing the possible applications of these tools. STDF has published the *SPS-Related Capacity Evaluation Tools: An Overview of Tools Developed* by international organizations (STDF, 2011), which aims "to inform developing countries about the range of tools that could be used to evaluate their SPS-related capacity needs, and offer guidance on the selection of which tool for which purpose." Periodical revision of this publication is required as development agencies develop new and more sophisticated solutions and extend the original scope from assessment and evaluation to all capacity building tools in food safety, like this research. STDF's own P-IMA tool or FAO's Food Control System Performance Assessment Tool are examples of these new tools which are not included in the original publication but included in Annex A of this research.

12. Inter-American Institute for Cooperation on Agriculture (IICA)

12.1. Brief description of IICA

IICA is a specialized agency on agriculture with an exclusive geographic focus on the American continent. The organization's mission is to encourage, promote and support its member states to achieve agricultural development and rural well-being through international

technical cooperation of excellence. IICA's primary purpose is to carry out technical cooperation and assistance to the private and public sectors in the Americas by focusing on its knowledge management as a primary instrument.

IICA's project portfolio available online shows only eight projects in food safety; however, many of the projects are categorized under the trade theme due to their broader, SPS nature. The project sizes also depend on the scopes funded by development agencies and international organizations. Even though an open database is available, valid collection and investigation would only be possible if further information would be publicly shared.

12.2. IICA's 2018-2022 Mid-Term Plan

The organization's *2018-2022 Mid-Term Pla*n specifies its strategic goals and technical cooperation areas, also referring to food safety capacity building. This technical cooperation model leveraged the collaborative development of national cooperation and regional and hemispheric agendas, thus ensuring a more demand-driven programming method. The organization's intervention approach and programmatic focus areas are also outlined in its Mid-Term Plans (MTPs), and their strategic goals in the current MTP covering the period 2018-2022 align with the SDGs[18]. To support the implementation of the four strategic objectives, IICA defines five hemispheric action programs, one of which is Agricultural Health, Safety, and Food Quality. This program is considered cross-cutting in nature, and thereby it would collaborate with the other four programs, particularly the one on international trade and regional integration. IICA also identified the following main opportunities related to this program by addressing the main challenges of the continent; 1) strengthen and modernize capacities for food health, safety, and quality; 2) foster the effective implementation of international standards; and finally, 3) adopt best practices and improve the response to emergencies. The food safety-specific program will have the following line of actions (IICA, 2018):

- Drive institutional strengthening of Agricultural Health and Food Safety systems;
- Harmonize, modernize and implement health, safety, and quality standards;

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[18] The 2018-2022 Mid-Term Plan had the following four strategic objectives:
  1. Increase the contributions of the agriculture sector to economic growth and sustainable development
  2. Contribute to the well-being of all rural dwellers
  3. Improve international and regional trade for countries in the region
  4. Increase the resilience of rural areas and agri-food systems to extreme events

- Develop skills for adopting good practices and dealing with emerging issues and sanitary, phytosanitary, and food safety emergencies, emphasizing cross-border cases.

12.3. Food safety capacity building tools developed by IICA

IICA's flagship publication in food safety is the Performance, Vision and Strategy (PVS) Tool, which aims to support countries in enhancing institutional capacities based on the requirements of SPS measures by determining the existing performance and developing a shared vision with priorities and strategic planning. PVS is an acronym initially used by OIE in its assessment tool on veterinary services' performance and expanded by IICA to phytosanitary measures. All food safety capacity building tools developed by IICA are linked to the PVS approach (Annex A).

13. International Fund for Agricultural Development (IFAD)

13.1. Brief description of IFAD

Established in 1977, IFAD is an international financial institution and simultaneously a specialized agency under the UN umbrella with the goal to eradicate poverty and hunger in rural areas of developing countries. The organization's objectives are outlined in its latest strategic framework for 2016-2025, which will be discussed below. Concerning its intervention method, IFAD follows a bottom-up approach driven by rural communities to improve their productivity and build their capacities and market participation. As the first step of its interventions, IFAD, as a trusted broker, supports developing a results-based country strategic opportunities programme (COSOP)[19] based on the government priorities. After defining some strategic objectives through the involvement of national stakeholders, including rural communities, for better ownership, individual projects are formed and implemented under the country programs and evaluated based on the organization's Development Effectiveness Frameworks. To ensure standardized data collection to measure progress and outcomes at a strategic level, IFAD also adopted a set of Core Indicators in the document *Taking IFAD's Results and Impact Management System to the Next Level* (IFAD, 2017). Accordingly, these indicators also correspond to the strategic objective of the

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[19] As outlined on the website of IFAD, COSOP "is a framework for making strategic choices about IFAD operations in a country, identifying opportunities for IFAD financing and facilitating management for results." More information about COSOP is available on the following link: https://www.ifad.org/en/cosop

organization. Since IFAD mainly focuses on the food business operator side, its food safety and hygiene activities do not transcend to the meso- or macro-level activities. There is only one indicator called "number of persons trained in income-generating activities or business management" under its *Strategic Objective 2. Increase poor rural people's benefits from market participation* which collects information on the "handling in compliance with safety (use of chemicals, pesticides) and other requirements."

13.2.   IFAD Strategic Framework 2016-2025

IFAD's primary objective or strategic vision is "inclusive and sustainable rural transformation" in order "to generate improved and more resilient livelihoods for all poor rural people, including smallholder farmers, land-poor and landless workers, women and youth, marginalized ethnic groups, and victims of disaster and conflict, while not undermining the natural resource base" (IFAD, 2016). Smallholder agriculture and rural development is the engine of sustainable rural transformation. Therefore, IFAD aims to deliver the following activities for their support:

- Increased social, human, and financial capital of poor rural people;
- Strengthened institutions of and for poor rural people;
- Enhanced productivity, profitability, resilience, and diversification of poor rural people's economic activities;
- Greater and more gainful participation of poor rural people in rural, national, or international economies;
- Sufficient and affordable nutritious food and other agricultural products for a growing population; and
- Enhanced environmental goods and services.

To achieve the overarching goal of poor people overcoming poverty and achieving food security through remunerative, resilient, and sustainable livelihoods, IFAD set out three interlinked strategic objectives (SOs):

SO1: Increase poor rural people's productive capacities

SO2: Increase poor rural people's benefits from market participation; and

SO3: Strengthen the environmental sustainability and climate resilience of poor rural people's economic activities.

According to IFAD's expectations, these SOs will contribute to three main outcomes (IFAD, 2016): "(1) Enabling policy and regulatory frameworks at national and international levels; (2) increased levels of investment in the rural sector; and (3) improved country-level capacity for rural policy and program development, implementation and evaluation". However, the document does not refer to food safety or SPS as an area of thematic focus, which might create challenges to reach these expected outcomes and strategic objectives sustainably. In addition, IFAD did not develop any food safety-specific corporate strategy or tools, and thereby it relies on its partnership with other development agencies.

14. Catalog on the tools related to food safety

The systematic review and categorization of almost a hundred tools have led to developing a catalog organized in chronological order that competent authorities or development agencies could use (Annex A). Such collection allows practitioners to quickly identify the required tools for specific assessment or evaluation related to the capacities of a food control system or be informed on best practices. The catalog contains the categories through its columns:

1. **Code:** same coding used like in the FAO / WHO Food Control System Assessment Tool (2019). Maximum three codes can be entered per tool since the identified documents do not go beyond this proposed limitation;

2. **Year:** Date of publishing;

3. **Organization:** the international agency which initially developed the tool;

4. **Title of the document**;

5. **Objective:** as a summary of the purpose of the document;

6. **Technical area:** the specific technical scope of the document;

7. **Type of document**;

8. **Link:** On-line access to the tools whenever the document is publicly available on the Internet.

The comparative analysis of the scope and advantages of the identified eight evaluation and assessment tools, including the FAO WHO Food Control System Assessment tool, goes beyond the scope of this research. Publicly available lessons learned using these tools would contribute to the better application by practitioners. On the other hand, comparing the existing capacity-building tools with the covered areas elaborated in the FAO/WHO assessment tool shows certain gaps by not having specific tools or publications in to the following categories:

A.2.1. Infrastructure and Finances – Financial resources

A.2.3. Infrastructure and Finances – Analytical resources

A.3.1. Human Resources – Qualification of personnel

A.3.3. Human Resources – Staff management & staff motivation

D.1.1. Science Knowledge Base and Continuous Improvement - Access of competent authorities to updated scientific and technical information

Developing additional guidelines and tools are necessary for the following areas, considering international best practices:

1. Establishment of a data-driven decision-making and performance management system to continuously monitor and improve the performance of different functions of competent authorities.

2. Optimization of the operation of competent authorities through a collaborative data-sharing approach with third-party food safety service providers.

3. Development of performance indicators for the performance monitoring framework of a food control system in a structured manner to ensure its trustworthiness.

4. Development of a competency framework to ensure required qualification, management, and motivation of staff involved in the operation of competent authorities.

The last chapter of this research will further discuss the first and the second point, which can be considered for any potential guideline.

15. Comparative summary of the development agencies in food safety

As an additional outcome of this state-of-the-art systematic review of the publications and the scope of work of international development agencies, the research compares (Table 8) the different international organizations active in food safety capacity building based on the following factors:

1) food safety-specific organizational strategy or food safety activities integrated into the organization strategy;
2) food safety-specific thematic evaluation conducted by the organization to identify best practices in their capacity building initiatives;
3) number of food safety-specific capacity building tools developed by the agencies;
4) organizational mandate or focus in terms of capacity building within the food control system (compliance capacities of the industry or private sector, enabling

environment by enhancing functions of competent authorities or creating awareness among consumers);

5) the limitation to deliver large-scale and comprehensive interventions, addressing multiple shortcomings in the food control system.

These five areas provide a snapshot of the agencies' capacities and practices within the global food safety capacity building landscape during the research. As a limitation, the agencies' past experiences in food safety capacity building could not be analyzed in detail due to the limited access to information on the number of projects. For an accurate comparison and identification of synergies and best practices, it would be highly recommended that development agencies create open database platforms for their projects, including the most basic project documentation, and conduct a thematic evaluation on their food safety interventions to identify best practices on the application of developed tools. This can lead to the identification of additional capacity building needs and additional tools. Furthermore, those development agencies that do not have food safety-specific strategies or capacity building approaches should develop those for more structured services to their member states. It was also noticed that only FAO had conducted meta-evaluation on their food safety portfolio. STDF also conducted a meta-evaluation on its portfolio, but since it is not an implementing organ in food safety capacity building, it can only monitor and guide development agencies and countries. This meta-evaluation would create a better understanding for decision-makers regarding how they may enhance current practices and which additional areas might be required for their Member states. In general, more resources should be allocated to assess previous outcomes and identify lessons learned before organizations could scale up their approaches.

The various international organizations analyzed in this research provide complementary work essential to ensuring adequate food safety practices and capacities. However, some projects found on the smaller, specialized international organizations show that they tend to deliver capacity building services that might not necessarily be outlined in their mandate. The importance of food safety might raise the question about the added value of establishing a specialized UN agency or inter-agency network focusing on food safety. A similar practice has already occurred due to the HIV/AIDS pandemic, which resulted in establishing a specialized UN agency called UN AIDS. Currently, there are no global platforms that facilitate dialogue among competent authorities, industry associations, and consumer groups

globally. Such a platform would contribute to the identification and dissemination of best practices, forging stronger partnership and collaboration among food safety stakeholders.

The services of development partners tend to focus on the establishment or upgrade of competent authorities' regulatory framework and their functions, and the pilot of food safety management systems in the private sector. The last decades show that competent authorities often face limitations due to limited public resources allocated to food safety. As a result, any investment in the enhancement of public services will have sustainability issues. Some donor agencies are providing budgetary support to competent authorities, but this does not necessarily resolve the long-term financial challenges of competent authorities. Development agencies should also design methods that will support the coregulatory approach and promote the creation of meso-level third-party food safety services. Except for UNIDO, no other agency referred to this in their strategy or intervention approach.

Food safety capacity building investments could be categorized into four categories based on their size: 1. Micro-projects (> 1 million US dollars); 2. Small-scale projects (> 20 million US dollars), 3. Mid-sized projects (between 20 and 100 million US dollars); 4. Large-scale investments (100 million dollars <). Most of the food safety investments observed on the development agencies' websites are micro or small-scale projects. International financing institutes are in the position to provide larger financial commitments in food safety; however, they might not have the required expertise to implement such initiatives. Those initiatives that aim to provide limited capacity building or advisory support in a specific area, such as developing policies, strategies, or risk-based inspection or focusing on developing a tool, are mostly micro-projects, not always having a clear sustainability approach. Small-scale projects are considered currently more comprehensive, but still with limitations in going beyond the upgrade of few strategic food products or providing technical assistance to the competent authorities or the private sector. Although more mid- and large-scale investments are required, their number is still minimal.

To ensure the dissemination of best practices and avoid outdated practices, periodical revision of the publications is highly recommended. The research has observed that some technical tools and guidelines did not go through a periodical review, even though terminologies and practices might have changed. The collection and categorization of these

tools could lead to more widespread application among beneficiaries, similar to Annex A's. In addition, this would support the discovery of additional tools based on the identified gaps and needs.

The next chapter aims to carry out a comparative analysis of projects financed by international aid and implemented, among others, by international organizations, building on these findings. Furthermore, it will attempt to further elaborate on the added value of international organizations compared to other development partners in food safety capacity building.

Table 8. Summary table on the capacity of international organizations

	FAO*	WHO	OIE	UNIDO	ITC	World Bank	IFAD	STDF / WTO	IICA
Food safety specific strategy/food safety activities integrated into the organization strategy	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Food safety specific thematic evaluation	Yes	No	No	No	No	No	No	Yes	Yes, but the most recent is from 2003
# of food safety capacity building related tools developed	33 + 19 (IPPC)	29	7	7	3	3	0	3	4
Mandate / organizational focus within food safety capacity building	All areas with limitations on consumer awareness & enterprise compliance (depending on the country)	Capacities of competent authorities, communication & advocacy (incl. consumers)	Sanitary measures & capacities of relevant competent authorities	Agri-food enterprise compliance (value chain) & supporting capacity building institutions, quality infrastructure	Trade policy research (NTMs), agri-food enterprise compliance (value chain), quality infrastructure	Industry compliance, mainly medium and large enterprises	Small-scale agriculture practices	SPS measures from trade aspect	All areas
Limitation to deliver large-scale and comprehensive interventions	Depending on the country team's specialization	Less focus on industry compliance as a driving force	Limited capacities as not considered under the	Limited scientific capacities to improve the abilities of	Limited permanent country presence and focus on trade-specific	Financial liquidity to deliver large-scale interventions	Limited technical capacity to deliver food safety-	Not implementing agency	Specific geographical scope

			UN umbrella	competent authorities.	development challenges	but limited experience	related services		

*IPPC is considered under the FAO

Chapter 2 – Comparative analysis of case studies

Billions of dollars have been spent in the past decades through official development assistance to build the food safety capacities of developing countries. These initiatives often have difficulties reaching their expected outcomes, particularly to score high on the sustainability of the results achieved during the project life cycle (Andersson, 2018). Before suggesting to scale up any investments in food safety, their comprehensive review would need to be performed to identify systematic failures occurring during the design and implementation of these interventions. Even though previous research attempted to investigate the results of an investment in a region (Mosuku et al., 2018, GFSP, 2019), no such comprehensive analyses have been conducted to compare food safety capacity building outcomes in different countries.

This chapter aims to test the research hypothesis by conducting a comparative analysis of two country case studies with structurally different food safety capacity building interventions: one with several smaller targeted initiatives and one with one single integrated intervention. It must be mentioned that one capacity building program would never be sufficient to address all development needs of a food control system. This is because development initiatives are designed for a specific period, typically lasting three to five years, with a given budget and objectives. In contrast, the setup of a national food control system goes beyond this. For this comparison in the research to be relevant, the selection of the case studies has to obey stringent criteria that make the two cases comparable while acknowledging limitations. As an example for the selection criteria, all selected projects should have been financed through official development assistance and not by the national governments. These case studies will be described by assessing the development status of the national food control systems and reviewing the capacity building project-related documentation, such as progress reports and evaluations, depending on their availability. The review of these documents will reveal the conditions for success to achieve the set objectives and attain the foreseen impacts. Afterward, these conditions will be used as evaluation criteria for the comparison of the two case studies. In addition, they can also be considered factors that can eliminate systematic failures and facilitate improved food safety outcomes.

On the other hand, their lack can also lead to systematic failures of these investments. The research will also analyze how the identified projects possibly improved food safety outcomes or were impacted by the development level of competent authorities.

1. International agreements on development aid effectiveness

The promotion of improved practices in international development aid is anchored in two international agreements:

1. Paris Principles on Aid Effectiveness signed in 2005, aiming to create a roadmap of practical commitments through the application of five key principles (OECD, 2008a):

Ownership	Partner countries exercise effective leadership over their development policies and strategies and coordinate development actions
Alignment	Donors base their overall support on partner countries' national development strategies, institutions, and procedures
Harmonization	Donors' actions are more harmonized, transparent, and collectively effective
Managing for results	Managing resources and improving decision-making for results
Mutual accountability	Donors and partners are accountable for development results

2. Accra Agenda for Action, signed in 2008, aiming to accelerate the Paris Principles, which have the following key points (OECD, 2008a):

Predictability	Donors will provide information on their future planned assistance to partner countries (3-4 years in advance)
Participation	Developing country governments and donors will engage a broader range of stakeholders in preparing, implementing, and monitoring national development policies and plans

Country systems	Partner country systems will be used to deliver assistance as the first option, rather than donor systems
Partnership	Recognition of the role and valuable contributions of different types of stakeholders (e.g., local governments, private sector, civil society) and development of inclusive partnerships that address management and coordination challenges
Demand-driven approach	Donors' support for capacity development will be demand-driven and designed to support country ownership
Reduced fragmentation	Donors will reduce the fragmentation of aid by improving the complementarity of their efforts and the division of labor among them, including through improved allocation of resources within sectors, within countries, and across countries

These principles will be considered throughout the analysis to identify possible shortcomings and highlight lessons learned from the two countries.

2. Comparative analysis of case studies

Before commencing with the comparative analysis, it is essential to follow a structured, step-wise approach for this process, as indicated in Figure 5. The idea of comparing capacity building investments in different countries is introduced by this research and thereby it should develop new techniques to conduct this analysis. The criteria setting, the structure of the case studies as well as the actual comparative approach are developed for the purpose of this research. Based on the detailed review of case studies, the research will identify a number of conditions for success, which will be used as a criteria to compare the case studies and as a result address the research hypothesis.

For easier understanding, the steps shown in Figure 5 serve as a methodological approach for the research, leading to the addressing of the hypothesis.

Figure 5. Process of addressing the research hypothesis using a comparative approach of two case studies of food safety capacity building programs

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│   Step 1. Criteria setting           │
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┌─────────────────────────────────────┐
│   Step 2. Identification & final     │
│   selection of case studies          │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│   Step 3. Rapid assessment of        │
│   selected countries' food control   │
│   systems                            │
└─────────────────────────────────────┘
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┌─────────────────────────────────────┐
│   Step 4. Analysis of projects in    │
│   both countries                     │
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│   Step 5. Comparative analysis       │
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│   Step 6. Addressing hypothesis      │
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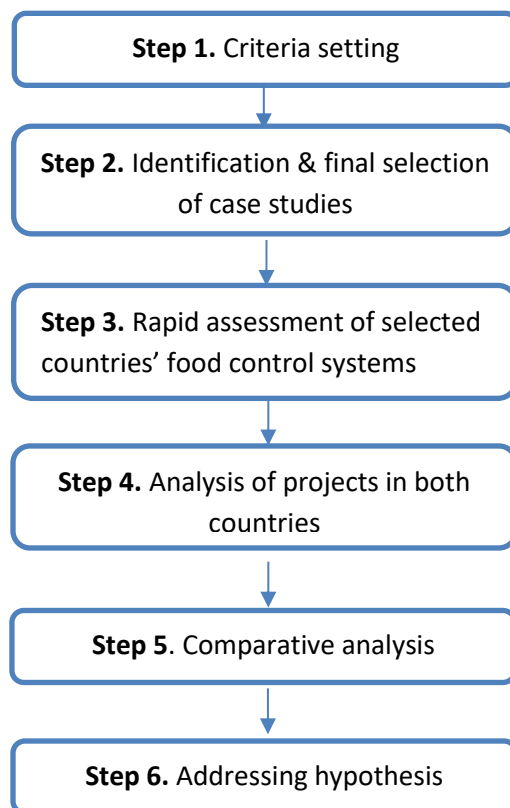
2.1. Criteria setting

The criteria for the identification and selection of country case studies are categorized into three different stages:

> **Stage 1 criteria** are socio-economic indicators publicly available in most countries and usually updated on an annual basis. As most food safety performance indicators, for example, productivity loss or the number of foodborne illnesses per year, are either estimations or unavailable for many countries, they could not be considered for this criteria group. Explicitly, these criteria are:
>
> - Countries from the upper-middle, lower-middle, and low-income from the World Bank categorization;[20]

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[20] Country list as per 2020 fiscal year https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

- Difference between pre-identified countries' agriculture, forestry, and fishing value added (% of GDP) is under 10 percent. A double-digit difference in GDP would show that countries have different economic priorities in terms of food production and thereby their food control system might require emphasis on different functions;[21]

- Population size[22] grouped by large (above 12 million inhabitants), mid-sized (between 1.3 and 12 million), and small-sized countries (under 1.3 million inhabitants). After the preliminary selection of five country pairs based on the indicators above, the following criteria were developed and applied:

Stage 2 criteria focus on the existence of food safety capacity building investments and the operation of different international organizations in both countries:

- Different development agencies and partners involved in the two countries with different investment sizes in food safety-related capacity building;

- Size of food safety-related investment in the form of international aid: micro-projects (under US$1 million), small-scale (under US$20 million), mid-size (between US$ 20 – 100 million), and large-scale investment (above US$ 100 million);

- Number of food safety capacity building projects closed and evaluated between 2004 and 2019;

Stage 3 criteria indicate the limitations which can affect the selection of the country case studies for the comparative analysis:

- Transparency: Access to project documentation on food safety capacity building;

- Availability of documentation in English, French, or German;[23]

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[21] Access to the latest information on this criterium: https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

[22] List of countries available on the following link based on United Nations Population Division estimates; https://www.worldometers.info/world-population/population-by-country/

[23] Since the author is able to read and analyze documents in those languages, food safety interventions were researched in those languages.

As countries have different development levels in food safety measures, economy, and trade, it is imperative to better understand the applied criteria before commencing the comparative analysis. The first two criteria in stage 1 are quantitative indicators to indirectly describe the food safety development status from a socio-economic perspective (STDF and OECD, 2010). Higher-income countries tend to have more robust food control systems, whereas that is not the case for low-income countries (Jaffee *et al.*, 2018). This also originates from the fact that low food safety capacities negatively impact countries' economic output and efficiency through losses in productivity and trade capacities due to their inability to comply with international requirements. The selected case studies would need to have similar population size as the magnitude of food control functions changes with the size of the consumer group. Accordingly, different categories were established by dividing the existing 235 countries in three equal-sized groups. Since Burundi was on the 78th place among the countries with almost 12 million inhabitants, countries above that were considered large. While Timor-Leste's population with 1.3 million was 156th place on the ranking in terms of population, every country before was considered mid-size and after that small.

The stage 2 criteria allow that investments from various development agencies are compared, although having the same agencies might produce the same outcome in the two case studies. Nevertheless, having multiple agencies provides a better comparison for the outcomes of food safety capacity building services. The categorization of investments' size was applied based on the observation made during the review of capacity building investments in Chapter 1. Micro-projects with a single deliverable, for instance, a single training or policy support, and regional projects, where multiple countries participated in single technical assistance, are not considered for this research. Even though these investments are also essential to fill an immediate need or enhance regional coordination, their review would require another comprehensive research. The research had considered projects implemented between 2004 and 2019, since the former date is the beginning of Web 2.0 or when the international organization started to share more information on the web. Without having these reports available, undertaking this research would not be possible. 2019 was selected as the end date because, after the project closure, the writing and approval of final narrative reports take an additional twelve to fifteen months. Considering this period, any project closing beyond this date could not be analyzed.

2.2. Identification & selection of case studies

The research has commenced with the identification of country pairs, applying the stage 1 criteria in the order of income group, population size, and agriculture value added as a percentage of GDP. After a comprehensive review of countries, five-country pairs were identified by going through these indicators in the World Bank site: Nigeria - Pakistan, Egypt - Viet Nam, Algeria - Ukraine, Brazil - Pakistan, Montenegro – Suriname, and Cambodia – Senegal (Table 9). The initial motive of country pairs was the identification of the final case studies. At the time of the research, only these country pairs were found, but others might be identified in the future in case the research methodology is being replicated.

The selection process was then directed to the data collection based on the stage 2 criteria. The identification of food safety capacity building initiatives occurred through the following sources

- Official websites of international organizations, international finance institutes, and national governments were visited to identify the capacity building investments.
- Two databases for academic journals, Web of Science and Scopus, were used where the following keywords applied for search: "food safety, " "capacity building," and the countries' names in English and French.
- Project databases developed by the US government[24] and other agencies' websites were scrutinized, particularly those with more structured project databases, like World Bank or UNIDO.
- Evaluation reports (EU, 2016, GFSP, 2019, FAO, 2011, 2017b; World Bank, 2017b) identified visiting the web.

2.3. Selection of the case studies

Two food safety capacity building investments vastly surpassed the rest, both funded by the World Bank Group, namely the Agricultural Competitiveness and Food Safety Project in Ukraine for US$ 150 million and the Livestock Competitiveness and Food Safety Project (LIFSAP) in Viet Nam for US$ 108 million. Such capacity building investment in food safety is still considered rare despite its ability to transform existing capacities and practice. The

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[24] www. foreignservice.org

importance of large-scale capacity building investments was also emphasized by the Safe Food Imperative written under the leadership of the World Bank (Jaffee *et al.*, 2018).

Upon carrying out the comparative analysis of the gained information from the country pairs (Table 9), certain shortcomings of potential case studies were revealed and led to their exclusion due to: 1) the lack of international investments in certain countries such as Senegal, Cambodia, Algeria, and Egypt; 2) the fact that the same development agency implemented the projects with similar size in both countries, UNIDO in Pakistan and Nigeria; 3) the lack of open access to project documentation for Cambodia, Suriname, Senegal, and Montenegro; and 4) the language of project documentation, as was the case for Ukraine where documents were only available in Russian.

The World Bank provides a detailed documentation on the LIFSAP project in Viet Nam, with a budget of US$ 108 million. While Nigeria and Pakistan had potential matching multiple mid-scale investments (Annex B for the list of projects), the former had a total food safety-specific investment of around US$ 29 million with two projects (GFSP, 2019), whereas the latter had around US$ 103 million with eight projects. In case of Cambodia, there were multiple small-scale investments which were not well documented.

The initial comparison of the country pairs based on the selection criteria led to the conclusion that Viet Nam would serve as good case study for a single large investment where Pakistan for multiple fragmented one. Although they were not originally considered as a country pair, they are a good match for the comparative analysis.

 After identifying the two countries and possible food safety-related investments, the availability of project-related documents, such as project documents, progress, and final reports, and independent evaluation in English, has also allowed proceeding with the comparative analysis. However, before analyzing these investments in-depth, it is necessary to briefly introduce both countries' food control systems and their progress until 2019. This brief review will allow better assessing the results of the investments and if they could have an impactful change in their food safety systems.

Table 9. Analysis of country pairs for case study selection

		Nigeria	Pakistan	Egypt	Viet Nam	Algeria	Ukraine	Cambodia	Senegal	Montenegro	Suriname
Stage 1 Criteria	**Population group (number of inhabitants in 2019)**	Large (200,963,599)	Large (216,565,318)	Large (100,388,073)	Large (96.462.106)	Large (43.993.638)	Large (43.993.638)	Large (16.486.542)	Large (16.296.364)	Small (627.987)	Small (563.402)
	Countries income group (fiscal year 2020)	lower-middle	lower-middle	lower-middle	lower-middle	upper-middle	lower-middle	lower-middle	lower-middle	upper-middle	upper-middle
	Agriculture, forestry, and fishing value added (% of GDP)	21.2%	22.6%	11.2%	14.6%	12.3%	10.1%	22,00%	16.6%	6.8%	12.6%
Stage 2 criteria	**Largest investments implemented by**	UNIDO	UNIDO	No major investment	WBG	No international aid-based food safety initiative	IFC	No international aid found on food safety for the period 2004-2019		Private consulting firm	FAO
	Accumulated investment in food safety-related projects by development community (in US$)	$29 million	$103 million	-	$108 million	-	$ 150 million	$ 2.5 million	-	$ 800,000	$15 million
	Number of projects (all project details in Annex B)	4	8		1		1	5		1	1
Stage 3	**Availability of project documentation in English, German or French**	Available in English for Pakistan		Available in English for Viet Nam		Level of documentation on the Ukrainian project. Documents were in Russian.		Documents are not available.		Documents are not available for the projects.	

Remarks	UNIDO has designed the most significant food safety-related investment in both countries.	There was no relevant investment in food safety invested/implemented by an international organization in Egypt.		According to the mapping undertaken by the World Bank, there were five food safety-related projects in the total amount of US$2.5 million. Since these are small activities of micro-projects without having exact reference, Senegal was not considered.	FAO currently implements a large-scale investment in Suriname. In the case of Montenegro, only a small-scale (US$1 million) food safety and SPS project is implemented by a private consulting firm.

2.4. Structure of the rapid food control system assessments for Pakistan and Viet Nam

Food control systems are usually considered robust when they have well-operating functions, including the proper application of evidence-based risk analysis principle, which also entails the scientific abilities of competent authorities (Godefroy and Clarke, 2016). Accordingly, the review of existing literature and reports developed by the academia and the development sector will consider the following building blocks noting that an in-depth assessment of the national food safety systems is beyond the scope of this chapter:

- Regulatory and legal framework;
- Institutional framework and coordination (national and provincial level);
- Supportive national policies and strategies;
- Application of risk analysis principle and scientific capacities to ensure scientific evidence-based decision-making
- Capacities of food safety-specific functions (control, testing, communication, and surveillance)

The research will mostly rely on existing reports and academic articles regarding the analysis of the food control systems and project-related documentation (project documents, presentations, progress reports, and project evaluation) regarding the different food safety-related investments in the selected countries. Scopus and Web of Science databases were used to identify academic articles by applying keywords like "food safety," "food control," and the country's name. In the case of the project-related documentation, a detailed online search was required by visiting the different international organizations and international finance institutes' websites.

2.5. Case study 1: Viet Nam
2.5.1. Food control system of Viet Nam
Regulatory and legal framework

The food safety system of Viet Nam has commenced its transformation in reaction to the public attention following food safety incidents covered by the press in the early 2000s (Pham and Lan Dinh, 2020). This also triggered high-level political commitment (Kang *et al.*, 2019), which should be considered a prerequisite for developing and operationalizing a national food safety system. Several articles (Nguyen-Viet *et al.*, 2017; Dordi, 2018; Pham and Lan

Dinh, 2020) and technical reports (Thang and Bao Linh, 2015; World Bank, 2017b; Kang *et al.*, 2019) offer a review on the Vietnamese food control system after the adoption of its new Food Safety Law in 2010[25]. This food safety law provides the overall regulatory guidance, but additional governmental decrees and ministerial circulars/decisions are being developed to address other emerging issues/problems in this domain. The Food Safety Law clearly defines the roles and mandates of various competent authorities at the federal and provincial levels, but it does not provide a clear definition of establishments. In addition, the law also stipulates specific requirements at the federal level instead of referring to certain standards. Therefore, it could become problematic when the requirements change as the revision of the law should go through the same legislative process as before.

Institutional framework and coordination

To improve decision-making among competent authorities in the country, this law has also assigned the food safety-specific roles and responsibilities among three ministries, namely the Ministry of Rural Development (MARD), the Ministry of Health (MOH), and the Ministry of Industry and Trade (MOIT). As per the World Bank report (2017), this multi-agency system divides the responsibilities based on food products across the value chain (primary production, preparation, processing, storage, marketing, and distribution). The Viet Nam Food Administration (VFA) under the MOH, MARD, and MOIT are responsible for the overall food safety, including management and coordination among relevant ministries and agencies involved in this domain, setting standards as well as technical regulations, development of joint circulars (as a form of further elaboration of guidelines). Concerning the accreditation of laboratories and development of standards and methods for quality control of traded goods (import/export), the Ministry of Science and Technology (MOST), particularly its Directorate for Standards and Quality (STAMEQ), is the responsible agency. Overall, the country's (Kang *et al.*, 2019)

> Food safety management is decentralized between central and local governments at all levels (from provincial governments to district and commune levels of government), especially for the domestic sector. Local level management is carried out through People's Committees which promulgate local technical

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[25] Revised food laws with specific reference to food safety or new food safety laws usually serve as a catalyst for improved practices and capacities, by showing increasing political engagement in the form of a legislation.

regulations, develop and organize implementation of regional master plans and take responsibility for food safety controls in respective areas.

For the overall coordination of capacity building investments, a platform called Inter-Sector Steering Committee for Food Hygiene and Safety was established and received support from the VFA. To ensure high-level political engagement, this committee is chaired by the Deputy Prime Minister and co-chaired by the Minister of Health.

Supportive national policies and strategies

The *National Food Safety Strategy for 2011-2020, with a vision toward 2030,* was announced in 2012 (Official Gazette Vietnam, 2012), outlining the general and specific objectives for food safety. Further ensuring high-level political engagement, this strategy was published as a decision by the Prime Minister. The general objectives of the strategy were:

1) By 2015, master plans on food safety from production to consumption to be implemented on the basis of a strong and effective management system with considerable and comprehensive impacts on improving the situation of food safety in the country;

2) By 2020, the control of food safety in the entire food supply chain to be established, ensuring effective and proactive protection of the health and interests of consumers to meet the requirements of national development and international economic integration.

The same strategy listed the following five objectives with additional target indicators:

Objective 1: To improve food safety knowledge and practice for target groups;

Objective 2: To build capacity for the food safety management system;

Objective 3: To markedly improve food safety assurance by food producers and processes;

Objective 4: To markedly improve food safety assurance by food traders;

Objective 5: To effectively prevent acute food poisoning.

The Prime Minister signed an additional decision (Thang and Bao Linh, 2015) on national target programs, including in food hygiene and safety, further elaborating on the objectives outlined in the 2011-2020 National Food Safety Strategy and priorities between 2012 and

2015. The other decision listed six sub-projects as per the specific objectives and assigned relevant ministries to the different projects.

Additional policies were developed, some of which are general or related to food security, others focusing on developing production and food safety markets, including safe foods production, food safety in the value chain, and market development for safe foods (Thang and Bao Linh, 2015).

Application of risk analysis principles and scientific capacities to ensure evidence-based decision-making

The food safety law describes the application of food safety risk analysis, but its actual implementation is not widespread yet. A more prescriptive approach is currently applied in Viet Nam regarding the application risk analysis, focusing more on results instead of processes (World Bank, 2017b). Unlike other food control systems that are considered robust, such as the Canadian or the American, where the risk assessments are publicly available, in Viet Nam such studies or reports are not released publicly at the time of writing.

Concerning scientific capacities, some local universities provide specific training courses on food safety risk analysis, including the Ha Noi School of Public Health and the Viet Nam National Agriculture University. However, to further improve evidence-based food safety risk analysis, research capacities need to be further strengthened in public institutes, like agricultural and public health-related universities and institutes (World Bank, 2017b)

Capacities of food safety-specific functions (inspection, testing, and surveillance)

Although the food safety law integrates the basic idea of a risk-based inspection approach, the competent authorities follow different approaches and priorities in their inspection and enforcement strategies. These three ministries inspect food business operators based on the product category under their mandate and target program, where the minimum number of inspections were laid down for each ministry without any coordinated national framework or strategy for inspection. MOH coordinates this national target program at this stage, and reports are developed on a six-month basis (World Bank, 2017b). The inspection approach of command-and-control, currently applied in Viet Nam, relies on punishment as a typical response to food safety non-compliances found during inspections (Nguyen-Viet *et al.*,

2017). This approach can have multiple adverse effects, including stagnating economic growth due to lower sales of food business operators and unlawful acts by governmental officials. For this reason, the compliance culture promotion approach could be encouraged, where inspectors support food business operators and provide them earned recognition based on their food safety performance.

With regard to food testing capacities, the National Food Safety Laboratory (NFSL) network is the main food safety diagnostic body under the MOH. The National Institute for Food Control (NIFC) plays a vital role as the national reference laboratory in food safety under MOH and one of the five institutes that conduct surveillance activities. NIFC supports resolving disputes due to contradictory testing outcomes of different laboratories and simultaneously conducts capacity building training in proficiency testing programs to other laboratories besides implementing ISO 17025 requirements. Four regional laboratories cover different provinces of the country and preventive medicine centers at the provincial level. Provincial as well as district-level laboratories usually have limited testing capacities. Overall, "testing parameters are classified into groups based on the type of food and the technique used" (World Bank, 2017b). As a large segment of the Vietnamese economy relies on agriculture, further investments would be required with the possibility of private sector involvement.

The country still lacks a comprehensive national food safety surveillance system as the current efforts of the different agencies are "fragmented, weakly coordinated and poorly integrated" (World Bank, 2017b). Specific components of a surveillance system already exist, such as market surveillance or surveillance of food business operators in manufacturing and service establishments, but they are neither comprehensive nor do they have an overall plan to become fully integrated (Kang et al., 2019).

Viet Nam Food Administration serves as the national focal point for multilateral organizations in food safety, including the Codex Alimentarius Commission, the International Food Safety Authorities Network (InFoSAN), and the Association of Southeast Asian Nations' (ASEAN) Rapid Alert System for Food and Feed.

Viet Nam's national food control system has gone through many improvements during the past decades, benefiting from strong stakeholder ownership at the federal level. This has resulted in a more structured and developed regulatory, legal and institutional framework. Despite these changes, the research has highlighted multiple gaps, which need to be addressed by Viet Nam to become a robust food control system. As a positive point, food safety and sustainable agriculture transformation remain a priority point on the government's agenda and benefit from continuous support from the development community.

2.5.2. Livestock Competitiveness and Food Safety Project (LIFSAP)

Project background

As part of the World Bank, the International Development Agency (IDA)[26] has financed the Livestock Competitiveness and the Food Safety Project (LIFSAP) initiative, which had an expected closing date of December 31, 2018. The World Bank Board approved the disbursement of US$ 65.26 million in September 2009 with additional financing of US$ 44.68 in June 2015. Through this financing, the IDA provided additional capacity building activities, including "support to cooperatives and less formal groups for production and marketing, improving the management of meat markets, and assistance to the Government of Viet Nam for legal and policy dialogue and reform." The final consolidated credit was US$ 109.94 million after the project closure, which was spent almost wholly. In 2009, the agriculture sector accounted for 22 percent of the country's gross domestic product (GDP), 30 percent of exports, and more than 60 percent of national employment. Within that, just the livestock sector has provided 6 percent of the total GDP (World Bank, 2009b), showing its strategic economic role for the country.

Other strategic initiatives during the project

The LIFSAP has coordinated with the *Food and Agriculture Product Quality Development and Control Project* and the *Quality and Safety Improvement in Agriculture Project* during its planning stage (World Bank, 2009b). Some additional information is available on these projects in Annex B. In addition to these projects, the EU has provided extensive support to

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[26] IDA is an international financial institution, as a member of the World Bank Group, provides grants and loans to the poorest developing countries. The aforementioned loans are concessional, taking into consideration the economic situation of the borrower.

the country through the *Multilateral Trade Policy Support* (MUTRAP) initiatives implemented in 3 phases between 2001 and 2017. All these initiatives could also benefit from the ongoing and planned donor activities on SPS-related matters conducted by STDF (van der Meer and Ignacio, 2008). In 2015, a national food safety working group (FSWG) was formed to facilitate dialogue among different stakeholders, including government agencies and development partners, on emerging solutions to food safety issues in Viet Nam. FAO further mapped a more significant number of projects in 2017 as part of Viet Nam's food safety working group, highlighting the ongoing commitment from the development community.[27] This also shows that adequate governmental policies and coordination in food safety are essential to better target investments among the international development community and donor agencies.

Sources used for the LIFSAP review

For identifying strategic documents developed under the project, two key resources were found helpful for this analysis, the official LIFSAP website[28], documenting the project results, and the World Bank library on the project-related documentation, administratively recording the project progress and outcomes in the form of biannual "implementation status and results reports." All relevant documents were available for the project in English, including the project appraisal document, serving as a project document, the implementation completion and result report, considered as a final report, and the implementation completion report review, which evaluates the project outcomes at the end. The available reports provided sufficient evidence by shedding light on the most significant challenges during the project implementation. The project has received positive feedback with a "satisfactory" key rating for the outcome as well as bank performance and "modest" rating for the monitoring and evaluation ("M&E"). These challenges and recommendations will be further discussed after the introduction of the overall project, its objectives, and outcomes.

Objective of the project

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[27] Link to the report: http://www.fao.org/3/a-i6827e.pdf
[28] Link to the website: http://www.lifsap.vn

The original project development objective (PDO) was "to improve the competitiveness of household-based livestock producers by addressing production, food safety and environmental risks in livestock product supply chains in selected provinces…The project aims to provide livestock-producing households with the resources to remain competitive and participate in the livestock sector's growth" (World Bank, 2009b). It also states that food safety is a key element of the project due to the transformation of the Vietnamese retail sector and consumer awareness. In addition, the project was keen on supporting the government in avoiding further disease outbreaks, such as the African swine fever (ASF).

Short description of project activities

The World Bank's in-house technical expertise has also coordinated with the FAO through its cooperation program involving international technical experts in specific areas. As a result, the original project has had the following three components:

Component A – Upgrading of Household-Based Livestock Production System and Market Integration (US$ 66.2 million)

> **Subcomponent a.** Good Animal Practice (GAP in priority livestock production areas);
>
> **Subcomponent b**. Piloting Livestock Planning Zones (LPZs);
>
> **Subcomponent c.** Upgrading Slaughterhouses and Meat Markets; and
>
> **Subcomponent d.** Provincial Capacity Building and Monitoring.

Component B – Strengthening Central-Level Livestock and Veterinary Services (US$ 3.0 million)

> **Subcomponent a.** Strengthening the capacity of the Department of Livestock Production (DLP)
>
> **Subcomponent b.** Strengthening the capacity of the Department of Animal Health

Component C – Project Management and Monitoring and Evaluation (US$ 8.8 million)

The results chain of the LIFSAP intervention is presented in Figure 6. Although the project has offered a farm-level guideline in Good Animal Husbandry Practice, it did not develop such technical documents for meat-related establishments, like slaughterhouses and meat processing establishments.

Figure 6. Results Chain of the LIFSAP
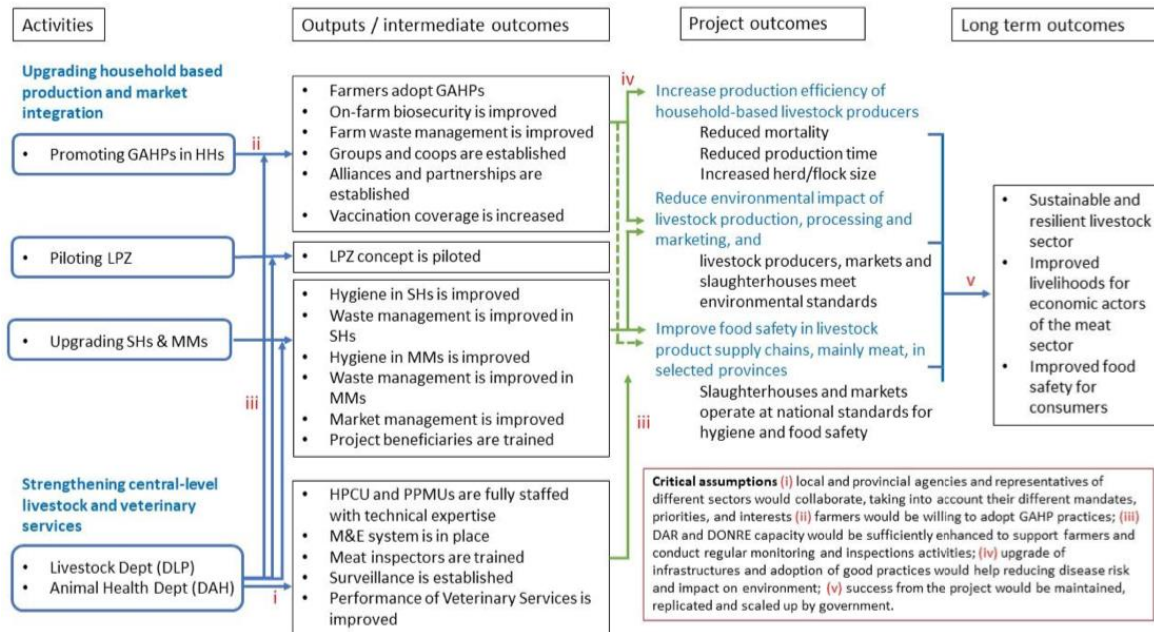
Source: IDA (2019) *Implementation Completion and Results Report*. Washington D.C. doi: 10.4324/9781351258968-9. p. 10

The Departments of Agriculture and Rural Development (DARD) from the pre-selected project provinces have directly implemented component A. Activities under Component B were targeting the capacity building of the two livestock-specific departments in areas, such as food safety or livestock disease control through the development and implementation of procedures and protocols. Component C has focused on the operationalization of national, provincial, and local project bodies by strengthening relevant actors' capacities.

Results of the project

The project received an overall "satisfactory" rating, the second-highest,[29] for its outcomes. This is also supported by the fact that all project indicators were either achieved or over-achieved (the summary of results in Figure 7), which might be questioned due to the modest monitoring and reporting practices. The report also mentioned that many indicators were not set correctly during the formulation phase, and they were only introduced in 2015 when the project was halfway through its implementation. To better understand the indicators collected throughout the project and the achieved results, data were summarized in a tabular form and

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[29] More information on the World Bank's rating system is available on the following website: https://policies.worldbank.org/sites/ppf3/PPFDocuments/090224b08235b35b.pdf

presented below. The overall satisfactory rating was due to "the project's high relevance, substantial efficacy, and substantial efficiency…The project contributed to improving the food safety for a large number of consumers" (IDA, 2019). In the case of the World Bank performance, it was rated satisfactory as "the project preparation and supervision processing were timely and effective, with strong skills mix and good collaboration with the Government teams" (IDA, 2019).

The project has also established food safety monitoring and improved practices by introducing good animal husbandry practices (GAHP) on farms, Good Hygiene Practice (GHP) at slaughterhouse and meat markets level, and upgrading practices as indicated in the results figure below. In addition to describing well the project results, the Implementation Completion and Results Report explained the different key factors that have impacted the project preparation or formulation and the project implementation.

Figure 7. Summary of Results, Expressed in Terms of Achievements for Each Objective Outcome

Outcome Indicator	Unit of Measurement	Original baseline 2010	With AF baseline 2015	Actual Achievement 2019	End of Project Target (2019)
Outcome 1: Increase the Production Efficiency of Household-Based Livestock Producers					
Livestock mortality rates reduced	Percentage of pigs	15	11.8	10	10
	Percentage of chickens	41	31.12	13.9	29
Livestock fattening times shortened	Days for pigs	135	118	116.03	116
	Days for poultry	66	58	55.96	56
Number of pigs/birds per herd/flock increased	Number of pigs	26	31	40.00	40
	Number of birds	935	1,400	1,826	1,800
Outcome 2: Reduce the Environmental Impact of Livestock Production, Processing, and Marketing					
Households supported by the project with lessened[3] adverse environment impacts from their production	Households	—	10,999	25,172	25,000
Small slaughterhouses supported by the project with lessened adverse environmental impact from slaughtering	Number	—	193	303	310
Medium and large slaughterhouses supported by the project meeting national environment standards	Number	—	42	70	40
Wet markets supported by the project meeting national environmental standards	Number	—	378	572	500
Outcome 3: Improve Food Safety in Livestock Product Supply Chains in Selected Provinces					
Small slaughterhouses upgraded by the project producing meat of improving quality and safety	Number	—	235	373	350
Supported wet markets meeting national meat quality and safety standards	Number	—	378	572	500
Direct project beneficiaries (including female)	Number	—	120,819	155,728 (49% female)	135,000

Source: IDA (2019) *Implementation Completion and Results Report*. Washington D.C. doi: 10.4324/9781351258968-9.

During the project implementation phase, environmentally friendly and food safety management practices at the operator level were introduced, requiring "a mindset change in terms of practices and behaviors, much more than investments" (IDA, 2019). This entailed the additional capacity building of technical staff in the relevant departments of MARD and other relevant departments in order to "ensure their active participation in the training of producers and other stakeholders in the new concepts and approaches to sustainable livestock production." The report (IDA, 2019) has also highlighted that

the positive project results can be attributed to a combination of factors including appropriate project design targeted to local conditions; demonstrated benefits to stakeholders and farmers leading to adoption of the methods introduced or promoted; support provided by the Government through funding, laws, and regulations which were put in place; endorsements, for example, its collaboration in awareness raising which contributed to behavioral changes in project agencies and management, and the facilitation and technical support provided by local government agencies.

Challenges noticed during the implementation of the project

The assessment of the World Bank's performance included achievements in the implementation phase and challenges that the project has faced during its lifetime. Among the key risk factors highlighted are the counterpart's inability to familiarize themselves with project activities and budget allocation issues, causing delays in project activities. Furthermore, some of the new concepts, such as livestock planning zones (LPZ), have raised high expectations at the project formulation stage; however, only a pilot solution was implemented due to the technical, economic, and environmental risks. Nevertheless, lessons learned and potential scaling-up were reflected in the Livestock Development Strategy (IDA, 2019). Overall, the project development objective (PDO) is "likely to be sustained because of the capacity and skills developed with the project will remain in the provinces among the implementing agencies, technical agencies, and operators" (IDA, 2019). However, in case of implementing good animal husbandry practice (GAHP), potential pushback by the local private sector can be expected despite its integration into local policies and strategies due to oversight issues and a communication gap between the public and private sectors. In addition, potential disease outbreaks, for instance, the African Swine Fever (ASF), can further jeopardize the income source of smallholder farmers from the livestock sector.

Finally, a local entity has confidentially requested the internal oversight arm of the World Bank called the Inspection Panel in 2017. The case is publicly available on the Inspection Panel's website. However, after reviewing the information gathered through its due diligence and the information received from Bank Management, the Panel has decided to not register the Request for Inspection given the absence of a currently applicable World Bank Operational Policy and Procedure on animal welfare against which the Panel could determine Project compliance (World Bank, 2017a).

Lessons learned and recommendations by the project evaluation

IDA (2019) has provided the following lessons and recommendations for the project:

1) LIFSAP helped to shape the national Livestock Strategy by piloting/implementing relevant environmental and food safety approaches in the project;
2) Replicability of the slaughterhouse and wet markets models introduced during the project phase will depend on the private sector and the opportunity costs of these investments;
3) LIFSAP initiative provides more experience on the implementation of such large-scale and complex programs, allowing the Linkage the project interventions with future projects, such as the Agri-Food Safety Project (AFSP);
4) Ensuring a more robust design for the M&E system with the inclusion of at least two quantitative evaluations (midterm review and end line) with impact evaluations of control group if required, and other independent qualitative evaluations to further explore issues and impacts based on the other thematic areas.

These four points can serve as practical lessons for a large-scale intervention undertaken in a coordinated and supportive enabling environment. The coordination in the project planning phase allowed the fine-tuning of project intervention areas. If this does not occur before launching an intervention, a project might need to be revised during the implementation phase, risking the ability to achieve its objectives. Nevertheless, the satisfactory implementation of this intervention also encourages the development community to maintain its investment in food safety within a country and support the government to transform into a self-sustainable robust national food control system. Having a positive case study will also ensure the donor agencies that future investments will lead to tangible and long-lasting outcomes. The project also provides an interesting perspective on how stakeholder ownership and synergy with other investments can be maintained, leading towards more successful food safety capacity building interventions. The LIFSAP is a positive case study for a large-scale, integrated investment that led to the achievement of its outcomes. The following section will scrutinize food safety initiatives in Pakistan to see if they could reach the expected outcomes and any references made to the application of best practices highlighted in Viet Nam.

2.5.3. Concluding remarks on the Viet Nam case study

The LIFSAP initiative has played a vital role and a positive case study to intensify food safety capacity building investments. The project has also positively benefited from a favoring

political environment with high-level coordination and monitoring of investments. The competency of World Bank personnel handling the initiative and the local project implementation unit is another critical factor to achieving the expected project objective and handling this large-scale investment with confidence. Even though a single large-scale investment cannot claim to transform the entire food safety system, it can play a vital role in enhancing regulatory frameworks and functions and simultaneously pilot best practices along the entire value chain. Such positive factors can encourage the donor community to allocate additional funds with more certainty and enhance the national food control system in the long term.

2.6. Case study 2: Pakistan

2.6.1. Food control system of Pakistan

Pakistan and Viet Nam went through a major war in their recent history, which entailed the need to rebuild their state apparatus, including their national food control system. Since then, both countries transformed their economy to which the development community and multinational enterprises have contributed during the past decades.

To analyze the development level of Pakistan's food control system, a detailed search was conducted, including the identification of academic articles and official reports. These articles were identified through an extensive search in Web of Science based on the combination of different keywords, such as "Pakistan," "food safety," "food control system," "SPS," and "capacity building," as well as a detailed Internet search. During this process, it was observed that very little peer-reviewed research (Akhtar, 2015; Akhtar et al., 2015; ShaoSheng et al., 2019) focused on the national food safety system of Pakistan. On the other hand, Kellermann (2019) made the most comprehensive overview, investigating the outcomes of food safety and SPS capacity building investments in Pakistan. Nevertheless, none of these researches and reports have followed a structured approach to review the development level of the entire food control system.

Regulatory and legal framework

There has been no integrated legal framework for food safety in Pakistan to date. Five major food laws serve as a foundation to reach at least a minimum level of food safety which would require an update:

(i)   The Pure Food Ordinance from 1960 on food preparation and sales, including the prevention of adulteration;

(ii)   The Cantonment Pure Food act which similar in terms of previous law with the exception that it is on cantonment:

(iii)   The Pakistan Hotels and Restaurant Act from 1976 on the control of hotel and restaurant's rates and standard of services, including hygiene practices;

(iv)   The Pakistan Standards and Quality Control Authority Act (PSQCA) from 1996 on the creation of an apex body for standards formulation and enforcement, including the mandate to inspect and test products and services; and finally

(v)   The Pakistan Halal Authority Act from 2016, in charge of standard-setting for Halal food production and its trade.

There were efforts by the development community, like in the case of the Trade-related Technical Assistance (TRTA) initiative of UNIDO, to support the development of a new legal framework, including a new institutional setup with a single food safety authority. Until 2020, this was not adopted by the government. Instead of further regulatory harmonization and integration at the federal level, including food safety, the 18th Amendment of the Constitution of Pakistan on 8 April 2010 has increased the power of provinces, leading to their increased sovereignty. Simultaneously, the Ministry of Food, Agriculture and Livestock (MINFAL), as the main governmental body in charge of food safety, was restructured and renamed to Ministry of National Food Security and Research (MNFSR). As part of this constitutional reshuffle, the ministry has also lost its provincial mandate by being deprived of its legislative power in 47 topics, including food, agriculture, livestock, and fisheries (Nagesh and George, 2020). This resulted in the devolvement of previously federal functions to the provinces, which started to develop their food regulatory framework, commencing with new provincial acts on establishing food safety authorities with the mandate of inspection. However, food imports regulation remained under the purview of the federal government. The failed attempts to centralize certain food safety functions and the puzzling regulatory framework show its outdated structure, notably the lack of comprehensive vision

in the overarching policies. The failure to adopt an improved federal framework in food safety is the testimony of a supply-driven approach in food safety capacity building where decision-makers were not convinced adequately about the country's need.

Institutional framework and coordination

The 18th constitutional amendment has long-lasting repercussions on the current institutional framework, requiring actors at the federal and provincial levels to collaborate and coordinate in multiple areas, posing additional challenges for the food control system. Like Viet Nam, Pakistan is a multi-agency system where the Marine Fisheries Department conducts the fish inspection, whereas the Animal Quarantine Department performs meat inspection for products aiming to export markets. In addition, SPS responsibilities at the federal level became more complex as the Ministry of Food and Agriculture and Livestock was further divided into different ministries (Kellermann, 2019), with specific sanitary measures shifting to the provincial entities. Today the competent authorities concerned with food safety are:

(i)   The Ministry of National Food Security and Research (MNFSR),

(ii)   The Ministry of Science and Technology (to which ministry PSQCA also belongs),

(iii)   The Ministry of Health,

(iv)   The Ministry of Commerce, and finally

(v)   The provincial governments, five with food safety mandated authorities.

At the provincial level, the mandate and operation of the different food authorities are very much dependent on the economic development level of the province itself. As a result of the constitutional amendment, the provinces went ahead with establishing their authorities. The first and most developed food safety authority functions in the Punjab province, a major food producer, manufacturer, and exporter, where a food safety agency was established in 2011 under the name of Punjab Food Authority. Before the constitutional amendment, the Punjab government rejected federal level directives to create a federal food safety agency (Kellermann, 2019). Following the Punjab model, also using the text of the act for the institutional mandate, several other food authorities were created in other provinces: the Khyber Pakhtunkhwa Food Safety and Halal Food Authority (established in 2014), the Sindh Food Authority (in 2016), Balochistan Food Authority (in 2018) and Islamabad Capital

Territory Food Authority (in 2017). Most of these authorities are still in an initial stage and face several operational and technical challenges, such as proper strategies and policies guiding their operation, a lack of proper inspection practices and testing capacities, or excessive focus on the product instead of process control. The dire need to harmonize food standards at a national stage was addressed at the end of 2019 when PSQCA and the provincial authorities agreed to establish harmonized food standards in exchange for the full power of enforcement and monitoring of standards remaining with the provinces (Kalbe, 2019). PSQCA still has the federal mandate for testing, standard-setting, and certification, and it is also the national focal point for the Codex Alimentarius and the WTO.

Application of risk analysis principle and scientific capacities to ensure scientific evidence-based decision-making

The scientific evidence-based decision-making process, applying the risk analysis principles, is still absent from regulatory practices in Pakistan, which will hold back to the country to fulfill the SPS and TBT Agreement. Since decision-makers are not aware of the importance of applying risk analysis principles, it is neither mentioned in any laws related to food nor has any designated national institutes which conduct research accordingly. Although the Pakistan Agriculture Research Council (PARC) is an existing institute with some research capacities, the country would require a more structured approach for risk assessment. Some universities offer short-term courses or even Master's programs in food safety, but risk assessment is still not part of the universities' curricula.

Capacities of food safety-specific functions (inspection, testing, and surveillance)

As mentioned above, inspection services are fragmented in Pakistan, where import/export controls are undertaken by either the Animal Quarantine Department or the Department of Plant Protection under the Ministry of National Food Security and Research. The provincial food authorities inspect the food business operators based on the requirements defined in provincial acts and national standards. On the other hand, PSQCA has had the mandate to inspect and test products and services, including food items (Bean, 2019), until the most recent development on the allocation of food control functions. Since these authorities are relatively new, their inspection services, like in Viet Nam or other developing countries, are

very much based on the approach of command-and-control instead of a risk-based inspection approach.

The most significant number of laboratory services in Pakistan were in the food processing sector, whose test volume has increased by 46 percent for microbiology testing and 5 percent for chemical testing between 2009 and 2013. Despite this increase, testing capacities are still not able to cope with local needs. As the World Bank report on the transformation of the Pakistani quality infrastructure indicates (Kellermann, 2019), while in 2005 the country was not a member of any international or regional grouping on accreditation and did not have an internationally accredited laboratory, it has since become a signatory of the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF). It has had internationally accredited laboratories for more than a decade. With the appearance of provincial authorities, the need to improve local testing capacities became necessary to ensure standards enforcement on local products. Even though Pakistan has a number of accredited laboratories, the new enforcement structure did not consider the allocation of accredited laboratories to the provincial food safety authorities.

At this stage, the surveillance and monitoring system is not in place for foodborne illnesses since they seem to be reported in most extreme cases, for instance, the unfortunate death of two siblings due to consumption of expired meat (Khan, 2018). The research also did not find any references for a surveillance policy or monitoring system being considered or developed in Pakistan at this stage.

The food control system of Pakistan is still in an early development stage where the high-level political will is still missing. New institutions were established in the past few years, but their capacities and practices, including the absence of modern policies and strategies to fulfill their functions, will require additional support. The upcoming section will describe the identified food safety capacity building investments in Pakistan. Furthermore, the revision will follow the same structure (project background, objectives, and description of investments) introduced in the previous section to enable better comparability with the other case study.

2.6.2. Food safety and SPS investments in Pakistan

Backgrounds of the selected projects

Pakistan has benefited from billions of dollars of official development assistance (ODAs) in the past, which drastically increased since the war on terror in the early 2000s. The highest ODA in the country's history was in 2015 when US$3.5 billion was invested by the development partners in multiple areas. According to the OECD database[30], in parallel with bilateral donor agencies, such as the United States, the United Kingdom, or Japan, the International Development Association (IDA) of the World Bank Group along with Asian Development Bank (ADB) have spent a substantial part of their international development spending for Pakistan in 2016 and 2017 (Figure 8). However, it must be mentioned that these investments also include areas like infrastructure, public health, governance, human rights, etc. Many of these initiatives are indirectly linked to food safety since they serve as essential enablers in establishing an adequate environment for food business operators and more informed practices of consumers.

Figure 8. Top Ten Donors of Gross ODA for Pakistan, 2016-2017 average, USD million
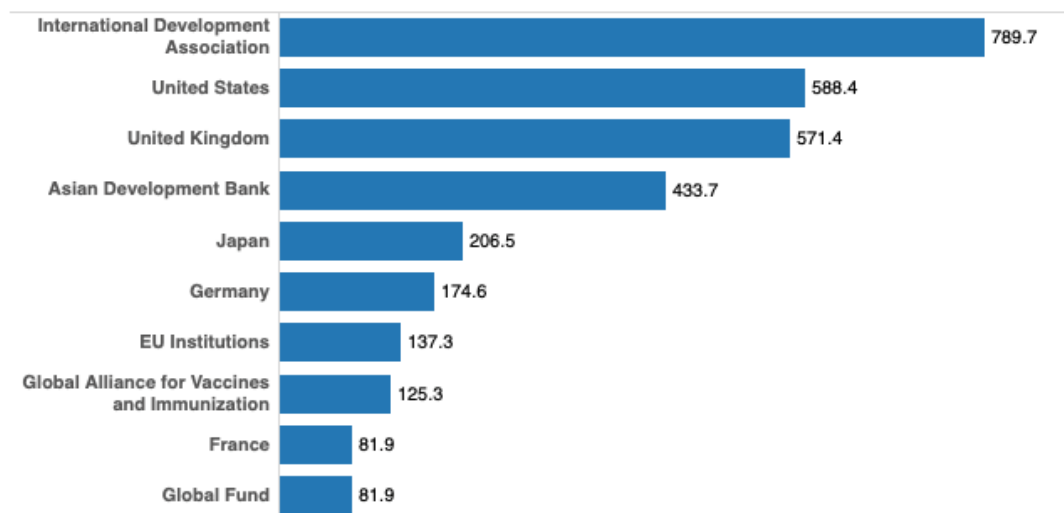
Source: OECD (2018) *Aid at glance*. Paris. Available at: https://public.tableau.com/views/AidAtAGlance/DACmembers?:embed=y&:display_count=no?&:showVizHome=no#1

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[30] OECD's public Tableau Platform
https://public.tableau.com/views/OECDDACAidataglancebyrecipient_new/Recipients?:embed=y&:display_count=yes&:showTabs=y&:toolbar=no?&:showVizHome=no

The Government of Pakistan also funds its own capacity building initiatives often implemented by provincial departments or local consulting agencies. These initiatives were not included in this study as they are not funded by international aid. Accordingly, eight projects (Table 10) were identified for this case study based on the selection criteria. Most of them differ in terms of scope, approach, and implementing agencies. The United States Agency for International Development (USAID) has invested in three out of the eight projects, which is why it is considered a long-term partner of Pakistan in terms of international development.

Concerning the identification of the projects for this case study, many agriculture or agri-business projects had unsustainable food safety activities as part of the project scope. This can be explained by the fact that food security received more attention as a common issue. The shortage of food for a growing population is the result of geopolitical instability, natural disasters, and negative consequences of climate change, such as less rain in some regions of the county. Subsequently, most agriculture-related technical assistance initiatives tend to address productivity-specific challenges in the agri-food sector instead of focusing on compliance with technical regulations and private standards that could address issues like improper fertilizer usage, availability of irrigation water, and financing opportunities (Rehman *et al.*, 2019). Nevertheless, each identified project has either food safety or SPS-related activities. Furthermore, during the identification of the capacity building investments, it was observed that agriculture and market competitiveness projects tend to focus on a specific province or geographical area.

FAO has implemented almost 600 projects worth more than $300 million to provide advisory support in policy development, capacity building, and pilot interventions since the beginning of its operation in Pakistan (FAO, 2011). Despite this extensive portfolio, only one food safety project was found, titled C*apacity enhancement assistance for the Ministry of Food, Agriculture and Livestock (MINFAL).* This initiative was mainly provided advisory support in WTO-related policy and strategy development and project formulation. Without providing a specific title or budget, some reported projects aimed to improve strategic food value chains by supporting food safety standard-setting processes or overall policy and regulatory framework upgrades at the provincial or federal level. FAO's 2017 evaluation on its

operation in Pakistan highlighted that the country "did not fully utilize FAO's normative products and services" (FAO, 2017a). A report to the SPS Committee (WTO, 2006) shows that the Government of Pakistan has requested FAO assistance in building national capacities related to food safety and quality, more precisely "in reviewing and revising SPS laws, remodeling animal and plant quarantine services, enhancing the capabilities of reference laboratories, forging technical linkages and fostering cooperation with developed economies," however, there is no evidence found for such assistance.

Table 10. Food safety capacity building investments in Pakistan

Title of the project	Funding agency	Implementing agency / entity	Investment	Period
The Agribusiness Project (TAP)	USAID	Agribusiness Support Fund	$ 39.9 million	2011-15
Trade-related Technical Assistance (TRTA): Phase I & II[31]	European Union	UNIDO	$ 17.5 million First 2 phase + 3 bridging funds	2004-14
Phytosanitary Risk Management Programme (PRMP) in Pakistan	USAID-US Department of Agriculture (USDA)	Center for Agriculture and Bioscience International (CABI)	$1.5 million	2014-19
Pakistan Sanitary and Phytosanitary (SPS) Distance Learning Program	USAID	Texas A&M University (TAMU) & CABI	$1.5 million	2013-17

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[31] The TRTA had three phases, out of which two were implemented by international organizations and the third phase by a private contractor.

Agribusiness Development Project	Asian Development Bank (ADB)	Ministry of Food and Agriculture ADB provided some small-scale technical assistance	$ 21.6 million	2011-16
Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs	IAEA	International Atomic Energy Agency (IAEA)	€208 321	2012-14
Capacity enhancement to the Ministry of Food, Agriculture, and Livestock in WTO related policy and strategy development and project formulation		FAO	$ 677,000	2005-10
Agricultural Market Development	USAID	Cultivating New Frontiers in Agriculture (CNFA)	$20.4 million	2014-19

In a total of apr. US$ 103 Million

Objectives of the identified projects in Pakistan

Although the selected nine projects might not have an explicit objective specific to food safety, the activities defined under the projects envisaged creating better food safety outcomes. At the same time, measuring cause and effect relationships between food safety

and non-food safety labeled projects is a complex exercise due to the data gaps in food control systems. In addition, some projects target to upgrade the capacities and practices of stakeholders (macro-level - enabling environment or food regulatory and policy level; meso-level - provision of required food safety services; and micro-level - food business operator or consumer level) are labeled under other thematic areas. Nevertheless, the expected outcomes could only be achieved by conforming to food safety and quality requirements.

For an easier understanding of relevant activities within the selected projects, the linkages with food safety or SPS-related areas are highlighted in the project objective column in Table 11. During the review of the documents, it was also observed that the terminologies often differ from the one commonly used in food safety. Instead documents often use the vocabulary of agribusiness development, quality infrastructure, or trade facilitation. As mentioned above, this is a common practice in the development sector, even though the outcome will positively affect food safety compliance. For example, USAID's Agribusiness Project (TAP) indicated adopting new techniques, which included activities in integrating food safety principles into the training materials to farmers and food business operators. In addition, the Agribusiness Development Project has assisted in developing standards to comply with international requirements, which also linked to the compliance with SPS measures.

Table 11. Collection of project objectives of selected food safety- and SPS-related interventions in Pakistan

Project title	Funding agency	Project objective
Capacity enhancement assistance to the Ministry of Food, Agriculture, and Livestock	FAO	To review and **revise SPS laws, remodel animal and plant quarantine services, enhance the capabilities of reference laboratories, forge technical** linkages, and foster cooperation with development economies (WTO, 2006)
Trade-related Technical Assistance (TRTA): Phase I & II	European Union	TRTA I focused on public sector-capacity building related to **the SPS** and TBT Agreements to the WTO and its rules.

		TRTA II aimed "to further enhance its capacity in trade policy as well as strengthening the quality infrastructure for export and to enhance compliance with intellectual property rights (IPR)" (EU, 2016). As part of the TRTA II projects, **food safety and quality code of practices were developed and disseminated among food businesses, and a food safety certification program established in Khyber Pakhtunkhwa.**
Agribusiness Development Project	Asian Development Bank	The main objective of the project was to make Pakistan's agribusiness more competitive and sustainable by (i) improving the managerial, production, and processing skill levels of entrepreneurs and farmers; (ii) supporting increased agribusiness lending through participating financial institutions (PFIs); (iii) reorienting government institutions to facilitate agribusiness development through public-private partnerships; (iv) making the policy and regulatory environment more responsive to the needs of private sector engaged in agribusiness; and (v) **establishing the framework and standards necessary for Pakistan's agribusiness to comply with increasingly stringent international standards**. (ADB, 2014)
Agricultural Market Development	USAID	The Agriculture Market Development had two guiding objectives for the horticulture (mango, *kinnow,* and vegetables) and livestock value chains:

"Objective 1: Increase the efficiency, quality, and profitability of the aforementioned product lines, through the adoption of production, marketing, and **business organization management** practices to transform supply chains of select specific product lines to higher levels of production. The U.S.-Pakistan Partnership for Agricultural Market Development facilitates increased demand for Pakistani agricultural products and fosters supply-demand synergies between producers and buyers, thereby complementing supply-side improvements by the USAID Agribusiness Project. |

		Objective 2: Improve market linkages within targeted product lines and develop the institutional capacity of catalytic actors within chains. The U.S.-Pakistan Partnership for Agricultural Market Development works with processors, traders, retailers, and ancillary service providers who support the targeted product lines. Short description of project activities" (USAID, 2016).
Pakistan Sanitary and Phytosanitary (SPS) Distance Learning Program	USAID	"To strengthen Pakistan's ability to **comply with international trade rules** to increase gross domestic product through greater commodity exports" (USAID, 2018).
The Phytosanitary Risk Management Programme	USAID	The project aims "to implement a biological control program. It will focus on the most destructive insects and in turn, will reduce Pakistan's food losses. If successful, this program will **mitigate the impact of pre and post-harvest pests of rice and horticultural crops**" (CABI, 2019).
The Agribusiness Project (TAP)	USAID	"The project has three objectives: 1. Strengthen capacities in horticulture and livestock value chains to increase sales to domestic and foreign markets; 2. Strengthen the capacities of smallholders (through farmers enterprise group, individual farmers, and agribusinesses) to operate effectively and efficiently; and 3. Increase productivity and profitability through the **adoption of new techniques** and technological innovations (among farmers, agribusinesses, and business development service providers)" (USAID, 2015).
Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs	IAEA	**To develop and standardize multi-analysis methods for on-site screening on veterinary antimicrobial agents** (IAEA, 2014).

<u>Description of food safety specific activities in selected capacity building projects</u>

The Ministry of National Food Security and Research (MNFSR), being in charge of agriculture in Pakistan, would need to play a vital role in promoting and ensuring adequate capacities and practices in food safety and SPS measures, particularly among the farmer community. FAO had a small-scale intervention called *Capacity enhancement assistance to the Ministry of Food, Agriculture and Livestock*, ending in 2010. This project has aimed to support the MNFSR, previously called the Ministry of Food, Agriculture and Livestock, to enhance the country's SPS regulatory framework, including policy and strategy development. Despite the strategic importance of such an intervention, no documentation is available on this investment's actual support and outcomes. Even though FAO documents (FAO, 2011, 2017b) made a brief reference to the project by listing them among their "success stories," no evaluation report, fact sheet, or detailed report are available. The supported ministry was restructured after the closure of the project and renamed from Ministry of Food, Agriculture and Livestock (MINFAL) to Ministry of National Food Security and Research (MNFSR) in September 2011. This transformation was linked to the 18th constitutional amendment, which excluded the provincial mandate from the new ministry's responsibility (Nagesh and George, 2020) and shifted to provinces, thus encouraging the establishment of new authorities. To establish enabling environment for food safety compliance, the trade-related technical assistance (TRTA) initiative funded by the European Union has had three phases so far, the first two mainly implemented by UNIDO, ITC, and World Intellectual Property Organization (WIPO). Since the third phase is still ongoing and has a non-food scope, it is not considered for this research. The TRTA Phase 1 and 2 have included activities on the design of relevant policies, strategies, draft laws for policy-makers, support the setting standards process, and improve testing capacities of relevant authorities. The projects have also piloted the upgrade of actors' compliance capacities in the *kinnow*, captured fish, and mango value chains. As a brief comparison between the first two phases, the TRTA phase 1 has concentrated on capacity building of the public sector on the World Trade Organization (WTO) matters and its rules. In contrast, the

second phase focused on enhancing the public sector's capacity to develop trade policy, quality infrastructure for export and compliance with intellectual property rights (EU, 2016), and the pilot application for mango as mentioned earlier.

The Agribusiness Development Project funded by the Asian Development Bank was expected to improve agricultural products' quality and safety, including packaging and traceability (ADB, 2014). From three project components, the last focused on agribusiness capacity building, aiming to support national institutions' capacities based on their mandate by attempting to (ADB, 2012)

(i)   support the rationalization, restructuring, and coordination of the agencies and offices in the Ministry of Food and Agriculture (MINFA) that were concerned with alignment with World Trade Organization (WTO) regulations and international product standards;
(ii)   promote the development of market information provision in the public and private sectors;
(iii)   strengthen the capacity of export quality certification;
(iv)   strengthen the Federal Seed Certification and Registration Department (FSCRD) in seed and planting material certification;
(v)   facilitate implementation of project activities in the horticulture sector, including the provision of training to strengthen the capacity of various agribusinesses; and
(vi)   support the establishment of a livestock and dairy development board (LDDB) as a corporate entity to enhance and expand activities in the livestock sector.

Similar to this project, the Agricultural Market Development (AMD) also aimed to promote food safety standards at the primary production level, particularly among high-value & off-season vegetables and livestock (USAID, 2016), to improve sales and export.

Pakistan Sanitary and Phytosanitary (SPS) Distance Learning Program funded by USAID has developed a blended 172-hour long program which also contained online and in-person workshops to disseminate the concept of this learning approach (USAID, 2018). The curriculum included modules on SPS Agreement, through pest and plant pest risk analysis to market access process to IPPC standard-setting process, mainly focusing on the phytosanitary aspects, despite the more inclusive title.

The Phytosanitary Risk Management Programme implemented by CABI envisaged the improvement of plant health regulators' technical ability to manage the risk of aflatoxin by

developing pest surveys and deployment of biocontrol agents. In addition, biological control laboratories were planned to be established in Natural Enemy Field Reservoirs (NEFRs) in Sindh, Balochistan, and Gilgit-Baltistan. Furthermore, by performing "regular on-farm releases of biocontrol agents," CABI ensures that relevant actors understand "the theory of insect biological control and know how to establish and maintain NEFRs and Sanitary and Phytosanitary compliance in rice and fresh produce supply chains" (CABI, 2019).

The Agribusiness Project (TAP) has included activities under the International Market Access Program (IMAP) umbrella to organize events on export markets and market requirements for Pakistani manufacturers and exporters from target value chains, including meat apricot, grape, high-value off-season vegetables, and potato. In addition to higher export sales, the project has foreseen establishing networks, creating exposure to innovative ideas and technologies for processing, marketing, value addition, and promotion.

Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs was delivered in partnership with the Pakistan Atomic Energy Commission, the Nuclear Institute for Agriculture and Biology (NIAB), and the National Institute for Biotechnology and Genetic Engineering. This project addresses the need for the country's testing capabilities to be further enhanced to "analyze the antimicrobial residues used – legally and illegally – in animal production, including aquaculture, by employing internationally accepted protocols and standards in a cost-effective way" (IAEA, 2014). The IAEA/FAO Joint Division offered technical and operational assistance, including the procurement of analytical instruments and laboratory materials and laboratory staff training to support them towards ISO/IEC 17025 accreditation.

Results of the projects

This section will describe the achieved results as indicated in the different evaluations and final reports. Since indicators are not harmonized among development agencies, including data collection methodologies, the comparison of results based on indicators, where available, is not possible. Nevertheless, three projects, two small-scale (Capacity enhancement to MINFAL, the Agribusiness Development Project) and one mid-sized investment (TRTA Phase II), have provided technical assistance to relevant ministries. None

of the technical support focused on the adoption of a risk-based approach in food safety inspection.

The TRTA Phase II also supported the establishment of the National Agency for Animal and Plant Health Inspection Services (NAPHIS), which has not materialized until today due to some political disagreement with the Punjab Food Authority (Kellermann, 2019). TRTA Phase II has supported the national quality infrastructure system, including the Pakistan National Accreditation Centre (PNAC), towards international recognition through advisory support and capacity building of assessors. As a result, it has reached Mutual Recognition Arrangement signatory status with the Asia Pacific Laboratory Accreditation Cooperation (APLAC) for testing and calibration laboratories. The laboratory testing capacities have also increased by 20 percent between 2009 and 2013. TRTA Phase II has also developed a national quality policy with a corresponding roadmap. In addition, it has successfully supported the three agri-food value chains towards export markets by improving their SPS management system. As an ultimate result, captured fish was removed from the EU ban list. TRTA Phase II has also ensured regular follow-up with other investments to "avoid overlap and foster complimentary delivery of activities" (Kellermann, 2019)

To strengthen export certification services in the country, the Agribusiness Development Project has revised and upgraded 24 national quality standards. However, the Cabinet of the Government changed the institutional responsibility for export certification right after the project, and it did not initiate any follow-up actions to put them into force. The overall unsatisfactory rating for the borrower's and Asian Development Bank's performance has also received a negative rating (inefficient and unsuccessful) and 44 percent of budget delivery of the overall project. In terms of testing capacities, two out of the seven targeted laboratories were only upgraded, and it is unclear if they reached the required ISO 17025 certification. The project was overly ambitious when it came to institutional capacity building and value chain-specific targets. As the evaluation report suggests, the project could have "opted to pilot in one subsector in one province" instead of operating across the country (ADB, 2014). As per the project completion report (PCR), most of the trainings were also not delivered, including those on international standards.

USAID's Agricultural Market Development project has benefited numerous enterprises in the livestock, citrus, mango, and high value & off-season crops value chains by upgrading their operation with required technologies and basic food safety management systems.

CABI's Phytosanitary Risk Management Programme has established six biological control laboratories in the main cities (Rawalpindi, Islamabad, Karachi, Quetta, Gilgit, and Skardu). In addition, 14 technologies were developed to tackle specific pests, and about 36 million biocontrol agents deployed for which resulted in increased production of papaya by 121.8% and training of more than 5.500 beneficiaries (4,000 farmers as well technical experts) on biological control and SPS compliance in rice and other fresh horticulture produce (CABI, 2019).

The Agriculture Project's (TAP) IMAP initiative has provided technical and financial support to almost 80 local companies to participate in various international trade fairs, stimulating more than US$ 33 million in export sales for 23 businesses. The project's evaluation report has questioned the calculation of this result since many beneficiaries had already participated in such trade fairs. As a result, the evaluation report has stated that "TAP was not particularly successful at increasing access to export markets" (USAID, 2015). Even though the evaluation report indicated that the IMAP component successfully exposed participants to standards, none of the value chains have met the requirements of export markets and international standards.

CABI has created a blended learning program for Phytosanitary measures as part of the Pakistan Sanitary and Phytosanitary (SPS) Distance Learning Program with 14 computer-based modules, in-person module review sessions, seven in-person workshops, and finally with one in-person review session. The inclusion of such face-to-face sessions at three different locations also raises the question why the project title states this as a distance learning program instead of a blended one. This course's actual long-term and sustainable impact is highly questionable as until today, as it is owned by an implementing partner, Texas A&M University, and national agencies might have budgetary limitations to travel to other locations after the project closure. The evaluation report has also not made any reference to the training of local resource people or trainers. For these reasons, the actual development

impact of the intervention is also highly doubtful, particularly due to the statement on "increased trade access for U.S. products" (USAID, 2018) but not vice versa.

Despite the limited budget, the IAEA/FAO project called Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs has shown several achievements by launching the first ISO 17025 accredited laboratory for antibiotic and chemical residue testing in foodstuffs. In addition, the project has also trained 300 farmers on proper production practices as per the test results generated by the supported laboratory (IAEA, 2014). Since the evaluation and the final report were not publicly available, identifying lessons learned and recommendations could not be further analyzed for this project.

Identified challenges in the analyzed projects

Incoherent and uncoordinated capacity building initiatives remain a challenge in the country, which requires additional government-led coordination among the development agencies. The different projects have revealed many challenges that the development agencies need to face during the implementation of a food safety capacity building project. Some challenges are described in general thematic evaluations (USAID, 2015; EU, 2016; Kellermann, 2019) and the project reports.

As highlighted by a European Union (2016) evaluation on its technical cooperation between 2007 and 2014 in Pakistan, the risk management strategies are highly recommended in countries with many uncertainties regarding the economy, climate change, and security. However, this risk management should be further expanded to political situations like a possible constitutional amendment. The TRTA Phase II project has also faced difficulties due to the changing governance structure triggered by the constitutional amendment, requiring the project to collaborate with new counterparts. The changing governance structure is a type of risk that might need to be considered during project formulation, as suggested by the EU evaluation. Due to this new constitutional structure between provincial and federal agencies, certain legislation, including those on food safety, became a power struggle among different competent authorities. The TRTA Phase II project spent substantial time and resources to develop a new food safety bill for the establishment of NAPHIS, which has not passed due to political reasons. In addition to a provincial food authority, the Pakistan

Standards and Quality Control Authority (PSQCA) has also opposed this law because the mandatory status and enforcement of food standards is one of its primary income sources, and this mandate would have been shifted to NAPHIS.

The high fluctuation of project officers (4 over five years), poor follow-up by ADB coupled with poor management and coordination from the borrower and executing agency (in this case, the ministry in charge of agriculture) lead to the unwanted outcome of the Agribusiness Development Project. The project has also failed to fulfill ADB's internal administrative requirements in terms of data collection and reporting based on the performance indicators. Changing governmental structure, including a major constitutional amendment, has negatively impacted outcomes and challenged the actual operation of the project. This last point should have alerted the relevant agencies and the ADB to consider the suspension of the relevant project activities. In Pakistan, governmental officials have a high level of fluctuation, impacting every food safety capacity building investment.

The Agribusiness Project was originally a five-year US$ 89.4 million which was awarded to Agribusiness Support Fund (ASF), a local organization that did not have prior USAID experience in November 2011. Two years after the project was given to ASF, the 2013 Office of the Inspector General (OIG) audit has concluded that the organization does not have the required capacities to implement such a large-scale project (USAID, 2015). After a mid-term correction triggered by this audit report, most activities were considered reasonably well-implemented. As a consequence of the long start-up period, "substantive engagement with many beneficiaries" (USAID, 2015) was delayed by two to three years. This also limited the beneficiaries' ability to gain the required experience after the technology and knowledge transfer. The report (USAID, 2015) also mentioned that ASF needed to familiarize itself with the USAID requirements and build a solid understanding of the value chain development approach before starting the project activities. Therefore, it was not surprising that despite having a major component on international market linkages, the project could not provide the necessary support to the private sector to upgrade their food safety management systems.

The SPS Distance Learning Project has also reported some challenges during the project implementation, particularly political buy-in from stakeholders due to the complexity of the SPS domain. In addition, the training module formulation seems to forget considering the

actual testing of the content before rolling it out to the beneficiaries, which resulted in additional recommendations for content improvement and the actual delivery of the training (USAID, 2018). Despite the importance of this program, very few stakeholders know about its existence, leading to potential duplications of efforts by new initiatives.

In the case of four projects, namely (1) the Agricultural Market Development, 2) Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs, and finally, 3) FAO's Capacity enhancement assistance to the Ministry of Food, Agriculture and Livestock and 4) the Phytosanitary Risk Management Programme, no evaluation or final report was available and thereby, actual issues during the project life cycle could not be identified. The lack of publicly available information is just one of the complex issues that development practitioners need to face during the formulation of new initiatives. Most agencies do not follow full transparency by sharing information and project-related documents.

Changing priorities and governance structure, missing local technical and managerial competencies, and lack of local coordination on food safety investments are significant challenges that development agencies need to face when implementing interventions in Pakistan.

Lessons learned and recommendation of evaluation and final reports

Capacity building interventions often focus on creating access to new markets for food businesses, but they fail to provide a sustainable solution for the food industry beyond project closure. As a result, some businesses will be aware of best practices and market requirements but will not transform their operations. For this reason, local food safety services in mentoring and coaching are vital for food business operators (FBOs) to reduce their costs related to private food safety certification or voluntary third-party assurance (vTPA) programs.

The TRTA Phase I project has also identified some issues during the project implementation, such as insufficient coordination among the three components implemented by different partners, insufficient needs analysis, articulation of explicit capacity building, and insufficient private sector involvement in policy dialogue (EU, 2016). Learning from the first

phase of the TRTA initiative, the TRTA Phase II project has ensured better coordination with other agencies implementing programs. In addition, the TRTA Phase II project has also aimed to support the country in establishing a single agency system called National Animal and Plant Health Inspection Service (NAPHIS), which the PSQCA opposed, thus keeping its mandate and subsequently its income source (Kellermann, 2019). Cost-benefit analysis and stakeholder mapping with incentives are tools to identify these risks early and propose a better supported institutional setup, for instance, a multi-agency governance structure like Canada.

In the case of the SPS Distance Learning Program funded by USAID and implemented by CABI and Texas A&M University, several technical recommendations were provided to the project, some of which were already discussed in the previous section of this case study. Overall, the executing partners have commenced the project without knowing the risks and challenges related to implementing such projects. As the recommendation section of the project evaluation confirms (USAID, 2018), the developed training program covers only phytosanitary measures. Furthermore, the developed training program should be integrated into the national system, either through a local university or the national agency serving as a focal point to the SPS Committee of the WTO.

The overall unsatisfactory outcomes experienced throughout the implementation of the Agricultural Development Project resulted in several precious lessons and recommendations that were also captured in the project completion report (PCR) (ADB, 2012). Out of the eight points, a couple deserves need to be highlighted as they are less country-specific and could contribute to better technical assistance initiatives in food safety capacity building in general (ADB, 2012):

> (i) A thorough analysis of institutional capacity is required during the design process. The state of inter-institutional linkages and the possible effect on project implementation of weaknesses and difficulties with these linkages also needs to be considered.
> (iii) Policy-related work—which in this project involved preparation of a national agribusiness policy and provincial and special areas horticultural policies—will almost invariably take longer than expected and consume a disproportionate share of management resources during implementation.
> (iii) Consultancy output for policy work needs to be very specifically defined. For example, should the output be a policy framework or a complete, agreed and

adopted policy. If the latter, it must be made clear and agreed with the borrower who is to sign off on the policy document.

(iv) Attempting to work along the whole value chain from farm production to market (either domestic or export), as this project attempted to do, will almost certainly be more difficult than concentrating on a few key links…

(v) A clear strategy to exit from support for agencies or offices established under projects needs to be defined at the outset by firmly establishing whether the entity is expected to have a continuing role post-project and, if so, how its operations are going to be financed.

2.6.3. Concluding remarks on the Pakistan case study

The identified projects in Pakistan have showcased various challenges which food safety capacity building investments can face during their implementation. Some of these are caused by external factors that projects should consider as risks during their formulation, such as changing governmental priorities or governance structure. On some occasions, the development partners have failed to fulfill their duty and ensure best practices related to aid effectiveness, including transparency and coordination among each other. In addition, the government also did not encourage the development community to exchange information and improve the prioritization of food safety investments periodically. As a result, the country has not benefited from a large-scale food safety capacity building investment, addressing the major shortcomings of its national food control system. Until its system is not reformed with clear institutional mandates and functions, Pakistan will not be able to fully protect its consumers and economically benefit from enhanced food export. As leading agencies in food safety capacity building, FAO and WHO did not have the required local technical competencies to advise the government in this regard. Some initiatives also aimed to support the restructuring of the Pakistani food control system, but these attempts failed due to the changing political priorities and overall governance structure in Pakistan.

3. Lessons learned from the two case studies

During the analysis of the two case studies, several conditions were identified that could improve future investments' marketability and their likelihood for success. As for recommendations, the conditions for success could be grouped to national, the implementing or executing agency, and at the project level. The principles of the Paris Declaration and Accra Agenda for Action on aid effectiveness were also integrated into these conditions:

At the national level:

Political buy-in: The competent authorities' political willingness or demand for technical assistance is a crucial prerequisite. The case studies show that governments having adequate strategies and policies with correctly set food safety objectives tend to receive more official development aid in this domain. In countries where segmented investments can be observed without having the required political buy-in and support, capacity building activities on food safety are just a sub-component of projects, and they are not able to address the needs of food safety stakeholders sustainably.

Modern national policy framework in food safety: A well-structured policy and legal framework would mean the foundation of food safety capacity building investments. If such a policy document is not developed with the involvement of the industry and competent authorities, this should be handled as a priority to set a roadmap for future investment needs. This policy framework should also integrate the latest and most advanced concepts in promoting compliance culture, risk-based approach, and evidence-based food regulatory decision-making.

Coordination mechanism at the national level: The government has the ultimate role in coordinating and synergizing capacity building investments and ensuring the adequate way of investing in its food control system. Coordination among development partners has also been identified as a clear issue in food safety capacity building. International development agencies often compete with each other, which can be avoided through transparent dialogue among food safety stakeholders. For this reason, the projects need to be designed from the beginning in a way that each agency's activities are complementary, and agencies agree to institutionalize their cooperation through different platforms led by the government. This platform should also include the private sector to avoid objections to adopting new guidelines and food safety practices.

At the implementing agency level:

Experience in implementing the same volume of investments, which they are planned to be involved: The executing agencies must have experience implementing investments in the same volume they are involved in and understanding the country/region. Those implementing agencies that cannot showcase the required competencies, depending on the

level of involvement, might underestimate the technical and administrative obligations of implementing a development initiative.

Integrated capacity building approaches well-functioning in conjunction with other food safety investments: If an executing agency has an approach or strategy for enhancing a food safety system, it is also aware of its comparative advantages to other development agencies' services. The agency will also be able to identify synergetic investments in an environment where are multiple ongoing food safety capacity building investments.

Building inter-agency consortia in specialized areas: A possible way for development agencies is to develop synergetic strategies by establishing inter-agency consortia in food safety based on the functions of a food control system. Different platforms and coordination mechanisms are already in place worldwide, ranging from intra-project or national level coordination to consortia-like inter-agency collaboration to more institutionalized like the IAEA and FAO joint division.

Strong / Established evaluation practices: Food safety capacity building investments will require a structured evaluation practice and more frequent independent evaluation. In addition, as evaluators are being compensated through the donor or the project itself, the conflict of interests among parties participating in evaluating capacity building investments will continue impacting their outcomes. Finally, development agencies must have competent evaluation personnel knowledgeable about food safety capacity building.

In-house specialized competencies: The approaches of development agencies should be built on existing in-house competencies, address complex development challenges in food safety, and allow working with other development agencies' strategies in a symbiotic manner. In case development agencies would like to extend their service portfolio with new food safety capacity building areas, full-time in-house expertise should be available.

At the project level:

Competent project personnel: The personnel of the implementing agency engaged in implementing food safety capacity building initiatives need to have the required expertise and experience. Some agencies have the mandate and the in-house domain knowledge to

support countries with the required technology and knowledge transfer, but they are not involved in project implementation. Designing large-scale food safety capacity building investments requires substantial experience in building complex systems in the development context.

Selection of appropriate assessment tool: Development agencies use their technical tools to assess existing capacities and practices within the food control system. Due to their large numbers, it would be highly recommended to synergize assessment practices among development partners and ensure the availability of these reports among them through a shared database. Evaluating project outcomes based on the original DAC evaluation criteria (relevance, coherence, effectiveness, efficiency, impact, and sustainability) should be complemented by assessing the executing agency's performance.

Early involvement and integration of piloting practices with the industry: Many capacity building investments focus on the capacities of competent authorities without involving the industry in the form of pilots. The engagement of the private sector will enhance the marketability of investments by assessing their readiness to change and self-invest in the improvement of their food safety practices.

Collection of verifiable data for the project indicators: Although some projects had a final independent evaluation and were part of a meta-evaluation, the reported results still cannot be fully verified. This remains an issue already right after the project closure, which could only be addressed through a more robust framework in data collection with verifiable evidence.

Inclusion of an exit strategy to address sustainability issues: Capacity building investments tend to offer a single solution for all problems instead of setting achievable goals. Having an exit strategy would allow the project partners to provide future recommendations or upscale strategy endorsed by the government and the industry. Using these strategies as reference documents, the development community and the competent authorities can have a more structured and transparent dialogue on future investment needs in a food control system. In case a follow-up investment is already planned before the project closure, an exit strategy might not be required.

4. Comparative analysis of the two case studies

This section compares how the two case studies based on the previously collected information performed by applying the previously described conditions for success. A color-coding is introduced to indicate if a condition for success was fulfilled: yes (in green), no (in red), and undecided (blank). In cases where no information was available, or it was not applicable to the majority (at least five projects) of investments in Pakistan, the condition was undecided.

Table 12. Comparison of case studies based on the conditions for success

Conditions for success	Viet Nam case study	Pakistan case study
At the national level		
Political buy-in	The motive to address food safety was triggered by reported death cases, which also captured the attention of the public and afterward the political leadership. As a result, the political leadership prioritized the enhancement of food safety practices and capacities.	The political buy-in and ownership at the highest level in Pakistani politics remain elusive. There is a lack of understanding of the importance of the food safety domain and its complexity.
Modern national policy framework in food safety	Partnerships and the fragmentation of projects are addressed by the National Food Safety Strategy of Viet Nam (Official Gazette Vietnam, 2012) by encouraging collaboration among food competent authorities, including provincial and	The policy framework remains outdated, sometimes even non-existent, without having specific documents guiding food safety governance and capacity building investments.

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	federal level, and coordination with international organizations in food safety capacity building.	
Coordination mechanism at the national level	Periodical meetings among development partners and led by the government are organized to report ongoing investments and identify synergies. This also ensures the ownership of the government.	There is no structured and periodical coordination mechanism led by the government, and few initiatives have coordinated with other agencies.

At the implementing agency level

Experience in implementing the same volume of investments, which they are planned to be involved:	In this case, the World Bank has a long-standing experience in administering and technically overseeing large-scale investments, however, mainly outside the food safety domain	Some agencies (ADB, UNIDO, USAID, and FAO) have had experience administering and technically overseeing mid- or large-scale investments. When it came to a larger investment, a local consulting company could not comply with the requirements of ADB.
Integrated capacity building approaches well-functioning in conjunction with other food safety investments	World Bank did not have a policy document during the period when the project was implemented.	Only FAO had a strategy touching upon food safety but only limited technical assistance provided in food safety. The other agencies did not have a documented

		food safety capacity building strategy or approach during the implementation period of the projects.
Building inter-agency consortia in specialized areas	The World Bank has several specialized arms, which creates access to a network of experts. However, in this case, no collaboration was reported.	Some projects (TRTA Phase I & II) have included multiple agencies. The country has also benefited from the specialized support of the IAEA-FAO consortia.
Strong / Established evaluation practices	Documentation on external evaluation is available and shows a strong commitment towards transparency	Four projects did not make the final evaluation available on the Internet. In the case of smaller investments, it might be the case that the final evaluation was not even conducted. These limitations are more linked to the internal policy of different agencies. For instance, FAO generally does not share such documents with the public, whereas the Asian Development Bank shares all information.

In-house specialized competencies	The World Bank has domain experts in food safety. Various World Bank publications serve as proof for this expertise.	All development agencies have experts in food safety capacity building.
At the project level		
Competent project personnel	The satisfactory rating of the World Bank's performance would not be possible without competent personnel handling the LIFSAP Initiative.	ADB had reported competency issues when they wanted to engage with a private consulting agency. Due to the lack of information on the project personnel's actual performance, this cannot be decided.
Selection of appropriate assessment tool	No information was provided on the applied assessment tools.	
Early involvement and integration of piloting practices with the industry	The LIFSAP initiative has piloted the developed guidelines, but it also had sustainability issues when it came to its wider rollout. The project has also successfully upgraded	There were piloting in case of the projects which aimed at industry support.
Collection of verifiable data for the project indicators	The final evaluation has suggested further improvements in the M&E framework, including the introduction of additional indicators.	Except for few projects, no verifiable information was found. These are usually available in the final report.

Inclusion of an exit strategy to address sustainability issues	No specific exit strategy was developed for the project, but a subsequent food safety project was recommended and started to be formulated before the project closure to ensure continuous support to the country.	Only the TRTA Phase II project had a detailed exit strategy on the developed activities. Other projects did not report on any exit strategy.

A comparative analysis using the developed conditions for success shows that Viet Nam has provided a more favorable environment to implement food safety capacity building investments. This also shows that Viet Nam's regulatory and policy framework is more advanced than the Pakistani, even though the LIFSAP initiative did not support this. In addition, the risk analysis principles are embedded in current legislations and educational frameworks in Vietnam, whereas this is still non-existent in the current regulatory framework of Pakistan. Unexpected changes in the institutional framework of Pakistan's food control system have negatively impacted the outcomes of some initiatives. These changes were politically driven and not to enhance the food control functions, resulting in further fragmentation and delay the different food safety functions at the local level.

As a comparison of the different outcomes in the two case studies, major investments enabled by a favorable political environment aiming to upgrade the food safety and SPS practices and capacities in public and private sector lead not only to better outcomes but can also facilitate additional investments required for a food control system to become more robust. Accordingly, the fulfillment of national-level conditions should be handled as prerequisites for any large-scale food safety capacity building initiatives. Thereby the policy and legal framework should consider good regulatory practices, including the involvement of the industry and other food safety stakeholders. Without having these in place, it is not certain if the policy-makers are well-equipped with the basic concepts of a robust food control system.

The analysis on the conditions at the implementing agency level shows that the World Bank and the development agencies involved in Pakistan had the required competencies and

experience. Outstanding underperformance was reported when local consulting companies aimed to deliver the same service. Although some private enterprises in Western countries have solid experience designing and implementing food safety capacity building initiatives, a local company in developing countries might not be the most suitable selection, mainly where the national food safety system is still underdeveloped.

Based on the conditions for success, the LIFSAP initiative in Viet Nam has performed better than the identified projects together in Pakistan by fulfilling three conditions versus one. The enabling conditions at the national and implementing agency level have also contributed to the positive outcomes of this project. Some good practices, particularly the consideration of the sustainability of investments, were highlighted as an issue in most evaluations. These are often addressed by exit strategies or follow-up investments which were not the case. Most projects did not collect verifiable data on their performance, which raises questions about their outcomes and impacts. In addition, since the definition and collection method of indicators are not harmonized among development agencies, they cannot be compared. Verification of the impact would only be possible if the governments also apply and publicly share performance indicators on their food control systems, which is still not the case in these countries. Consequently, this should be a priority area which the government needs to address.

5. Addressing the hypothesis

The two different cases show the importance of having strong ownership by local stakeholders in an environment where food safety transformation, anchored in modern food safety policy and regulatory framework, is demanded by the public and the food industry. As a result of foodborne illness outbreaks, the political leadership of Viet Nam has realized that they are at a crossroad where transforming its food control system and promulgating food safety management practices are essential to protect consumers and support economic growth through enhanced trade. Although many food safety scandals were also reported in Pakistan, they did not lead to widespread outrage followed by political buy-in and improvement of the national food control system. As the research revealed, both countries had received development aid to improve their food safety practices. Some investments in Pakistan have failed to achieve their expected outcomes due to poor project management practices, lack of

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coordination among interventions, limited stakeholder ownership, and inadequate project intervention approaches. On the other hand, the LIFSAP initiative could ensure proper coordination with relevant partners, including other food safety investments, and piloting best practices among food business operators.

The comparison of the case studies based on the conditions for success indicates that a large-scale food safety investment can deliver more far-reaching outcomes than segmented initiatives, thus confirming the research hypothesis. Smaller initiatives will only overperform a large-scale investment if all implementing partners involved in a country agree to work in a symbiotic relationship with periodic coordination, and all initiatives can achieve their expected outcomes. This continuous coordination would require the formulation of a public-private partnership that, among other duties, will coordinate food safety investments. Such a mechanism is still very new to developing countries, and until then, large-scale investments have a higher chance to transform food safety systems.

In conclusion, the research hypothesis is confirmed that major investments have more potential to achieve project objectives than multiple smaller food safety capacity building investments. In addition, the conditions for success can play a fundamental role in ensuring the desired results. Even though donor agencies are continuously reemphasizing the principles on aid effectiveness, they should also translate these into practical tools and methods which correspond to the multidisciplinary nature of food safety capacity building. Accordingly, the next chapter will draw from the abovementioned findings to address the gaps in project design and develop tools for project implementation and evaluation, which are meant to improve the likelihood of positive outcomes of such investment.

Chapter 3 – Guidelines for food safety capacity building investments

Capacity building projects have distinctive but still interconnected phases (project planning, monitoring, and evaluation) where best practices must ensure the expected outcomes and continuous improvement. The international development community continuously strives to improve these capacity building approaches. However, less attention was paid to enhancing the marketability of food safety capacity building initiatives so far, which would be crucial to improve global public health and transform the economies of developing countries. As the previous chapters revealed, development agencies often operate in silos, and there are many areas where improvements could be introduced, from better planning and coordination to better-defined capacity building approaches and strategies.

The chapter's main objective is to develop a set of tools in project formulation and evaluation, aiming to maximize the impact of food capacity building investments. It will also elaborate on the best practices for project implementation as a guideline for capacity building practitioners.

Besides confirming the research hypothesis, the previous chapter also identified a set of conditions for success that can improve the likelihood of positive outcomes in food safety capacity building initiatives. The different guidelines developed in this chapter will build on the application of results-based management, the most widely spread project management approach among development practitioners, and integrate conditions for success. Results-based management (RBM) is "a management strategy applied by all actors, contributing directly or indirectly to achieving a set of development results by ensuring that their processes, products, and services contribute to the achievement of desired results" (UNDG, 2010).

To better understand the theoretical background of results-based management, a review of the most relevant concepts will be offered in this research. Accordingly, it will scrutinize the lessons learned and challenges of each stage of the project life cycle in chronological order, explicitly project planning, project implementation, and evaluation. Complementary academic literature identified through the systematic review of Scopus and Web of Science and reports developed by international development agencies will be used in conjunction

with the findings from the previous chapter to highlight current development challenges in food safety capacity building. The concrete output of the research will be 1) a quality control checklist developed for the project formulation phase, 2) recommendations for the improvement of project implementation, 3) an evaluation tool for food safety capacity building investments adapted from an existing evaluation framework, and 4) technical competency requirements for evaluators in food safety capacity building.

Suppose food control systems and their operationalization are based on a foundation of standardized generation, collection, and use of data. This could accelerate the development process of national food control systems in developing countries, contributing to enhanced trade by establishing more rapid and evidence-based recognition of system equivalence. Today, data collected through capacity building projects may be lost and are not accounted for further developments, only serving the purpose of measuring the impact of specific investments. An integrated and harmonized performance monitoring framework based on data can unlock potentials for more marketable and better-targeted capacity building practices.

1. Addressing global challenges to foster food safety

The analysis of the case studies in the previous chapter has revealed several issues, such as limited data sharing and transparency in capacity building, lack of coordination among development partners, and a dearth of ownership by the national government. In developing countries where food safety is not a priority agenda item of the political leadership, capacity building initiatives will face significant challenges to achieve their expected outcomes. Data sharing and transparency in capacity building initiatives would require a more extensive effort demanded by the member states of the United Nations. The lack of ownership also changes the nature of interventions from a demand-driven approach (the required capacity building needs to be known to decision-makers) to a supply-driven intervention (lack or complete absence of knowledge on needed food safety practices and corresponding investments), making the work of project teams more difficult. This usually will entail more frequent coordination and repetitive explanation to ensure a clear understanding of most fundamental concepts. In the case of supply-driven capacity building projects, the project implementation team needs to spend substantial time justifying project activities and

convincing the beneficiaries of the importance of the intervention instead of implementing activities.

Vipham, Chaves and Trinetta (2018) discussed similar challenges to fostering food safety from a systematic perspective, such as inadequacies in data, governance, and infrastructure, value chain engagement, and inconsistencies in standards, regulations, and certifications. Jaffee et al. (2018) have elaborated on these by pointing to the market failures to provide safe food and the need to have an integrated solution through the food safety life cycle model. Export market opportunities translated to potential higher income source remains the primary incentives for food business in developing countries to comply with higher food safety standards (Jaffee *et al.*, 2018). On the other hand, adequate sanitary and phytosanitary (SPS) and trade facilitating regulations set by the government through evidence-based risk analysis principles are critical in avoiding domestic market distortion. Particularly in developing countries, where food safety competent authorities might not have the required resources to fulfill their control functions, co-regulatory approaches might be applied (Garcia Martinez *et al.*, 2007) by applying private certifications. Another solution can be a center of excellence in risk assessment and other food control functions, aiming to disseminate best practices at the national or regional level (Godefroy *et al.*, 2019).

As a general background, Vallejo and When (2016) offer a good summary of the existing capacities and challenges in international development assistance by concluding that "existing methodologies and approaches are not sufficient, and thereby hybrid or multi-path approaches to capture changes in capacity and their contribution to results require further methodological development in order to effectively provide a basis for careful decisions regarding future capacity development efforts and investments." Chapter 2 has reaffirmed this issue and suggested that development agencies should define their capacity building methods to improve the outcomes of food safety investments.

To improve the efficiency and effectiveness of food safety capacity building initiatives, Jaffee et al. (2018) have set five principles:
-   Invest for the right reasons;
-   Invest in the right things;
-   Use public investment to leverage private investment;

- Track the impacts of investment;
- Ensure the sustainability of investments.

With regard to forward-looking investments, the report (Jaffee *et al.*, 2018) identifies the foundational aspects of food safety systems, namely 1) sound science and evidence, 2) human capital (or food safety professionals), and 3) producer and consumer food safety awareness and knowledge. Several other guidelines were developed by the World Bank (2009a, 2014), STDF and OECD (2008), aiming to improve investment practices in food safety and SPS capacity building. An OECD Conference highlighted the following weaknesses of projects by reviewing evaluation reports of trade-related assistance projects in developing countries (OECD, 2008b):

- Unsystematic or incomplete needs assessments;
- Weak project management and project governance structures;
- Fragmented trade-related donor interventions with insufficient synergies to broader development assistance programs;
- Weak explicit linkages to poverty reduction;
- Insufficient donor co-ordination and complementarity at headquarters and field level;
- Inadequate internal communication and donor expertise on trade-related matters.

As per these key findings, the evaluators participating in the OECD Conference in 2008 listed the following key recommendations:

- Ensure partner country ownership through wide stakeholder dialogue;
- Base activities on a sound, consultative diagnosis;
- Establish an explicit link to national poverty reduction strategies to take account of the potential impact on the poor;
- Manage for results, which should apply results-based management approach;
- It is the duty of beneficiaries to improve impact.

As food safety is a public good, national governments must ensure adequate financial or domestic public resources to enhance and maintain adequate practices in controlling

operators and awareness-raising of consumers and the industry. If governments in developing countries neither have the required financial resources nor financing instruments, food safety-related investments could be funded from concessional financing instruments, such as official development assistance (ODAs) and beyond ODA flows (BOFs), depending on the requirements of the funding partners. Along with the upgrade of obsolete practices in food safety systems, relevant governmental organs should consider the introduction of supportive financing policies, including tax and service fees. Creating additional financial resources can encourage the industry to upgrade facilities based on the requirements of food safety standards. Blended finance can offer possible solutions to avoid any financial impediments for the private sector during the upgrade process. These bring "together development and profit-oriented flows, might be best suited for investments with development impact and non-competitive financial returns" (UN, 2019). Subsequently, impact investment should be well integrated into future initiatives for better sustainability. Such prerequisites will be considered during the development of the guidelines in project formulation and evaluation. To support the development of such guidelines through impact investment, the document *Investing for Impact: Operating Principles for Impact Management* (IFC, 2019) has defined nine principles based on five main elements as building blocks for a robust impact management system (Figure 9).

Figure 9. Investing for impact: operating principles for impact management
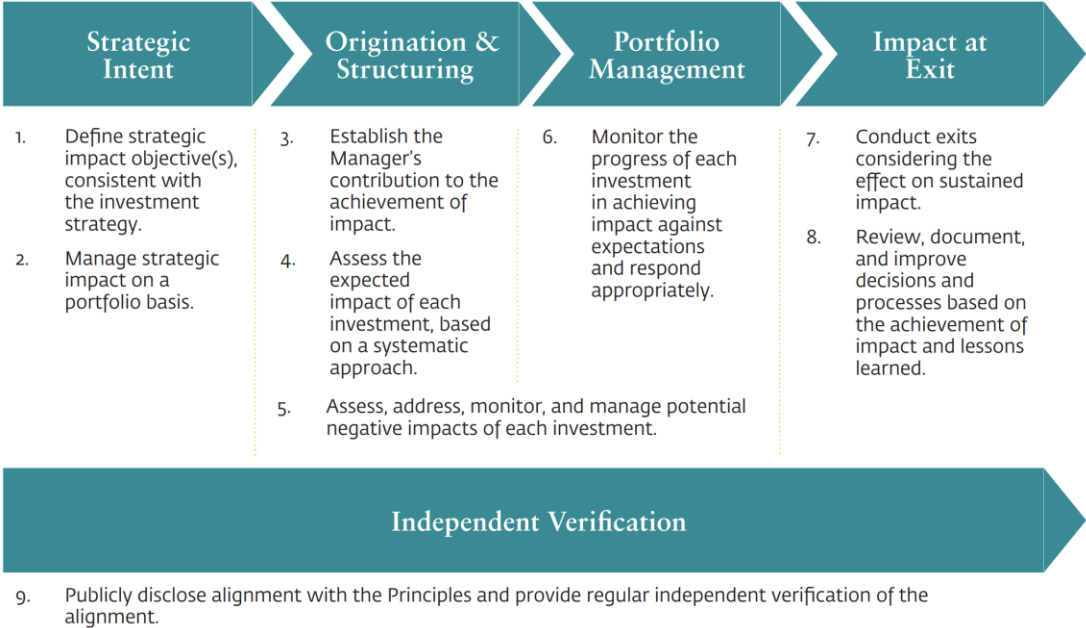
Current food safety capacity building investments can be initiated by the beneficiaries, the donor community, or development agencies, which should be carefully considered during the project conceptualization and formulation phase. It is commonly agreed among development professionals that the best theoretical framework for project management in international development assistance and cooperation is results-based management. The following section will offer a brief review of results-based management and its most relevant principles.

2. Basic concepts of result-based management

The results-oriented approach has been emerging since the 1960s as a public governance concept adopted by the United Nations in the late 1990s, serving as an overarching management strategy highly demanded by beneficiaries and donor countries. By receiving continuous global attention through the Monterrey Consensus in 2002, Paris Declaration on Aid Effectiveness: Ownership, Harmonization, Alignment, Results and Mutual Accountability in 2005[32], the Hanoi Conference on Managing Development Results in 2007, the Accra Agenda for Action in 2008, and the Busan Partnership for Effective Development Cooperation in 2011 focus remained on: (a) delivering results that would change the world; an on (b) enhancing national capacities for results-based management. (JIU, 2017).

Several handbooks and guidelines (OECD and WBG, 2006; UNDP, 2009; UNDG, 2011) were published to promulgate the fundamental knowledge on RBM and put in practice this conceptual framework. RBM has a life-cycle approach (Figure 10), which starts with planning by setting the vision and defining the results framework, sometimes called logical framework, agreed by all partners. After finalizing the project planning phase, the implementation of activities commences in conjunction with monitoring planned outcomes, with the primary purpose of reviewing progress to achieve goals. Monitoring is defined by United Nations Development Programme (UNDP) (UNDP, 2009) "as the ongoing process

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[32] After the Paris Declaration, OECD has also developed the Managing for Development Results (MfDR) concept which aimed to enhance the outcome of international development by increasing effectiveness and introducing results-orientation through practical performance management tools which help to implement national plans, country strategies, sector programs and projects (OECD, 2008a).

by which stakeholders obtain regular feedback on the progress being made towards achieving their goals and objectives." The final stage of RBM is an evaluation which entails "a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated objectives and contributing to decision making" (UNDP, 2009).

Figure 10. The RBM life-cycle approach
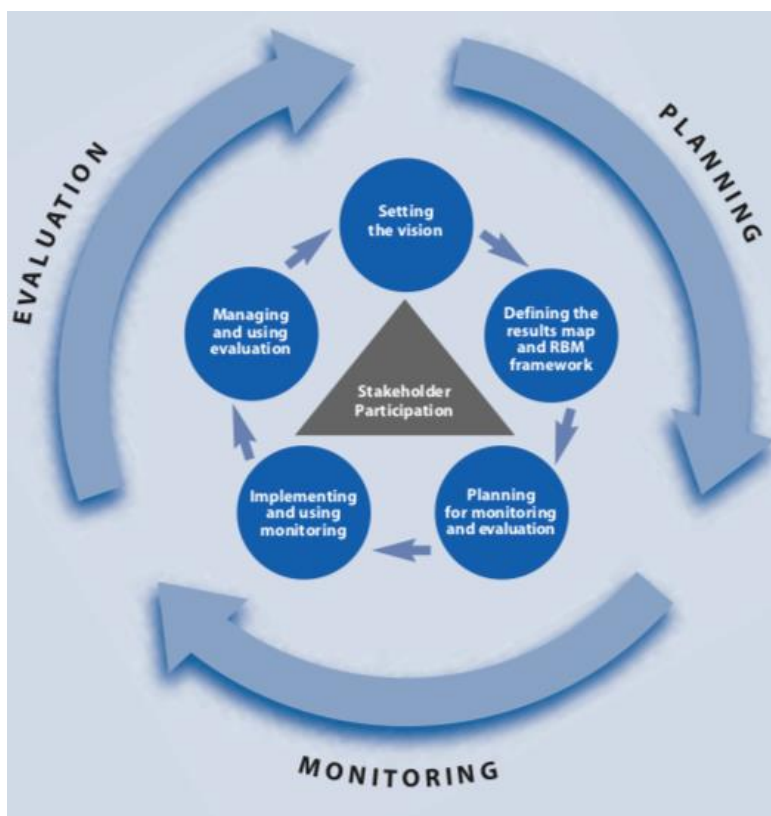
Source: UNDP (2009). Handbook on Planning, Monitoring and Evaluating for Development Results, p. 10

The most essential tool of RBM is the results or logical framework[33] , which supports "practitioners to discuss and establish strategic development objectives and then link interventions to intermediate outcomes and results that directly relate to those objectives" (World Bank Group, 2012). The logical framework elaborates on the results chain and intervention approach with expected cause-effect relationships among outputs, outcomes,

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[33]

and impacts. The following steps were defined to guide practitioners in establishing an effective result framework (World Bank Group, 2012):

Step 1. Establish strategic objective(s) for the problem(s) to be addressed

Step 2. Identify and work with stakeholders

Step 3. Define results (outputs and outcomes)

Step 4. Identify critical assumptions and risks

Step 5. Review available data sources and specify indicators

Step 6. Assign indicators and data sources for each level of results

Step 7. Establish the performance monitoring plan

Step 8. Establish a communication and dissemination plan

The logical framework is the heart of the results-based management system, allowing the proper planning and description of the expected deliverables in the form of results at output, outcome, and impact level. The logical framework is designed during the project formulation, providing the strategic guidance and monitoring of activities for stakeholders throughout the project implementation. Before exploring the best practices on logical framework design, it is worth examining the overall project formulation process and focus on proper ownership and knowledge dissemination on current practices and capacities.

3. Project planning guideline
3.1. Best practices in project planning

The previous section has described the basic structure of results-based management (RBM), which is the most widely applied project management approach in the development context. In the context of food safety capacity building, identifying best practices along the project life cycle can further improve the likelihood of positive outcomes, and thus, the marketability of food safety initiatives. The comparative analysis of the two case studies in Chapter 2 supported the identification of additional practices, which can be compiled into a quality checklist at the project planning level. More structured coordination among development agencies is fundamental to using the right approach for the proposed investments, including deploying adequate assessment tools and sharing the findings of these reports. Accordingly, the formulation of capacity building investments in a coordinated manner shall remain the responsibility of the governments, and the establishment of a national coordination

platform(s) in food safety and SPS capacity building chaired by the government can facilitate this effort. This platform can allow a data-sharing process among the partners to improve their food safety capacities. The inclusion of the private sector will be crucial to receive inputs during their planning phase and ensure the investments' sustainability. This can build trust among parties and encourage private sector investment. The previous chapter also revealed the importance of the development agency's competence and integrating sustainability in the overall intervention approach. Irrespective of any development agency's technical and administrative competencies, if it does not have experience designing robust projects, the intervention approach might be oversimplified and thus unable to address more complex development challenges. This, along with the integration of sustainability in the overall project intervention approach through its vision, will also allow for a more structured exit strategy or potential linkage with other investments related to food safety.

A study co-authored by STDF and OECD (2008) has identified additional lessons from observed challenges. These should be adequately reflected during the design of any SPS-related technical assistance intervention, also applicable to food safety to ensure better project outcomes:

1. **Country context and absorption capacity**: Differentiating among countries based on their development level as those with weaker performance observed to have lower absorption capacity;
2. **Ownership and demand- versus supply-driven technical assistance**: demand-driven approach refers to the beneficiaries' awareness of their capacities and required support, showing stronger ownership. The demand-driven approach has a higher likelihood to transform food safety capacities compared to the supply-driven approach;
3. **Needs analysis as a starting point for SPS-related technical assistance**: some of the relevant assessments are stakeholder analysis, cost-benefit analysis, enhancement of existing capacities, and development of results-based management tools to identify the required capacity building;
4. **Transparency, connectivity, and sequencing of SPS capacity building:** Linkages and synergies among investments lead to better outcomes;
5. **Value chain approach:** its adoption in the design of SPS-related technical assistance to address complementary activities;
6. **Active involvement of all concerned stakeholders, including the private sector:** inclusivity of all stakeholders reduces the risk on the adoption of new practices;

7. **Regional versus national approach to SPS-related capacity building:** regional projects can handle better transboundary issues, whereas national projects can focus on local capacities and practices.

3.2. Project planning tool

Based on the best practices identified from the literature review, this study has developed a conceptual framework with a corresponding tool for planning food safety projects. Accordingly, the research proposes the split of the project formulation phase into project conceptualization and project document design based on the general approach of developing new initiatives. This division also aims to address the need of better framing food safety capacity building investments based on the aid effectiveness principles stipulated in the Paris Declaration and its related Accra Agenda for Action. This research has also considered that some initial investments must carry out essential data collection and analysis, baseline assessments, and stakeholder consultation at the project formulation stage. More importantly, this period should also define the intervention approach or project vision which addresses the main food safety issues sustainably and inclusively. Usually, the main result of project formulation is that the stakeholders agree on an investment outlined in a project document or project appraisal document, depending on the agency's terminology.

The project planning tool with a quality control checklist (Annex C) based on a framework of eight sequential steps or criteria (Figure 11) is developed to enhance project planning practices. The framework follows the principles of and applies tools used in results-based management, which need to be considered during the project planning stage. In addition, recommendations identified as conditions for success at the end of Chapter 2 and by STDF and OECD (2008) have been integrated into the relevant criterium. Each quality criterium is elucidated and structured to elements with related questions. For the most effortless application of this checklist, besides naming each quality criterium, a definition and set of binary questions were developed to guide practitioners. In case of negative responses due to missed criteria, the user can consider how relevant that would be to the project and possibly impact the intervention's outcome. Regardless of the development and donor agencies' requirements for the content or structure of a project document, this checklist can be applied for any project conceptualization and document design in food safety capacity building.

Figure 11. Framework of the proposed quality control checklist for project formulation

Identification of the gaps and needs → Project vision → Stakeholder coordination

Synergy & linkage → Integration of cross-cutting themes (gender, youth, envirionment and innovation) → Design of the results-based management framework (logical framework, indicators and assumptions)

Sustainability → Monitoring, Reporting & Evaluation (MRE)
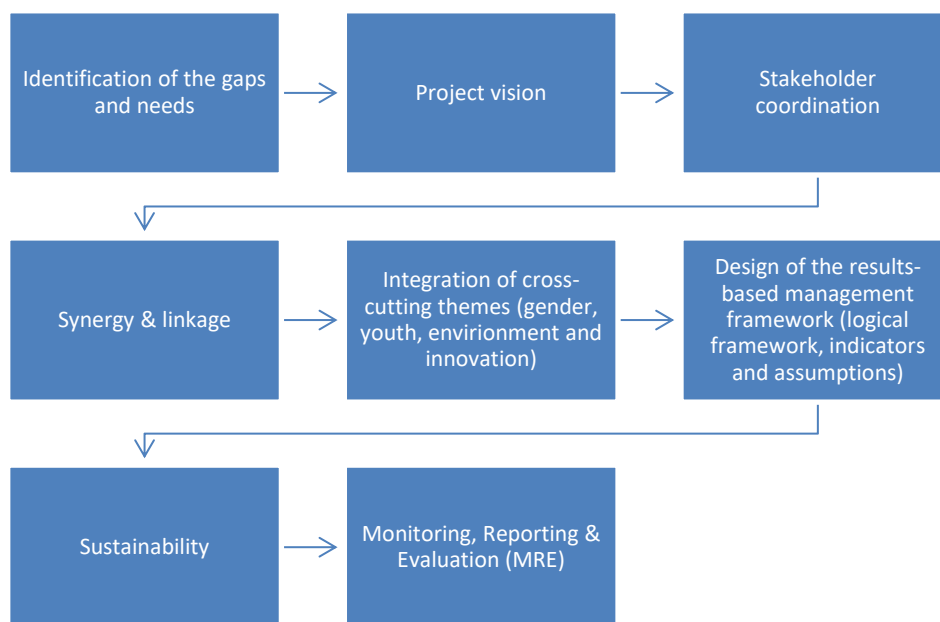
Some aspects of this project planning tool, such as introducing multifunctional indicators or integrating the project's logical framework within a more comprehensive performance monitoring framework of a national food control system, will be further explained in Chapter 3 and 4. In a local application by competent authorities continuously, questions linked to the development sector could be excluded from this tool. Since food safety challenges cannot be considered an isolated development issue, other development areas, such as environment, gender, and sustainability, are integrated within this list of guiding questions.

3.3. Development of a logical framework

The practical application of the logical framework can differ from one organization to another, sometimes including different types of information. The conceptual presentation of the results chain and its hierarchical structure, composing of impact, outcomes or intermediate outcomes, outputs, and activities, are necessary for a general understanding of the concept's definition and application. The results usually can be categorized into short-term outputs or long-term strategic objectives. The latter is referred to as outcomes and impact and can be achieved through the intermediate outcomes and outputs. The outputs are reached by delivering certain activities, which are also defined in the results framework. After defining the impact and outcomes along the results chain, adequate performance indicators should be assigned to measure results in qualitative or quantitative criteria and facilitate the monitoring and evaluation of the intervention (UNDG, 2011).

The project results are monitored through performance indicators, which are supposed to be developed based on a specific, measurable, achievable, relevant, time-bound (SMART) checklist. In order to enable these processes adequately, baseline and target data should be set for each indicator. Two collective groups could be distinguished, quantitative indicators represented by a number, percentage, or ratio, and qualitative indicators that measure quality and often are based on perception, opinion, or satisfaction levels. The collected data should be trustworthy, ensured through an adequate and preferably standardized data collection approach. The data collected in the form of indicators in capacity building initiatives can also measure the actual performance of national food control systems in a given period.

3.4. Analysis of previous efforts for setting indicators for food safety and food control systems

The previous chapter has also shown that comparing capacity building interventions based on their performance indicators is currently impossible as the indicators and data collections practices are inconsistent and not always developed empirically and evidence-based. As a result of the detailed project documentation review for the comparative analysis in chapter 2, this research has had additional observations on the current way of using performance indicators for capacity building interventions and related project reporting:

1) The use of inclusive and collaborative language to maintain a positive relationship with project stakeholders;
2) The release of funds by the donor is very often linked to positive project results, and thereby, it is neither in the interest of the implementing agency nor the beneficiaries to report any malfunctions; and
3) The reported data is not verifiable due to the data collection practices.

Several attempts were made to set performance indicators in the domains of food control systems. However, until today, no comprehensive and globally agreed on indicators are in place. As indicated in a World Bank report (2012) on results-based management, some governments have been considering integrating monitoring and evaluation systems in their institutional monitoring framework by utilizing data generated by their various bodies. The Codex's *Guidelines for Monitoring the Performance of National Food Control Systems* (CXG 91-2017) also highlights the principles of such initiatives on national food control systems to implement monitoring and system review of the competent authorities. One out

of the six steps in CXG 91-2017 [34] on monitoring the performance is establishing indicators as "means for measuring achievement, reflecting changes, or assessing performance" of the food control system (Codex, 2017). CXG 91-2017 does not entirely use the terminology of RBM, but in principle, the defined approach resembles it. The main differences are in the terminology used in the guideline; for example, Codex uses the wording "outcome framework" instead of results or logical framework and "intermediate and lower-level outcomes instead" of outputs. Harmonization of terminology, including applying standardized indicators used by the development agencies in food safety capacity building interventions, is required to ensure meaningful data sharing among stakeholders in food safety capacity building. Establishing a Codex guideline on food control system indicators is a possible way forward in order to enable any future harmonization efforts. This process would need to involve competent authorities and development agencies, focusing on food safety capacity building and experts in monitoring and evaluation, behavioral science, and data science. Accordingly, these indicators would fulfill multiple roles; 1) Monitoring performance of food control systems from public health and economic or trade perspective; 2) supporting the monitoring and evaluation of investment outcomes in capacity building; and finally, 3) supporting a reality-based rapid decision-making process on required investment options and identification of capacity building activities.

A search was conducted on food safety indicators in Web of Science database and also the web by having the combinations of the following words: "food safety" or "food control system" and "indicator." This exercise has shown a limited but comprehensive discussion among the development community (Van Der Werf, 2007; STDF and OECD, 2010; FAO, 2017c; IFPRI, 2017) and academia (Charlebois and Hielm, 2014; Le Valée and Charlebois, 2015). Even though the scope and background of the documents conducted by different stakeholders, mainly academia and international organizations, might differ from each other, strong linkages could be drawn between the actual indicators identified by the development

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[34] The planning steps for a Performance Monitoring Framework in a logical order are as follows :
Step 1. Preparation
Step 2. Define Outcomes to Monitor and Evaluate
Step 3. Establish indicators
Step 4. Create monitoring plan
Step 5. Collect and analyze data
Step 6. Report and incorporate findings

agencies for project evaluation (Van Der Werf, 2007), national SPS system performance (STDF and OECD, 2010), or national food safety indicators (FAO, 2017c) and their application to enhance the robustness of food control systems.

As per the request of countries after the publishing of CXG 91-2017, a regional consultation workshop for Asia and Pacific was organized by FAO in 2017, which aimed to "review existing indicators in the context of their national situations, particularly in developing countries" (FAO, 2017c). The conference proceedings report further elaborated on the existing research related to food safety indicators. In addition, it listed 139 food safety indicators in five categories (FAO, 2017c): i) system-level (25 indicators); ii) capacity-level (59 indicators); iii) sector-specific iv) specific food safety topic-based (34 indicators); and surrounding factors (6 indicators). This resulted from the discussions of the technical working groups, which set the selection criteria and determination formula. Even though data gaps, particularly aggregated data, were raised by some representatives of competent authorities from developing countries, less attention was paid to the identification of existing solutions in the forms of evaluation and capacity building tools. As another example of creating harmonized indicators, STDF and OECD (2010) highlighted the evaluation tools of IICA and OIE for this purpose and underlined that many tools use qualitative indicators.

The last chapter of this research will elaborate on applying quantitative indicators to implement food regulatory decision-making systems supported by the data. These indicators will also serve as material in the form of data for an explainable artificial intelligence[35] to better plan and evaluate food safety capacity building initiatives more seamlessly. In case the collected data through these indicators are not factual and based on evidence, the decision-making mechanism of regulators will also be impacted.

Figure 12. Framework of activities and results in food safety and quality capacity building

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[35] Explainable artificial intelligence (AI) is something which allows people to understand how the computer came to certain recommendations. This is the opposite of "black box" AI where decision of the computer cannot be explained.

Initial situation

moment of measurement t_0

Activities t_1

Outcomes t_2 t_3 t_4

Impact t_5

Assessment

Strategy

Program development

training
awareness raising
on-site trainings
outside trainings
workshops
seminars
dispersing information
establishing laboratory
creating guidelines
etcetera...

expectations / assumptions

companies applying good practices
number / quality of inspections
awareness
existence of food law
adequately educated managers
etcetera...

expectations / assumptions

decreased food borne illnesses
increased food exports
increased consumer satisfaction
increased farmer income
increased food availability

external factors

external factors

process indicators

outcome indicators

impact indicators

information about achievement of final goal

certainty of attribution

Source: Van Der Werf, H. (2007) *Evaluating the Impact of Capacity Building Activities in the field of Food Quality and Safety: Design of an evaluation scorecard and indicators, Draft Report*. Rome. p. 31

Indicators can be categorized at three different levels (Van Der Werf, 2007); process indicators, intermediate outcome indicators, and impact indicators for food safety and quality capacity building interventions (Figure 12). It would be imperative to define standardized results-based management practices to use these indicators for a performance monitoring framework of national food control systems. This will also contribute to a data-driven approach which will be further discussed in the last chapter of this research. Supporting this concept, another study (STDF and OECD, 2010) suggested that it would be more useful if indicators would be part of results or logical framework, thus allowing the identification of potential sources or means of verification for the measurability of the indicators. "Clear means of verification thus facilitates the establishment of monitoring systems and contributes significantly to ensuring that programs and projects are evaluation-ready" (UNDP, 2009).

Nevertheless, the literature review shows the complexity of making all stakeholders agree to standardized or harmonized performance indicators. These challenges require additional discussions and analyses to find common denominators applicable to every food control

system, thus creating multifunctional indicators. The multifunctionality refers to the different roles in monitoring the performance of food control systems and related capacity building investments.

Challenges of setting multifunctional indicators

STDF, in collaboration with OECD, has developed a working paper titled *Indicators to Measure the Performance of a National SPS System* (2010) that transcends these indicators by defining a set of SPS impact indicators and a logical framework for a national SPS System. The document also indicates the difficulty of measuring actual SPS outcomes and results based on individual projects and thereby argues next to the approach that "the creation of an effective SPS system requires more than one project or program, as well as complementary initiatives and actions by both public and private sector stakeholders in that country" (STDF and OECD, 2010). The report also identified the following technical issues related to the design and measurement of SPS indicators (STDF and OECD, 2010):

- **Clarification of the SPS scope**: the indicators might be inclusive (integration of animal health, plant health, food safety measures from public health perspective) or limited trade-related capacities.
- **Country-specificity:** Countries' SPS capacities can differ, impacted by factors like the size of the country and its economy, urbanization, product-market combination, domestic income levels, and geo-political location.
- **International comparison:** the abovementioned "country-specific factors complicate the design of macro-level SPS indicators."
- **Aggregation:** the difficulty of measuring macro-level indicators would have to be linked to measurable sub-indicators.
- **Estimating outcome and impact** is entirely uncertain as SPS capacities and performance are just enablers and they are not the main constrain for higher production, trade, and income generation.
- **Insufficient capacities in information collection:** there are gaps in the existing national statistical systems to collect data.
- **Indicators for food safety and animal and plant health:** would have to exist due to differences in policy priorities for the sectors in developing countries.

The following solutions are proposed to overcome these issues raised by the report:

- **SPS scope**: regardless of its scope (food safety or SPS-specific), the participation of standard-setting bodies (OIE, IPPC, and Codex Alimentarius) in developing indicators would ensure the adequate capturing of SPS measures in system performance.

- The **country-specificity** is essential, but without a certain level of standardization at the impact level, food safety benchmarking would create a constant impediment for "recognition of system-equivalence in food safety measures.

- **Aggregation** should be part of the experimentation to define causality and correlation along the results chain. Additional issues related to privacy protection and the ethical nature of data will be discussed in the last chapter.

- **International comparison:** this comparison based on different groups along the food safety life cycle can be done at impact level indicators which reflect the performance of food control system in 1) daily adjusted life-in-years (DALY), 2) productivity loss and 3) trade performance index. Foodborne illnesses calculated in DALY, and death in worst cases, are currently only estimates done by WHO for the first time in 2015. Capacity building would be required to improve public health authorities' reporting and data collection efforts and the health system. As a possible example, a trade-related indicator could explain the SPS capacity of a country in the form of an index which would have to require the inclusion of food trade performance of a country, the level of border rejections (export and import) due to noncompliance with SPS and TBT measures.

- **Estimating outcome and impact:** this indicates the requirement of collecting and analyzing additional economic, social, and environmental data and information. Most importantly, developing countries have to develop digitalized governance systems, including statistical reporting, facilitating prescriptive analytics among regulators.

- **Information collection:** Expert assessment should be translated into quantitative indicators within the food control system, and additional Internet of Things (IoT) solutions should be integrated where consumers, industry, and regulators share relevant data through aggregate reporting.

- **Indicators for food safety and animal and plant health:** As mentioned under the SPS scope, the SPS measures should be reflected in a set of indicators, which requires cooperation among international agencies. There are multi-agency platforms that can provide space for dialogue on setting and defining indicators.

International comparison of food safety performance through agreed-upon indicators also has relevance to trade by potentially providing an improved solution to countries in their efforts to recognize another food control system as equivalent through an evidence-based structure. Current system comparison mechanisms leave plenty of space for a political match between competing markets and do not rely on any internationally agreed process. The Codex Alimentarius Commission is currently developing a guideline on recognizing system equivalence, but the draft guideline does not cover the development of indicators. In more recent work to overcome this challenge, La Vallée and Charlebois (2015) have attempted to develop a benchmark based on ten food safety performance metric frameworks. However, the inability to succeed in this effort rests on the lack of knowledge on current opportunities in digitalization, access to structured and trusted data in developing countries, and the reliance on qualitative reports. This also demonstrates the need to utilize indicators for development initiatives, which can provide specific information on the performance of food safety systems. Consequently, the development of multifunctional indicators, which follow standardized results-based management (RBM) framework for capacity building interventions providing a better picture of the performance of the food safety system, can lead to improved data-driven food regulatory decision-making.

Development of multifunctional indicators

As mentioned before, indicators should be set along the results chain, which can be resourcefully utilized by governments, donors, and international organizations. By institutionalizing a standardized RBM structure, multifunctional indicators can serve three roles according to this study: i) monitoring the performance of food control system ii) facilitating more rapid and informed decision-making process on investment needs; and finally, iii) enabling the implementation, monitoring and evaluation of technical assistance interventions. Currently, indicators are used as a project management tool, and thereby, it would require a more comprehensive effort, probably under the Codex Alimentarius

Commission, to expand their role to other areas. As part of this, the indicators should support the behavior change of stakeholders within the food control system by guiding them towards a food safety mindset or culture[36]. A report developed by the Joint Inspection Unit (JIU) of the United Nations has indicated that the development of meaningful indicators for national capacity building "at the level of outcomes that can be aggregated is almost impossible" (JIU, 2017). However, capacity building in food safety and nutrition differs from other technical assistances as the structure and performance management of food control systems are well-defined in various Codex guidelines and approaches, particularly in CAC/GL 82-2013.

In summary, the robustness of multifunctional and standardized indicators can be ensured by proposing the following principles:

1. Setting up a multidisciplinary team for guidance with expertise in the food control system, food safety, data science, behavior science, and evaluation to develop a draft list of indicators;

2. Seeking international recognition by developing indicators as part of Codex guidelines in which effort the relevant development agencies should also be fully involved;

3. Agreeing on standardized results-chain data framework to be used among all relevant parties;

4. Collecting structured data by competent authorities in the forms of quantitative indicators or binary indicators;

5. A modular approach followed based on the roles and responsibilities of the competent authority(ies) and other relevant stakeholders for data collection (e.g., hospitals, consumers).

Based on these principles, indicators on each stage of the results-chain can be developed and used for performance monitoring of food control systems and capacity building initiatives based on the following suggestions:

- **Impact indicators** are used to define the overall performance of the food control system about areas such as foodborne illnesses, nutrition, and food trade;

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[36] Food safety culture as such was used for the food industry, however, it should go beyond this, also harnessing consumers and regulators with adequate knowledge on the culture of safety.

- **Outcome indicators** show the different functions of competent authorities, consumer awareness, and industry compliance with food safety regulations based on the set goals and strategies. This would be a potential indicator for benchmarking the system with foreign food control systems for recognition of system equivalence;
- **Output indicators** are used for purposes to indicate the different expected activities and services in the forms of various functions within the system and related capacity building initiatives which can be funded by the government and donor organizations;
- **Process indicators** will define the different actions or activities required to achieve the output indicators.

The Principles and Guidelines for Monitoring the Performance of National Food Control *Systems* (CXG 91-2017) provides an approach for competent authorities to operationalize performance monitoring and identify required investments by using data. This Codex guideline also offers some sample indicators for systems but disregards the possible data generated by development initiatives on the system performance. The table below provides an example of multifunctional indicators along the results chain.

Table 13. Example for multifunctional indicators

Example for a results-chain activity	Example for Multifunctional Indicators
Impact: By the year 2025, a food control system improves the public health outcomes by reducing foodborne illnesses and facilitates enhanced trade in food	Number of foodborne illnesses occurred or percentage change in foodborne illnesses Amount of food trade in comparison of total trade (in US$)
Outcome: Improved food control services as per Codex guidelines	Total number of food control functions operationalized to deliver required services
Output: Meat inspection practices developed based on international best practices	Number of inspection competency-programs based on OIE Terrestrial Animal

	Health Code adopted by the competent authority
Activities: Standard Operating Procedures (SOPs) for risk-based livestock inspection developed and disseminated among food inspectors	Number of SOPs for risk-based inspection developed /available

4. Best practices in the implementation of food safety capacity building initiative

Thematic evaluations conducted by development agencies (OECD, 2008b; STDF and OECD, 2008; FAO, 2017d; Kruse and Zozan, 2017; Andersson, 2018) in food safety, SPS and trade capacity building highlighted some best practices to enhance the implementation of these initiatives. Among these documents, the STDF and OECD (2008) report offered the most structured collection of recommendations, such as:

- **Use of strengthened country expertise and systems**: technical assistance takes place without properly including the actual beneficiaries and end-users in the development process;
- **Flexibility**: its integration in the project execution to be able to address changing circumstances;
- **Results-based management including monitoring and evaluation**: its application in food safety and SPS capacity building;
- **Active learning and linking skills development to practice:** linking training to daily duties and specific needs has the most effective way to build capacities, particularly if the selected beneficiaries have the required skills and experiences.

In conjunction with the findings of the comparative analysis in Chapter 2, the research proposes some additional best practices in project implementation which can improve project outcomes regardless of the actual scope of intervention:

- **Importance of political buy-in/commitment from the beneficiaries throughout the project:** From the project formulation stage, it is essential to deploy tools for stakeholder mapping and engagement to identify the potential beneficiaries of the

intervention and the likelihood of planned activities to succeed. If the actors do not have an appropriate level of commitment or capacities, the project might face some hardships to deliver the envisaged activities. In the case studies, it was also shown that project activities, particularly those with high political relevance, such as the development of specific laws and policies, have often failed as they went against the interest of some actors. For example, the proposed merging and restructuring of governance structure to create a single authority system in Pakistan would require the endorsement of some policymakers. If these issues are not remedied early, and the beneficiaries are not ready for such change, policymakers might resist implementing the project activities.

- **Existing capacities and needs of the industry during the delivery of capacity building sessions:** Even though the previous point partially covered the capacity-related aspect, further emphasis shall be put on supporting the industry to apply national and international requirements and localize the guiding materials to their needs. As enterprises might be at a different development stage within one country, a voluntary and gradual food safety capacity building might better address the various gaps and needs by integrating prerequisite programs as a gradual approach towards product compliance with HACCP certification requirements.

- **National actors endorse a more comprehensive policy and regulatory reform:** Certain limitations were also observed in Chapter 2 on developing new laws, policies, safety, hygiene schemes, and tools for the industry. Concerning the drafting of laws and policies, the involvement of the industry is part of the good regulatory practice, and thereby the project needs to consider them from the beginning or at least for the cost-benefit analysis process. Building trust might need to be part of the process as they might not have collaborated on previous policy documents, and their engagement might be new for some actors.

- **Collaborative approach in setting standards:** the developed standards need to reflect the inputs received from the industry besides the international best practices, keeping in mind their scientific nature. Otherwise, countries can face trade disputes due to the SPS Agreement of the World Trade Organization. These practices will

ensure adequate ownership and presence when implementing these guiding documents by the industry.

- **Establishment and operationalization of coordination platforms:** Platforms can be established with different mandates, depending on the stakeholders' preferences. Some of these platforms might be established as part of a capacity building intervention and others to support communication among food safety stakeholders in general. In both cases, strategic objectives and the scope need to be appropriately defined and agreed upon by everyone in a joint policy document. If a platform is established as part of a project, they need to be maintained by the government or local industry after its closure. The definition of these platforms' mandate or scope and frequency of their meeting shall rest with the stakeholders. At least the following areas shall be covered: 1) the development of policies, strategies, laws, and standards; 2) food safety and SPS capacity building coordination platform chaired by the government with the participation of donor agencies and development partners (agencies, NGOs and private consulting firms). In the latter case, such a platform will identify required investments, best practices, and lessons learned from a local perspective and coordinate investment efforts to avoid the counterpart's overlaps of activities and exhaustion.

- **Adequate competencies (skills and experience) of implementing agencies/partners:** Sometimes, the donor might design the project, while in other cases it is the beneficiaries. When it comes to the implementation, the responsibility can rest with the government, a development agency, NGO, consulting company, or experts providing support through technical cooperation. As indicated in the case of the Agribusiness Development Project (funded by Asian Development Bank) in Chapter 2, the initial project funding and scope needed to be revised due to the competency of the subcontracted implementing agency which also shows that donor organization in collaboration with the respective national government need to properly assess the expected implementing agency's capability to implement the designed project.

- **Flexible project management approach:** One of the main issues with a results-based management framework is its ability to address potential risks and challenges

without significant revision during the project implementation. This is less of an issue in short-term and low-scale investments, which tend to build upon few outputs with lesser impact at the end. Accordingly, the complexity increases with the size of the intervention, requiring more frequent coordination with internal and external project stakeholders.

- **Training complemented by coaching**: Many capacity building interventions are limited to some training sessions to local beneficiaries without providing a guideline on the development practices. These can be further restricted when the experts are not locals, and their visit is limited to a few days or weeks. The training approach should be expanded with complimentary coaching where beneficiaries learn about applying a developed tool or policy and how they can be further improved. This will also help them in future upscaling activities.

- **Building scientific capacities:** Without adequate scientific capacities in food, it is impossible to build sustainable food safety practices. Even though food safety is a multidisciplinary field, scientific evidence and the linked risk analysis approach will remain its foundation for the future.

- **Proper reporting and data-sharing practices**: proper reporting practices during the project implementation will allow monitoring the project results against its objectives and, in turn, also contribute to the identification of additional investments already during the implementation phase. Sharing the information on the project results with the partners and other development agencies can have a positive spillover effect on other capacity building investments.

- **Upscale and exit strategy**: successful projects with the aim of piloting improved practices need to address the upscale of their investments during the project lifetime. This should also be part of the project exit strategy. On the other hand, when no further upscale activity is expected, the potential bottlenecks for sustaining the investments need to be described and addressed during the intervention.

- **Consideration of gender and environment as a cross-cutting theme throughout the project implementation:** Activities undertaken by the investment should have at least a no-harm approach, or preferably further improve practices. In cases where a no-harm approach is applied, gender mainstreaming can be applied in the project

management structure, engagement of stakeholders, and development of documents (policies, strategies, laws, and technical reports) and tools with a gender-sensitive language and introduction of gender-equitable technologies. The application of technologies and chemicals should be considered, not only from food safety but also environmental perspective.

Along with these best practices, adequate monitoring and reporting practices should be paired to describe the lessons learned during the technical assistance activities properly. The monitoring, reporting, and evaluation practices could be further divided as independent evaluation usually performed by a third party.

5. Evaluation practices in food safety capacity building

The final stage of the project cycle is to evaluate the performance, which entails "a rigorous and independent assessment of either completed or ongoing activities to determine the extent to which they are achieving stated objectives and contributing to decision making" (UNDP, 2009). Another definition used by a recently developed UNDP guideline (2019) defines evaluation as "an assessment, conducted as systematically and impartially as possible, of an activity, project, program, strategy, policy, topic, theme, sector, operational area or institutional performance. It analyses the level of achievement of both expected and unexpected results by examining the results chain, processes, contextual factors and causality using appropriate criteria."

Investments are evaluated and measured by 'value for money' to assess whether they are of interest to national governments, international donors, and non-governmental organizations, including international organizations (Fleming, 2013). Evaluation policies differ from one organization's approach to the other; however, they are always based on six DAC criteria (Coherence, Relevance, Effectiveness, Efficiency, Impact, and Sustainability). Two principles along with Quality Standards for Development Evaluation were also introduced, which should be read in conjunction with the DAC criteria (OECD, 2020) and aim to underline the integrity and flexibility of the criteria "to conduct evaluations in ways that will be useful and of high quality" (OECD, 2020).

This section suggests an improved approach for impact assessment for food safety capacity building projects based on existing international best practices. It also provides a bridge to

the next chapter of this research, outlining data-driven regulatory decision-making for capacity building by elaborating on the required practice change in project evaluation. For such solutions to be applied as part of evaluation practices, a World Bank publication (Heider, 2016) highlights issues like overcoming fragmentation, assessing trade-offs among competing priorities, or the opportunities which data can offer in this regard, including a faster feedback loop with the application offered by data science.

5.1. Shortcomings of evaluation frameworks

The comparative analysis in the previous chapter has also shown that food safety capacity building investments are often implemented without proper coordination and information exchange, affecting the coherence and consistency of the overall monitoring, reporting, and evaluation (MRE) activities. In general, evaluations could be categorized to post-capacity building evaluation, country evaluation (usually donor-specific to assess the impact of their investment), and thematic or meta-evaluation conducted by international organizations. Even though many evaluations are claimed to be conducted by an independent party, the conflict of interest remains in cases where their remuneration is somehow linked to any project stakeholder.

The findings of Chapter 2 have revealed that current project reporting practices are not standardized and very much up to the administrative requirements of the donor. This leads to differences in quality, format, and data-sharing practices. More importantly, differences in monitoring and reporting practices will hinder the statistical comparison of project outcomes. Local private consulting companies and governmental departments in charge of project implementation often do not have the ability and experience to report on the progress made as per the rules and regulations of the donor community. Some reports use magniloquent language, giving the impression that the delivered results have created an impactful change in the performance or behavior of beneficiaries, while in reality, outcomes might provide a different impression. Consequently, evaluation should have the ability to review data and verify the actual project outcomes based on existing evidence gained through actual field visits and interviews with stakeholders.

In addition to such shortcomings, FAO, in collaboration with the World Bank (Muller-Praefcke, Lai and Sorrenson, 2010), has developed a report with the title *The use of*

monitoring and evaluation in agriculture and rural development projects which highlighted the following issues:

System design inadequacies:

- M&E system and institutional arrangements catered primarily for progress reporting;
- An unduly large number of indicators;
- Reliance on a blueprint approach in monitoring, based on a single rather than multiple sources of information, and inability to modify those throughout the project;
- Minor or no linkage of performance indicators to the logical framework;

Shortcomings during project implementation:

- Planned M&E systems and procedures delayed or not operationalized;
- Main attention on physical achievements, neglecting of project outcomes;
- Monitoring for the sake of compliance with donor requirements instead of internal management tool;
- Gap between M&E and management decision support systems.

At the UN-wide system level, the Joint Inspection Unit (JIU)[37] is the mandated agent to promote change across the United Nations system by reviewing current practices and providing recommendations to agencies. Concerning the evaluation function of UN agencies, the JIU has observed several key shortcomings and recommendations (Prom-Jackson and Bartsiotas, 2014), many of those institutional, such as the lack of strategic approach and human and financial resources to evaluate investments appropriately. Furthermore, evaluation questions are developed around the DAC five criteria, resulting in reports filled with evaluation jargon and consequently leaving readers very often with unanswered issues (Heider, 2017).

5.2. Quality control of M&E framework

The FAO-World Bank report (Muller-Praefcke, Lai and Sorrenson, 2010) also outlined a couple of approaches to enhance current practices for agricultural-related investments along

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[37] According to its website, the Joint Inspection Unit (JIU) "is the only independent external oversight body of the United Nations system mandated to conduct evaluations, inspections and investigations system-wide.

with a checklist of areas in monitoring and evaluation (M&E) system design and implementation (Table 14). Even though no specific checklist has been developed for food safety capacity building investments, Muller-Praefcke, Lai, and Sorrenso (2010) provide plenty of solutions for designing an M&E framework for agriculture and rural development projects.

Table 14. Sample checklist of key areas of activity and priority actions for effective M&E

Key areas	Priority Actions during System Design	Priority Actions during System Implementation
M&E system design	- Identification of main elements of the system to be integrated within the project management system: - key actors, - institutional arrangements, - resource requirements	- Continuous review and modification, where necessary, to ensure effectiveness in assessing project results and achievement of development objectives - Recruitment of the M&E manager/specialist - Contracting of technical assistance as required
Definition of the key performance indicators	- During project design, the key performance indicators are to be defined for assessing project outcomes and outputs - Setting of targets for each indicator to establish the expected time-bound results and reporting arrangements, including reporting frequency and responsibilities - Specification of source of field data and means of collection;	- Refine as necessary taking into consideration specific stakeholder needs, including direct beneficiaries and implementation agencies
Baseline survey	- Simple baseline survey conducted preferably before project start-up or immediately after project start-up with emphasis on participatory rural appraisal methods; definition of the 'project universe' and identification of target groups; - Statistical survey to cover representative project and non-project locations to establish 'with and without	- Additional baseline surveys may be required as new areas, new beneficiaries, or new activities, are introduced - Follow-up surveys on selected outcome indicators to be undertaken where specified in the programme plan

	project' and 'before and after project' bases for counterfactual analysis of project impacts	
Detailed specification of M&E system and operationalization	- Prepare the detailed M&E system as part of the preparation of the Project Implementation Plan (PIP); some refinement of the M&E system may be required during project implementation - Elaboration of data collection methodologies, covering primary or secondary sources of each dataset, and responsibilities for as well as frequency of data capture (which may differ from frequency of reporting)	- Refined and adapted based on implementation experience, stakeholder assessments and external evaluations; - Responsibility at overall project level would be with the Project M&E Unit, and Implementation Agency M&E unit at implementation agency level - Ensure sustained Borrower and Lender support throughout implementation
Capacity building in M&E	- Assess training needs of potential M&E staff and identify TA requirements - May require institutional analysis	- Conduct relevant training and capacity building workshops - May require facilitation of participatory processes
Budgeting for M&E	- Establish detailed cost elements of proposed M&E system and link with project budgeting - Provide detailed budget items for staffing, training, TA, surveys, studies, workshops and equipment	- Monitor expenditure by budget items
Gathering, managing and using M&E information	-Establish responsibilities by activity	- Monitor collection, analysis and use of data - Track indicators specified in the results framework - Convert field data into information for project management
Stakeholder participatory assessment	- Identify key stakeholders including the project beneficiaries - Identify the necessary incentives for effective M&E	- Ensure ongoing active participation of stakeholders including the project beneficiaries through start-up, mid-term review and implementation completion and result reviews

		- Ensure the necessary incentives for effective results-based M&E are provided
Periodic beneficiary impact assessment	- Based on simple baseline survey and official statistics estimate number and location of target population	- Conduct periodic stakeholder group discussions and workshops to involve beneficiaries in impact assessment
Independent dissemination of information	- During identification select institution(s) to be responsible and determine methodology to be followed	- Project management to facilitate evaluation work and take action as required
Reporting and dissemination of information	- Establish reporting requirements (type and frequency of reports) and make proposals for their distribution	- Ensure M&E reports are publicly accessible through ICT - Keep the reporting arrangements simple but flexible enough to be tailored to the specific needs of the different users (all project stakeholders - the beneficiaries, implementation agencies, project management, Borrower and Lender)
Using M&E to manage for development results	Identify key factors responsible at different levels of project hierarchy and at administrative levels	Continuously ensure that maximum results are being achieved in terms of the projects objectives

Source: Muller-Praefcke, D., Lai, K. C. and Sorrenson, W. (2010) *The use of monitoring and evaluation in agriculture and rural development projects - Findings from a review of implementation completion reports*. Available at: https://www.fao.org/sustainable-food-value-chains/library/details/en/c/267377/

Since there are some general tools in evaluation, a comprehensive and well-structured approach would be required to address the cross-cutting areas within food safety.

5.3. Existing evaluation methods in capacity building

Previous failures in capacity building have motivated developed countries to deploy evidence-based techniques in technical assistance. As part of this effort, impact evaluation plays a significant role in providing more information to achieve better outcomes around the project life cycle. In the context of evaluation in international development, there are some general publications (UNDP, 2009, 2019; van den Berg, Naidoo, and Tamondong, 2017) and more specifically on evaluation methods or approaches (Bamberger, Rao and Woolcock, 2010; Fleming, 2013). Vallejo and When (2016) have divided the evaluation methods to 1)

quantitative or economic model-based methods, for instance, calculating the actual economic return on investment for irrigation reform programs developed by the World Bank, 2) qualitative methods, such as case studies, cost-benefit and SWOP analysis, control group approaches, productivity studies and macro and micro methods, and 3) mixed (quantitative and qualitative) method using the logical framework to measure qualitative and quantitative manner for the project results. There is a wide range of qualitative and quantitative evaluation methods and processes in place, *inter alia*, beneficiary assessment, case study, causal link monitoring, collaborative outcomes reporting, contribution analysis, and development analysis. The mixed-method approach is relatively widely applied for impact evaluation. However, like each abovementioned group, it has its limitations. Bamberger, Rao, and Woolcock (2010) have outlined five principle issues for the use of mixed methods:

1) evaluation questions should determine the applied method and not the other way around;
2) application of statistical models, such as randomized controlled trials, in a development context and its fitness for the actual problem being assessed or deployed in response to;
3) adaptation of impact evaluation to the real-world contexts and constraints;
4) low rate of utilizing the findings of evaluation; and
5) acceptance of the evaluation paradigm by some of the stakeholders.

Despite their limitations, mixed methods also can address current challenges (Bamberger, Rao and Woolcock, 2010) by:

1) reconstructing baseline data by having a well-designed monitoring system developed in collaboration with evaluators;
2) observing unobservable for identification of missing criteria from secondary datasets by using mixed methods approach to assess and control selection bias;
3) identification of impact evaluation design options, considering the limitation and possible application of new methods;
4) rapid and economic data collection methods through new techniques; and
5) threats-to-validity to be assessed through cross-checking data.

Impact evaluation approaches demonstrate that the project leads to the envisaged results based on the following four primary purposes (Rogers *et al.*, 2015):

1) Advocacy – demonstrating the value of an investment in a particular program or portfolio;
2) Allocation —informing how funding will be allocated across potential programs, including ex-ante impact evaluation (done before an intervention is funded to estimate

likely impacts) and ex-post impact evaluation (done after implementation to inform decisions about whether or not to continue or scale-up);
3) Analysis – learning what is working to inform continuous improvement, including providing information about how to continue or scale-up effectively;
4) Accountability – effective risk management.

Most evaluations have a list of pre-defined key evaluation questions. Rogers et al. (2015) have differentiated three types of questions applied in impact evaluation: 1) descriptive – the way things are or were; 2) casual – how the program has caused these things to change: and 3) evaluative – overall value judgment of the merit or with of the changes brought about. These questions should clearly reflect the evaluation criteria, following the revised DAC definitions for the criteria and the intended use of the evaluation outcome. As impact usually happens after intervention and not an intermediate outcome of an intervention, the role of competent authorities is to evaluate and control these investments through their existing resources. The Magenta Book (Government of UK, 2020), being developed as the Central Government guidance on evaluation in the United Kingdom, provides a comprehensive overview of evaluation in government, including key questions related to the three major types of evaluations, namely process evaluation, impact evaluation, and value-for-money. Table 15 summarizes these three types of evaluation, each of them having its weaknesses for universal application.

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Table 15. Evaluation questions and types of evaluation

Process evaluation questions: What can be learned from how the intervention was delivered?	Impact evaluation questions: What difference did the intervention make?	Value-for-money evaluation questions: Was this a good use of resources?
Was the intervention delivered as intended? • Were there enough resources? • Were there any unexpected or unintended issues in the delivery of the intervention? • To what extent has the intervention reached all the people that it was intended to? What worked well, or less well, for whom and why? What could be improved? What can be learned from the delivery methods used? • Could the intervention have been procured and delivered for less cost? How has the context influenced delivery? • How did external factors influence the delivery and functioning of interventions? • How did external factors influence the attitudes and behaviours of target groups?	Did the intervention achieve the expected outcomes? • To what extent? Did the intervention cause the difference? • To what extent can the outcomes be attributed to the intervention? How confident can we be that the intervention caused the observed changes? • What causal factors resulted in the observed impacts? • How much can be attributed to external factors? • What would have happened anyway? How has the context influenced outcomes? • Has the intervention resulted in any unintended outcomes? • Have the outcomes been influenced by any other external factors? To what extent have different groups been impacted in different ways, how and why? Can the intervention be reproduced? What generalisable lessons have we learned about impact?	How cost-effective was the intervention? • Cost per unit (outcome, participant, etc.) • What were the costs of delivering the intervention? • Has the intervention been cost-effective (compared to alternatives and compared to doing nothing)? • What is the most cost-effective option? What was the value-for-money of the intervention? • What are the benefits? • What are the costs? • Do the benefits outweigh the costs? • What is the ratio of costs to benefits? Is the intervention the best use of resources? • How does the ratio of costs to benefits compare to that of alternative interventions?
Future Learning. The different types of evaluation can together help answer questions used for future learning: • Are the intervention's goals relevant, in different contexts? • Can the policy be expected to work in other contexts? • Is the intervention sustainable from financial, economic, social and environmental perspectives? • What has been learned about how to intervene in this intervention space that can be transferred to other initiatives and future appraisals?		

Source: Government of UK (2020) *Magenta Book Central Government guidance on evaluation*. London: Government of the United Kingdom. p. 31

Different evaluation approaches might be applied by different regulators, depending on the framework of the investment. Process evaluation fits more to smaller initiatives undertaken by the government or the competent authorities themselves, whereas impact and value-for-money by development partners. The selection of a suitable evaluation approach depends on how it is planned to be utilized. In case competent authorities can develop their performance monitoring framework, evaluation questions might need to follow a theory-based approach and methods, particularly those with more robust quantitative aptitude

5.4. Adaption of Rainbow Framework for evaluation of food safety capacity building investments

This research proposes adapting a practical framework in evaluation to serve as a food safety capacity building-specific evaluation tool. The application of a flexible evaluation system, such as the Better Evaluation's Rainbow Framework[38], would allow developing countries to apply the most suitable method, depending on the type of food safety capacity building intervention. As it provides a coherent and integrated approach for food safety capacity building evaluation, the visual structure in the research follows the seven color-coded cluster system (Manage, Define, Frame, Describe, Understand Causes, Synthesize, and Report & Support Use), thus also allowing the easier identification of methods, strategies, and processes. To showcase the complexity of the original framework, this tool has integrated information on more than 20 evaluation approaches and 300 evaluation methods developed by evaluation specialists in international development. The tool could also serve as a planning tool to "commission and manage an evaluation; plan an evaluation; check the quality of an ongoing evaluation; embed participation thoughtfully in evaluation; develop evaluation capacity" (Better Evaluation, 2014). Since this part of the research aims to improve evaluation practices in food safety capacity building, the structure of the adapted Rainbow Framework remains unchanged (Annex D). This study integrated the food safety-specific technical content in order to fit its purpose better. As projects can be funded by governments themselves or development partners, the evaluation approach should be flexible enough to be applied interchangeably, fulfilling some essential criteria regardless of the user, namely external or internal evaluator. In case of external evaluators, they have to define data

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[38] The Rainbow Framework: https://www.betterevaluation.org/sites/default/files/Rainbow%20Framework.pdf

collection processes to undertake required verification on the reported results. This evaluation tool contains many terminologies from social science and statistics, and further information and explanation on these are available on the Better Evaluation website.

This framework (Annex D) can improve evaluation-related practices and stakeholder ownership of any food safety capacity building project. The establishment of an M&E unit/section/platform led by the competent authority(ies), also participating in the overall coordination efforts with development agencies, would potentially facilitate the application of best practices among ongoing investment and avoid potential overlaps. In developing countries, this could be a platform and later transform into a more institutionalized system. Overall, the ownership of the competent authorities remains critical to ensure a demand-driven and collaborative approach among development agencies, including the sharing of data in a structured manner. For the sake of the continuous application of such a framework, evaluators should possess specific competencies. The following section will elaborate on these competencies and how they could be structured first as part of capacity building framework and more developed food control systems as its integral part.

5.5. Competencies of an evaluator for food safety capacity building projects

Competent staff having the required experience, skills, and education in monitoring and evaluating food safety capacity building is a challenge in most countries worldwide. Even in the case of general evaluation practitioners, "it may not be easy to find high caliber staff with enough seniority from within the public administration system to head up the project M&E unit/section" (Muller-Praefcke, Lai and Sorrenson, 2010). In such situations, a competence framework can trigger the establishment of a continuous training structure, creating a pool of qualified local experts. The Evaluation Capacity Development Task Force of the United Nations Evaluation Groups (UNEG) has developed a list of essential competencies for program evaluators (Imas and Rist, 2009), which can also serve as guidance. There are two approaches envisaged for these human development structures, a general competency framework and secondly organization/entity level framework, sometimes to address difficulties in reaching national or international consensus among partners on the requirements and content of the framework. Before exploring additional competencies which a food safety capacity building evaluator shall possess, it is necessary to indicate that the

development of a standardized competency framework can serve as a relevant tool for data verification on food control system performance, ensuring standardized evaluation of individual's competencies. The International Development Evaluation Association (IDEAS) goes beyond this and advocates for the idea of certifying evaluators for increased professionalization which might be a possible way forward. The introduction of such certification would require an internationally agreed competency framework for evaluators. Accordingly, Stevahn et al. (2005) has proposed a set of key competencies (Table 16) required for program practitioners involved in evaluating capacity building interventions.

Table 16. Essential Competencies for Program Evaluators

1.0 Professional practice

1.1 Applies professional evaluation standards

1.2 Acts ethically and strives for integrity and honesty in conducting evaluations

1.3 Conveys personal evaluation approaches and skills to potential clients

1.4 Respects clients, respondents, program participants, and other stakeholders

1.5 Considers the general and public welfare in evaluation practice

1.6 Contributes to the knowledge base of evaluation

2.0 Systematic inquiry

2.1 Understands the knowledge base of evaluation (terms, concepts, theories, assumptions)

2.2 Is knowledgeable about quantitative methods

2.3 Is knowledgeable about qualitative methods

2.4 Is knowledgeable about mixed methods

2.5 Conducts literature reviews

2.6 Specifies program theory

2.7 Frames evaluation questions

2.8 Develops evaluation designs

2.9 Identifies data sources

2.10 Collects data

2.11 Assesses validity of data

2.12 Assesses reliability of data

2.13 Analyzes data

2.14 Interprets data

2.15 Makes judgments

2.16 Develops recommendations

2.17 Provides rationales for decisions throughout the evaluation

2.18 Reports evaluation procedures and results 2.19 Notes strengths and limitations of the evaluation

2.20 Conducts meta-evaluations

3.0 Situational analysis

3.1 Describes the program

3.2 Determines program evaluability

3.3 Identifies the interests of relevant stakeholders

3.4 Serves the information needs of intended users

3.5 Addresses conflicts

3.6 Examines the organizational context of the evaluation

3.7 Analyzes the political considerations relevant to the evaluation

3.8 Attends to issues of evaluation use

3.9 Attends to issues of organizational change

3.10 Respects the uniqueness of the evaluation site and client

3.11 Remains open to input from others

3.12 Modifies the study as needed

4.0 Project management

4.1 Responds to requests for proposals

4.2 Negotiates with clients before the evaluation begins

4.3 Writes formal agreements

4.4 Communicates with clients throughout the evaluation process

4.5 Budgets an evaluation

4.6 Justifies cost given information needs

4.7 Identifies needed resources for evaluation, such as information, expertise, personnel, and instruments

4.8 Uses appropriate technology

4.9 Supervises others involved in conducting the evaluation

4.10 Trains others involved in conducting the evaluation

4.11 Conducts the evaluation in a non-disruptive manner

4.12 Presents work in a timely manner

5.0 Reflective practice

5.1 Aware of self as an evaluator (knowledge, skills, dispositions)

5.2 Reflects on personal evaluation practice (competencies and areas for growth)

5.3 Pursues professional development in evaluation

5.4 Pursues professional development in relevant content areas

5.5 Builds professional relationships to enhance evaluation practice

6.0 Interpersonal competence

6.1 Uses written communication skills

6.2 Uses verbal/listening communication skills

6.3 Uses negotiation skills

6.4 Uses conflict resolution skills

6.5 Facilitates constructive interpersonal interaction (teamwork, group facilitation, processing)

6.6 Demonstrates cross-cultural competence

Source: Stevahn, Laurie, Jean A. King, Gail Ghere, and Jane Minnema. 2005. "Establishing Essential Competencies for Program Evaluators." American Journal of Evaluation 26(1): 43-59

As a possible career path, someone can become a food safety capacity building program evaluator either by starting as a food safety practitioner or getting involved in international cooperation and evaluation, or vice versa. Even though these are two different ways, the research proposes that they should be able to comprehend and apply the following technical competencies in practice, in a non-specific order, as key concepts in food safety capacity building:

- Excellent knowledge of a robust national food control system's structure, including regulatory and legal framework as well as scientific evidence-based risk analysis function;
- Good knowledge of Codex Alimentarius Guidelines for food control system and its related function, particularly CAC/GL 82-2013 and CXG 91-2017;
- Familiar with the concept of shared responsibility and how the food industry should be able to fulfill its leading role;
- Good understanding of the international regulatory framework in food standard-setting and trade, specifically the World Trade Organization (WTO) Agreements in Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) Measures;
- Familiar with broader, regional, or continental level, SPS and TBT-related harmonization initiatives;
- Awareness of international agencies' mandate and their food safety-specific services;
- Good knowledge of the history on the creation and current development status of food safety functions in the developing country where the evaluation conducted;
- Good understanding of potential synergies from other capacity building investments due to linkage of enabler technical assistance programs, particularly quality infrastructure with conformity assessment services.

These technical competencies could be used for the competency-related section of a job description or food safety-specific requirements of the competency framework above. Even though these required technical competencies seem to be over-ambitious, a possible training framework could be developed for practitioners, complemented by specific recommendations on possible experiences. These evaluators would play a pivotal role in recognizing required investments and identifying possible next steps which need immediate

and long-term investments. Evaluators, who simultaneously provide consulting services in the same developing country(ies), where they perform an evaluation, can face a possible conflict of interests. In addition, they should still maintain their possible role in contributing to the training of evaluators participating from the side of local competent authorities. In the case of a food control system, these evaluators can later serve as internal auditors, verifying the outcomes of national food safety capacity structure and the integrity of quantitative data produced for a performance monitoring framework of a system. On the other hand, they could play a strategic role in food-trade-related negotiations and negotiations on recognizing system equivalence with another country.

6. Conclusion

Results-based management is the most widely used conceptual framework in international development, divided into three interconnected but still distinctive stages: project planning, monitoring, and evaluation. Despite its widespread use among development partners, the literature shows that the practical and standardized application in food safety capacity building remains an issue until today. As a result of different practices in applying indicators or reporting, food safety projects cannot contribute to national food control systems' broader performance monitoring framework. The concept of multifunctional indicators allows harmonizing efforts in performance monitoring and measuring the impact of investments. The research did not attempt to develop these indicators because such effort should result from a consultative process involving regulators, development agencies, and the industry. Additional research on collecting a list of potential indicators would assist future endeavors in that regard. The systematic review of food safety-specific literature around the project life cycle also showed the current limitation on project design and evaluation tools in food safety capacity building. Although this research provides some practical solutions for development agencies and competent authorities in capacity building, it is self-evident that they will develop their tools. This part of the research also revealed the limited number of professionals specialized in, as well as academics conducting continuous examination on food safety capacity building.

This study has proposed a completely new tool and theoretical structure for project design (Annex C), whereas, for project evaluation, it adopted an existing approach for food safety

through the Rainbow Framework (Annex D). These tools are deployable for future investments, but they might need to be adjusted to fit the specific needs of development agencies and competent authorities based on their policies and strategies. The project planning tool was developed based on recommendations identified in Chapter 2 and the best practices in the relevant literature. The testing of the developed tool through a new capacity building initiative might allow its finetuning with additional elements. Similarly, the Rainbow Framework adapted to evaluating food safety capacity building initiatives requires practical testing. This could not be done with the selected case studies in Chapter 2 due to multiple reasons: 1) such exercise would require financial resources for an extended field visit; 2) it would require a commitment not only from the development agencies and the governments; and finally, 3) the results of such post-investment evaluation cannot be compared with the one during the project closure. In addition, the collection of the data and access to different stakeholders are complicated processes during the project closure and even more so several years later.

The developed tools can ensure proper impact assessment and the trustworthiness of information in a data-driven food regulatory decision-making system. In this system, multifunctional indicators, applied to monitor the performance of food control systems and capacity building investments, will also play an essential role; however, their actual development would require a widespread collaboration among standard-setting bodies and development partners. The research also defined the required competencies of evaluators in food safety capacity building to ensure the trustworthiness of evaluation outcomes as verification of investments. This can serve as a guideline for development and donor agencies in identifying suitable candidates and thereby improving the verification or validation of reported achievements in the forms of indicators. Finally, the comparative analysis from the previous chapter and the literature review has shown that further research and possible exploration of best practices in project implementation are vital to improving the likelihood of positive project outcomes.

Chapter 4 -Theoretical approach of building data-driven food regulatory decision-making for more efficient investments

The research will present a comprehensive solution to address the challenges of current food safety capacity building initiatives by using new opportunities offered by data. It will provide a conceptual framework for data-driven food regulatory decision-making, which policy-makers can establish in their jurisdiction. Data-driven food regulatory decision-making can be defined as a regulatory decision-making mechanism facilitated by a technological platform that provides more robust and frequent evidence-based analytics and resulting options or recommendations for regulatory decisions based on structured and trusted big data. The scope of areas, which this decision-making system may impact, can include more systematic risk assessment practices within the food risk analysis paradigm, the design of well-tailored policies, and the identification of structured, relevant, and marketable capacity building initiatives. The performance monitoring of a national food control system should manage those as per relevant Codex guidelines.

Countries can adopt the data-driven food regulatory decision-making approach, thus having the potential of transforming their national food control system by making more accurate and proactive decisions than before. By having this data-centered approach for performance monitoring of food control systems, the underperformance of any system could be flagged early, and possible capacity building needs could be identified by using multifunctional indicators. This approach can be equally deployed by any national food control system, regardless of their stage of development. However, in case of less developed systems, certain functions, such as risk-based inspections or accredited testing capacities, would need to be simultaneously strengthened to ensure data integrity.

1. Notion of data-driven food regulatory decision-making mechanism
1.1. Fundamental concepts related to data in international development

Living in an age of big data facilitated by technological development and new programming solutions has launched substantial discussions on how the international development community should keep pace and what solutions can be envisaged to achieve the SDGs' indicators. These resulted in the formulation of new global fora, such as the Sustainable

Development Solution Network's (SDSN) Thematic Research Network in Data and Statistics (TReNDS) or the United Nations World Data Forum. These groups encompass academia, civil society, private sector, and multilateral organizations under shared platforms to discuss how to resolve the data gap challenge in developing countries and how to use data for informed and evidence-based policy decisions. However, the challenge is enormous in data collection efforts which often lack political commitments and required investments (OFID, 2019). As an example of the magnitude of this challenge, forty-four percent of countries cannot present comprehensive data on birth and death registration, and 77 percent of developing countries do not have poverty data (OFID, 2019). These types of data gaps originate from a lack of investments in data collection and digitalization efforts. In addition, where data collection takes place, there is still a two to three-year lag in data collection and publishing mechanisms (OFID, 2019). Digital transformation should address some of the challenges developing countries are facing today to enhance their policy-making practices.

Supporting digital transformation sustainably, international organizations, together with the donor community, have developed a set of Principles for Digital Development (Anonym, 2020), which are as follows:

> "**Design with the User**: user-centered design starts with getting to know the people you are designing for through conversation, observation, and co-creation;
>
> **Understand the Existing Ecosystem**: well-designed initiatives and digital tools consider the particular structures and needs that exist in each country, region, and community;
>
> **Design for Scale:** achieving scale requires adaptation beyond an initiative pilot population and often necessitates securing funding or partners that take the initiative to new communities or regions;
>
> **Build for Sustainability:** building sustainable programs. Platforms and digital tools are essential to maintain user and stakeholder support, as well as to maximize long-term impact;

Be Data-Driven: When an initiative is data-driven, quality information is available to the right people when they need it, and they are using those data to take action;

Use Open Standards, Open Data, Open Source, and Open Innovation: an open approach to digital development can help to increase collaboration in the digital development community and avoid duplicating work that has already been done;

Reuse and Improve: reusing and improving is about taking the work of the global development community further than any organization or program can do alone;

Address Privacy & Security: addressing privacy and security in digital development involves careful consideration of which data are collected and how data are acquired, used, stored, and shared;

Be Collaborative: being collaborative means sharing information, insights, strategies, and resources across projects, organizations, and sectors, leading to increased efficiency and impact."

Digital transformation could be approached from the perspective of a data revolution which can be harnessed for inclusive and sustainable development by taking proactive measures guided by the following principles (United Nations, 2014):

1. **Data quality and integrity**: The entire process of data design, collection, analysis, and dissemination needs to be demonstrably of high quality and integrity;
2. **Data disaggregation:** To the extent possible and with due safeguards for individual privacy and data quality, data should be disaggregated across many dimensions, such as geography, wealth, disability, sex, and age;
3. **Data timeliness:** Standards should be tightened and technology leveraged to reduce the time between the design of data collection and the publication of data;
4. **Data transparency and openness:** All data on public matters and/or funded by public funds, including those data produced by the private sector, should be made public and "open by default," with narrow exemptions for genuine security or privacy concerns;

5. **Data usability and curation**: The data architecture should place great emphasis on user-centered design and user-friendly interfaces;

6. **Data protection and privacy:** Clear international norms and robust national policy and legal frameworks need to be developed that regulate opt-in and opt-out, data mining, re-use for other purposes, transfer and dissemination;

7. **Data governance and independence**: Data quality should be protected and improved by strengthening national statistical offices and ensuring they are functionally autonomous, independent of sector ministries and political influence;

8. **Data resources and capacity:** Investments go to human capital, infrastructure, geospatial data and management systems, as well as information intermediaries. In addition, national capacity for data science must be developed to leverage opportunities in big data, to complement high-quality official statistics;

9. **Data rights:** These rights include but are not limited to the right to be counted, the right to an identity, the right to privacy and to ownership of personal data, the right to due process, freedom of expression, the right to participation, the right to non-discrimination and equality, and principles of consent.

1.2. Data in food regulatory science

Data endeavors in food safety tend to happen in an environment where non-existing policies, regulations, as well as inadequate capacities of governmental institutions in public health, agriculture, quality infrastructure, and trade can limit the efficiency of planned outcomes. These are just a few of the issues to address to build an informed and scientific evidence-based policy-making mechanism. The importance of data is also reflected in two Codex guidelines, *Principles and Guidelines for National Food Control Systems* (CAC/GL 82-2013) and *Principles and Guidelines for Monitoring the Performance of National Food Control Systems* (CXG 91-2017). Some competent authorities from robust food control systems, such as the European Food Safety Authority (EFSA), the Food Safety Agency of the United Kingdom, or the Food and Drug Administration (FDA) of the United States, have a more forward-looking approach (Botsis *et al.*, 2014; UK Food Standards Agency, 2018; Bronzwaer *et al.*, 2019) in finding potential solutions in digitalization and data-driven food regulatory affairs. At the same time, academia (Huang, Kangas and Rasco, 2007; Marvin et

al., 2017; Mooney and Pejaver, 2018) also scrutinizes the possibility of developing new solutions for competent authorities, including Internet of Things (IoT) applications for inspection service or machine learning-based food hazard risk assessment. Food safety researchers as well as the industry are attentive to the possibilities offered by the Internet of Things (IoT) technologies and big data applications, particularly blockchain and smart contracts. The food safety industry is particularly interested in improving its supply chain compliance and thereby aims to benefit from optimized processes that can pose ethical questions for the retail sector, such as Amazon's practice of tracking its warehouse workers.

With regard to data utilized by food regulators, the map of applications and developments are scattered, dividing countries into three distinct levels: 1) complete absence of data collection mechanism; 2) existing data collection without any analytics, and; 3) data analytics and improved decision-making mechanisms in food safety. The current, relatively static, and reactive approach of most national food control systems will continue to impact consumers' health and safety while often contributing to billions of dollars productivity losses for the industry. Digitalization efforts through GovTech solutions are widely spreading in Western countries, but they have yet to reach a breakthrough in the food control system of most countries. To deploy these solutions, it is inevitable to consider the prerequisites that a food control system needs. From a broader national perspective, policy-makers would need to enhance the trustworthiness of the data and avoid possible biases created by any artificial intelligence system.

1.3. Structure of data-driven food regulatory decision-making

Competent authorities in developing as well as developed countries started to use data in their food regulatory decision-making, so far mainly focusing on risk profiling of food sectors and import consignments, optimized frequency, and form of inspection visits and subsequent decisions. Regulators are collecting and improperly storing a large amount of unstructured data which could be standardized and connected into a defined data ecosystem. Current food regulatory decision-making practices could become more preventive, reliable, and robust than ever before. If the structure of this data system is being built more purposefully from its initial stage, it could be deployed for exploratory data analytics through an explainable

artificial intelligence application aiming to 1) generate performance analytics and as part of it identify capacity building needs, 2) support policy-settings, as well as 3) conduct enhanced food risk assessment (Figure 13).

The proposed framework for establishing data-driven food regulatory decision-making also considers that this would have to be built from the ground up with the consensus-based involvement of consumers and the industry. Such public-private partnership is crucial in a democratic system in order to build trust among the different stakeholders and provide reliable data to this system. Since most stakeholders will not have the required technical and practical experience, the capacity development of stakeholders should also be integrated. Capacity development should always remain a central part of this process to ensure the required competencies of regulators. The proposed structure is designed as a circular process that commences with developing local capacities, followed by building the performance monitoring framework and the explainable artificial intelligence applications (performance analytics, risk assessment, and policy setting) and continuing with the regulatory decision-making.

As part of this capacity building, regulators should learn about the relevant Codex guidelines, lessons learned from other regulators' experience in creating such a data-driven system, and ethical consideration throughout its development process. After understanding the basics of data-driven food regulatory decision-making, regulators need to establish a performance monitoring framework. As part of this process, regulators should set multifunctional indicators with targets, also involving other stakeholders.

The third chapter discussed the potential behind the role of multifunctional indicators in a data ecosystem for competent authorities. Accordingly, regulators need to define data collection processes and develop Internet of Things (IoT) technologies to ensure the data's trustworthiness and, as a result, the expected outcomes. After quality control of entered data, it should be stored securely, clearly defining the access rights based on the mandate of competent authorities. For instance, the draft Codex guideline on voluntary third-party assurance (vTPA) aims to define these processes to ensure the integrity of compliance data gathered from third-party conformity assessment bodies.

Figure 13. Structure of data-driven food safety regulatory decision-making
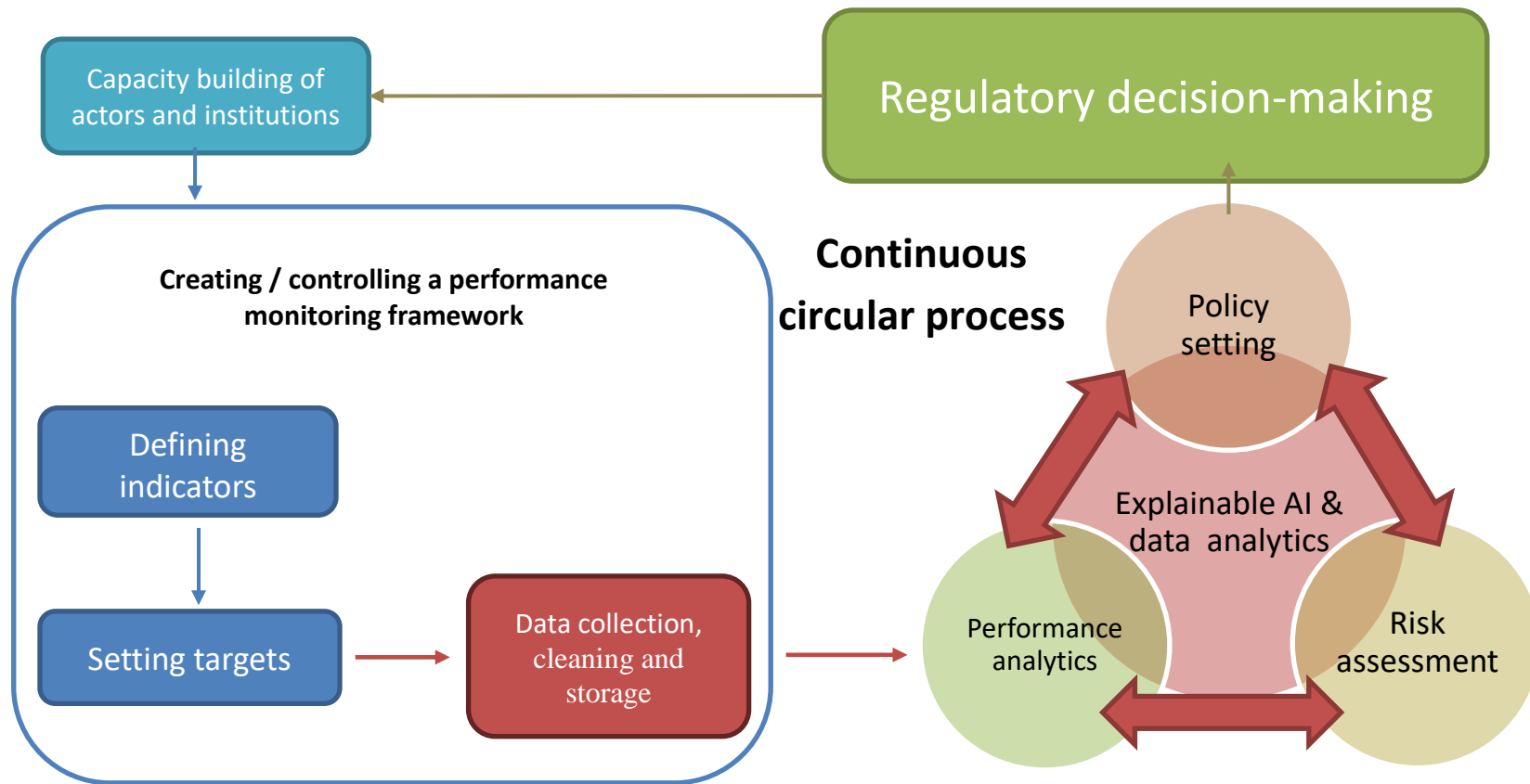
Regulators need to develop explainable artificial intelligence (AI) applications in performance analytics, policy setting, and risk assessment as a modular approach, starting with strategic food sectors. The recommendation system in the three different AI applications will provide sufficient information to regulators to enable them to develop more accurate and reliable policy options. The chapter will later elaborate on these solutions and the potential behind them.

2. Proposed approach transforming food regulatory decision-making using data

2.1. Drivers for data-driven food regulatory approaches

Concerning data and food regulatory governance, three Codex guidelines provide guidance for countries to improve their food regulatory decision-making mechanism, using data as a tool. These three guidelines are: 1) *Principles and Guidelines for National Food Control Systems* (CAC/GL 82-2013), 2) The *Principles and Guidelines for Monitoring the Performance of National Food Control Systems* (CXG 91-2017). and 3) the currently draft Codex guideline at Step 8 called *Guidelines and Principles on the Use and Assessment of Voluntary Third-Party Assurance (vTPA).* These Codex guidelines serve as international references to promulgate evidence-based decision-making among regulators using data. A fourth draft guideline is being discussed during this research, which focuses on recognizing system equivalence, but it will not be covered in detail due to the early stage of negotiations.

As the most fundamental document for the establishment of a robust national food control system, the Codex guideline CAC/GL 82-2013 has identified some of the possible data sources by stakeholders, such as government, academia, scientific institutions, and industry, as well as data types, for instance, epidemiological data on foodborne diseases or statistical data on production, trade, and consumption. Article 84 in this Codex document also references the identification of capacity building needs to be based on data, saying that "a national food control system should be regularly reviewed to contribute to the systems improvement, in response to, for example, control program data non-compliances and food safety incidents.

As the development of the food control system's monitoring and system review function has received limited attention in the CAC/GL 82-2013, more detailed guidance was required for

national food control systems. The *Principles and Guidelines for Monitoring the Performance of National Food Control Systems* (CXG 91-2017) offers an approach in the form of a "logical framework of planning, monitoring and system review steps for system monitoring of a national food control system." In other words, CXG 91-2017 (Figure 14) provides an overall framework for national food control systems to develop their performance monitoring framework allowing identification of policy priorities and capacity building needs through the application of data by using performance indicators. This guideline offers a general key concept by recommending a "phased approach with gradual expansion" for food control systems and performance monitoring principles, terminology, and best practices. However, it does not provide further explanation on the required prerequisites, ethical issues, and potential benefits. Considering these limitations, a programmatic approach needs to be developed for a data-driven performance monitoring framework of national food control systems and recognize potential challenges and added benefits. Data-driven decision-making describes organizational decision-making practices that emphasize the use of data and statistical analysis instead of human judgment only (Brynjolfsson, Hitt and Kim, 2011). The central idea of data-driven food regulatory decision-making is to improve public health as well as food trade outcomes by improving the scale and accuracy of regulatory decisions. To achieve this, it is necessary to develop a data mindset within competent authorities as well as the required infrastructure and data ecosystem.

As indicated by the Codex guideline on performance monitoring (CXG 91-2017), the national food control system would ideally monitor all components or functions based on its priorities. A targeted or phased approach can be developed by focusing on priorities through specific programs or functions equipped with relevant performance indicators. Chapter 3 of this research has already developed the idea of designing multifunctional indicators to serve as a data source for national food control systems for their performance monitoring framework. The Codex guideline (CXG 91-2017) also recognizes the possibility of utilizing external data sources under its "relevancy" principle. On the other hand, it does not necessarily consider how developing countries could also put this principle in practice and benefit from collecting data generated by past and ongoing investments related to their food control systems' different components and functions. It also excludes the prerequisites which

need to be in place to commence the operationalization of such an application. Figure 14 summarizes the different steps and principles to develop a performance monitoring framework for a national food control system based on the Codex guideline. The system can be split into planning and monitoring and a system review phase, dividing the six different steps. The border between the two phases is indicated through a red line.

Figure 14. Steps and principles for developing a performance monitoring framework of a food control system as per CXG 91-2017
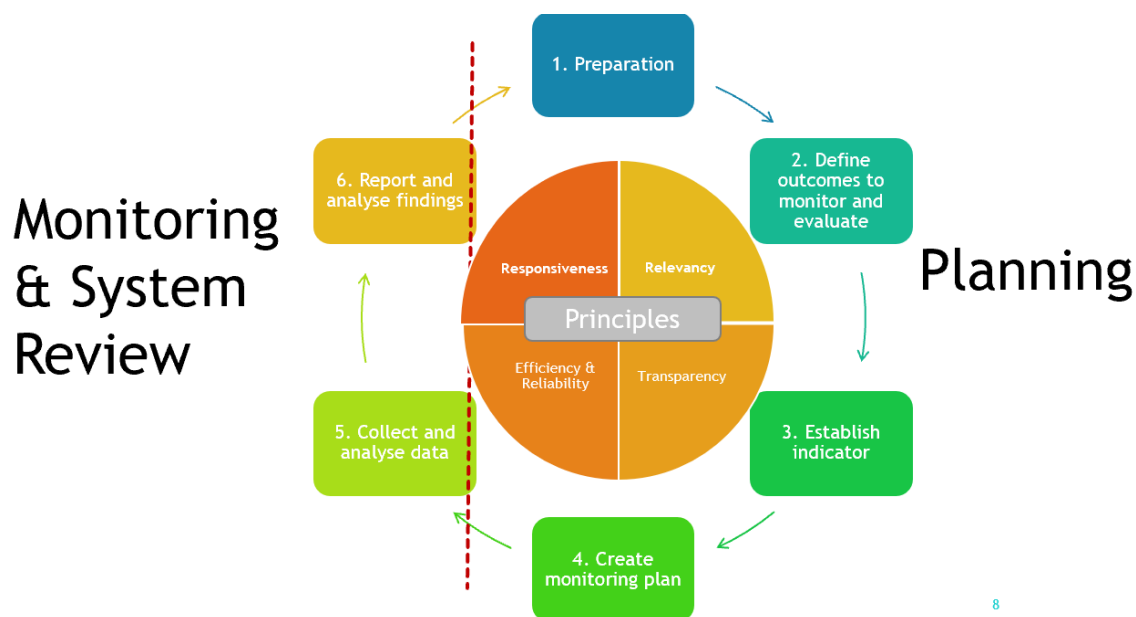
Even though a performance monitoring framework exists, the integrity and trustworthiness of data should be adequately defined. This can be enabled by existing quality standards, as data generated through internationally recognized conformity assessment services and other nationally accredited services based on internationally agreed quality standards. Through these quality checks, data can become a credible and verified information source for data-driven regulatory decision-making. The currently developed guideline on recognition and assessment of voluntary third-party assurance (vTPA) aims to also serve as an approach to ensure the data integrity and quality for improved risk profiling of foodborne illnesses by using data generated by certification bodies.

Certain prerequisites should be set at governmental, competent authority, and individual levels to develop a trusted data-driven regulatory decision-making. As per Codex guidelines and international trade agreements in the WTO, food regulators should continue applying

scientific evidence-based risk analysis as part of their decision-making, requiring existing scientific abilities and adequate knowledge on applying its principles. Most developed countries have these capacities and abilities, but developing countries often struggle to catch up with their more developed partners. This, along with performance monitoring of the overall food control system, could be further streamlined given the recent developments in data science, particularly artificial intelligence, which can leapfrog nations in improving their food safety capacities and practices. Although artificial intelligence and other Internet of things (IoT) solutions could accelerate these processes, legal and policy prerequisites for data utilization should be considered and preferably established in the national legal framework to avoid any inadvertent negative consequences on consumers, food businesses, and regulators. These prerequisites could be as follows:

- **A collaborative approach** among all stakeholders involved in the data collection process for adequate ownership and data sharing practices;[39]
- **National legal and policy framework for data ecosystem**, particularly the protection of privacy through the possible establishment of a regulatory agency for public data-driven decision-making and standards guiding public authorities;
- **Development of national data strategy** for public authorities, including identification of possible technologies;
- Existing **higher education programs in data science,** disseminating the same tools and research principles, including coding and statistical abilities;
- **Capacity building of policymakers** on the ability not only to make decisions based on the findings generated by a data analyst or an artificial intelligence system but also to understand the process behind these analyses for the identification of potential biases and errors;
- Development of **application programming interface and open data structures** for transparency and research purposes.

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[39] As part of the decision traps, behavioral science research might need to be considered particularly the work of Christopher Hodges (Hodges, 2016) on a collaborative approach among all stakeholders instead of competition.

2.2. Steps to establish data-driven food regulatory decision-making

The previous section's prerequisites should be considered as enablers to create a robust national food control system supported by data-driven regulatory decision-making. Simultaneously these can facilitate the work of competent authorities to develop their own data-driven food regulatory decision-making mechanism by following the steps below:

Step 1. Undertaking institutional assessment on human, infrastructure, and financial resources available and required to securely and sustainably apply data solutions;

Step 2. Development of a performance monitoring framework for the food control system, directly linked to organizational capacities and practices of the competent authority(ies);

Step 3. Establishment of a data strategy for the competent authority, focusing on the development of (a) creation of required institutional framework; (b) data-driven decision-making solutions; and (c) capacity building program to equip regulators with the required knowledge for the secure application of data;

Step 4. Implementation of institutional restructuring, positioning the data team close to policy- and decision-makers;

Step 5. Conceptualization / Procurement of digitalized solutions for data collection and infrastructure for securely store data;

Step 6. In collaboration with other partners (universities or regional bodies), develop an inter-disciplinary capacity building program for food regulators focusing on food safety and data;

Step 7. Piloting data application, observing outcomes, and defining potential best practices and a roadmap to upscale developed application.

These steps could be followed in the same chronological order, but some could be implemented in parallel. As data and the morality of its application receive larger and larger attention by the public as well as regulators, it is imperative to investigate the ethical issues and possible challenges related to such a system. To ensure that the system improves people's lives and not the opposite, even if it is accidental, specific ideas underlying any artificial intelligence and data-driven system must be carefully scrutinized before its deployment.

2.3. Ethical consideration for a data-driven food regulatory decision-making system

As data is receiving increased attention as part of the fourth industrial revolution or industry 4.0, it is necessary to investigate what type of criticisms are aimed at algorithms developed for improved decision-making. The negative experience of black box-based artificial intelligence solutions applied in the criminal justice system spurred regulators to think about ensuring the trustworthiness of data facilitating their decision-making process (Bathaee, 2018). Typically, the black box concept refers to the fact that computer or artificial intelligence technology undertakes a particular decision process or recommendation based on an algorithm and dataset, resulting in an output that the decision-makers or users cannot necessarily understand, leading to the so-called interpretability problem. The AI Now Institute at New York University researched the black box type of artificial intelligence and asked for banning its application in the criminal justice, healthcare, welfare, and education systems (Graham-McLay, 2020). The development of an "explainable AI" solution could be promoted through regulations and standards and the capacity building of regulators. This system should be developed in collaboration with regulators who are also the beneficiaries of this system along with the consumers and the food industry. This technology should not focus on replacing these regulators or reducing regulatory oversight. On the contrary, it should enable regulators to make more informed decisions and optimize their regulatory activities in risk assessment and policy setting.

When it comes to artificial intelligence (AI) in public regulatory enforcement, Altenburger and Ho (2019) highlighted the general issue that many data solutions tend to be more problem-driven instead of solution-driven. Addressing the morality of any application, the ethical matrix provides an exciting perspective for measuring the impact of a new solution on each stakeholder. This was initially developed by Mepham et al. (2006) and later adapted by Cathy O'Neil (2017) to overcome bias-related issues during the development of algorithms. Mepham et al. (2006) defined the ethical matrix as "a conceptual tool designed to help decision-makers (as individuals or working in groups) reach sound judgments or decisions about the ethical acceptability and/or optimal regulatory controls for existing or prospective technologies in the field of food and agriculture." This framework is used to address a broader perspective of algorithms applied for regulatory decision-making (Mudhol,

2018). The ethical matrix applies some *prima facie* principles to define a set of selected interest groups. The standard principles are respect for well-being, autonomy, and fairness, forming the ethical matrix's columns. The rows in the ethical matrix consist of the 'interest groups,' i.e., affected parties relevant to the issue in question. These might include different groups of people, such as consumers and food producers, and non-humans, such as farm animals. Using the same simple concept, an ethical matrix could be developed for the different data-driven food control functions, covering the different groups of stakeholders in food safety, namely competent authorities, academics / food safety scientists, industry, and consumers. This traffic light system can signal positive (green), negative (red), and neutral (yellow) outcomes based on changeable categories such as data quality, positive short-term and long-term benefits, and negative consequences. Depending on the considered model for each service, this ethical matrix can serve as a decision-making mechanism before deploying an algorithm or data application considered in food regulatory decision-making. Furthermore, it needs to be emphasized that any data-based system supported by an artificial intelligence technology should serve the purpose of accelerating and improving the accuracy of decision-making and not replacing humans with computers.

Any data-driven application should consider how it can impact any individual's life, environment, or economic trade-offs. In this regard, Altenburger and Ho (2018) have discussed how private citizen's bias can impact public food safety enforcement measures, for example, a disproportionate level of complaints targeting Asian restaurants in the United States of America. Such biases can discredit predictive analytics-based regulatory policy development. The repercussions of fixing these errors by cleaning and revalidating datasets are long-lasting and expensive and can lead to the abolishment of any data-driven decision-making programs through public distrust. As a result of these adverse outcomes, some governments are being more proactive. For instance, New Zealand has created the first algorithm standard signed by most public authorities, except for police forces, urging them to apply explainable artificial intelligence in data-driven decision-making (Graham-McLay, 2020). Hence, the design phase of food regulatory systems supported by data should consider the existing overall national data ecosystem, different data sources, including their validity and reliability, and should be based on standards as in the case of New Zealand.

Before further exploring what such a system could and could not do, an emphasis should be made on the ethical conduct and adequate knowledge of regulators on the developed applications. Decision-makers and regulators should not only know these technologies to make a more informed decision but also understand the implications and negative consequences of wrong judgments. The system needs to ensure constant monitoring and evaluation of outcomes by verifying results and investigating any potential abuse or misinformation, including possible cybersecurity attacks. The verification of results happens by comparing the policy target against the actual achievement, for instance, the percentage change of foodborne illnesses among consumers.

2.4. Data sources of data-driven decision-making in food regulatory systems

To enable data-driven decision-making processes in the food regulatory context, the existence of a national data ecosystem interconnected among the spectrum of the economy, trade, health, agriculture, and environment is paramount. If such a data ecosystem is not in place, a broader national strategy should be established with the inclusion of the public and private sectors as well as academia. A data ecosystem is defined as a network of a heterogenous set of actors (e.g., data consumers and data producers) who directly or indirectly consume, produce or provide data and other related resources (e.g., datasets, software, and services), each of which has different properties, quality, and functional requirements (Olivera and Loscio, 2018).

A public data ecosystem would require a change in specific rules and regulations and the existing bureaucratic mindset (Olivera and Loscio, 2018). For this transformation, a capacity development-based approach is needed to implement this data-driven regulatory decision-making system. Further research is also needed on governance (Douglas *et al.*, 2018) and emerging areas of public policy-making. Overall, standardized protocols on data collection, handling, and storage processes need to be carefully defined to ensure the trustworthiness and ethical use of structured data.

Potential data sources should be well defined as part of a larger data ecosystem to capture data to identify and analyze insights and trends. Within that, more structured and regulated data, potentially generated through certain internationally agreed standards, can further improve decision-making accuracy and reduce the possibility of human biases from the data.

The list below attempts to show the potential data sources within an interconnected food safety data ecosystem. The following stakeholder groups should be involved in this collaborative approach for a data ecosystem in food safety, also referring to their role in terms of trusted data sources:

1. **Hospitals and public health organs**: provision of data on foodborne illnesses and early identification of potential outbreaks;
2. **Inspection bodies**: surveillance and monitoring data on compliance capacities and practices of food business operators;
3. **Certification bodies and certification program owners**: non-conformities of food business operators and trends of compliance in terms of issued certificates;
4. **Laboratories:** toxicological and microbiological data related to foodborne illness cases and data on food safety hazards related to food testing;
5. **Research institute / Universities:** universities conduct research and related data collection in many fields related to food safety which are particularly important in systematic review-based risk assessments;
6. **Customs:** food import and export compliance and rejection data;
7. **Other national and international organizations**: national authorities, as well as international organizations, collect data related to the food safety performance of countries from projects through economic and trade performance data to consumer trends;
8. **Food business operators**: non-compliance of suppliers for potential recalls, sales of food products to identify consumption trends, and any inputs (e.g., applied herbicide and pesticide) which require compliance with national or international standards.

Some information could be gained through applications developed for the above entities in an interconnected manner, sharing predefined information among each other for regulatory and policy-making purposes. Therefore, the authority in charge of risk analysis principles or a platform of several authorities, in case of a multi-agency system, would be in charge of data storage and analysis and report to the public and relevant governmental decision-makers on an annual basis. In addition to these applications, there are other sources of data like social

media, which can also be misleading due to the biases of consumers and/or their wrong judgment.

2.5. Regulating the use of data in food control systems

The negative effects of current data-driven public policymaking point to the global need to define guidelines and standards that would allow the protection of privacy and encourage public discourse among regulators, industry, and civil society. As the industry also tests data applications while trading and monetizing the information collected on consumers to target online advertisements, regulators need to ensure that there is a framework for ethical conduct and the proper handling of data. Predatory practices could also emerge from the service industry if they have more data on food business operators' compliance. Therefore access to specific datasets should also be well considered. Such applications can easily be deployed for the wrong purposes, further spreading a 21st century concept of slavery. Once they are successfully spread among developing countries, e-agriculture and more advanced food processing practices might also put millions of jobs at risk in the upcoming decades.

As a positive application of data generated by the food sector and related food safety service sector, third parties, like certification systems and certification bodies, own a large amount of data on the compliance capacities of food business operators. Recognizing the potentials of improving practices of competent authorities, the Codex Committee on Food Import and Export Inspection and Certification Systems (CCFICS) is developing a new set of *Principles and Guidelines for the assessment and use of voluntary Third-Party Assurance (vTPA) programmes*. It aims to promulgate a new approach through which competent authorities can improve their risk profiling by assessing and recognizing trusted data sources, applying them in their inspection policy, and identifying possible risks among establishments. At the same time, scientific principles through the application of risk assessment should remain unchallenged, particularly due to the current governing international rules and regulations in food trade. Going beyond that, a data-driven system might contribute to upscaling and improving the accuracy of current risk assessment practices by making data accessible for research and the sectorial recognition of equivalence within food control systems.

From a management perspective, to enable data-driven decision-making, it is highly recommended that a data analytics team is established to work closely with scientific teams

and advise the policy or decision-makers. This team can be tasked to work in three main areas: 1) data digitalization solutions and database management, 2) data analytics, including predictive analytics on the performance of food control or safety system, and 3) conducting food risk assessment. The modular approach among the different food control functions is the only economically viable way to establish and test these applications in data collection, storage, and analysis.

For quality purposes, this data team must be overseen by a regulatory oversight body or internal audit system, thus ensuring that the results are statistically valid and data-driven decision-making processes are followed without jeopardizing the well-being of consumers. This would require specific standard operating procedures (SOPs) for the decision-making process and standards on the collected data. As an example, the Food and Drug Administration in the United States (2020) has established a Data Standards Council to "coordinate the evaluation, development, maintenance, and adoption of health and regulatory data standards to ensure that common data standards are used throughout the agency." Establishing such internal data quality control mechanisms is essential to ensure the trustworthiness of the deployed solutions and, most importantly, the competent authority in front of the public.

Defining the decision-making processes for food regulators in the form of standard operating procedures (SOPs) would simultaneously entail the need to have capacity building programs embedded in the approach. Some regulators will face knowledge gaps and further training needs. In case it is required, a competency framework could be set for regulators to ensure the required knowledge for the data-driven decision-making process.

Afterward, indicators should be set for the performance monitoring framework through a collaborative effort, commencing with modules for the different control functions and areas that might generate more trusted data for inspection, testing, or certification. This part also entails setting realistic targets based on the different policy objectives related to food safety. The data collection process should be done in a structured manner through defined surveys and data sources. It must be mentioned that data collection will also have a phased approach, from one function to the other, and generate analytics and narrative reporting based on the identified gaps. At the same time, shifting from data collection to data connection and

developing application programming interfaces (APIs) to democratize and make accessible data would allow automatic exchange of information, as it was also highlighted in an editorial paper produced by Cappè et al. (Cappè *et al.*, 2019).

3. Positive implications of a data-driven food regulatory decision-making approach

Domain experts identify and formulate safety capacity building investments through a lengthy process of document revision and field visits. In developing countries, this becomes particularly difficult when the donor community decides not to fund further activities, and local expertise is not available. This also underlines the dire need for building the capacities of regulators and developing new solutions that are more sustainable and less time-consuming. Like the policy priority inference (PII) (Castañeda, Chávez-Juárez and Guerrero, 2018), artificial intelligence-based models provide an exciting perspective to identify investments needs and understand the complex interconnectivity among a large number of performance indicators which will be further discussed below.

The proposed data-driven approach addresses current regulatory challenges in three areas: 1) food control performance analytics and identification of capacity building needs, 2) risk assessment, and 3) policy settings. Each area offers added benefits to all stakeholders who believe in the notion of shared responsibility in food safety. These data-driven mechanisms would require extensive research and discussion among regulators at the global stage, thus ensuring that its artificial intelligence part remains understandable or explainable for regulators. The research does not attempt to describe these in detail but rather explain their primary purpose and improvement in food regulatory decision-making.

3.1. Performance analytics

The research has presented the theoretical structure and the way performance monitoring systems could be developed. The overall purpose of the performance analytics function is to assess, improve and monitor the capacities and practices of food safety stakeholders (industry, competent authorities, and consumers) and control and possibly mitigate negative socioeconomic outcomes related to food and its production. A performance analytics function allows the examination of the improvement or lower performance of food safety stakeholders. It would also point out possible needs in changing policies and capacity

building investments. For this reason, the three elements of the data applications could and should be linked to each other. Multifunctional indicators set through a collaborative approach under the overall leadership of the competent authority(ies) with the inclusion of development partners would ensure an adequate process to identify data sources for such a system. As mentioned before, the trustworthiness of data could be questioned if they are not linked to internationally accredited conformity assessment services and other quality frameworks, including competencies of food safety practitioners in the public and private sector. On the other hand, having information on broader implications of improved food safety practices, for instance, level change of waste disposal, should also be monitored through environmental indicators.

Performance monitoring and surveillance systems should be distinguished, particularly from a legal perspective, as the former would entail mandatory practices by the food business operators, unlike the latter. Another difference is that the surveillance systems might legally oblige businesses to digitize their documentation and share data on their operation. This could also entail the promotion of digitalization and collection of monitoring data through sensors and information provided by business operators. An example of an advanced surveillance system with some capacity building function is the Foodwatch developed and deployed by the Dubai Municipality to "provide valuable data that the municipality can use for better public health decision-making" (Keogh, 2020). This platform also allows the training of food handlers and managers on food safety practices and helps create more trusted supplier relations by having access to digitized documentation and certifications of FBOs. Due to the level of data collected by this solution, specific performance analytics could be conducted to measure the performance of the private sector. The Foodwatch might be a solution that functions in the United Arab Emirates, but in countries with more stringent data protection laws, like the European Union, it might not be possible. One major issue which should be tackled is the ownership and sharing of data by food businesses, differing from one country to another, depending on the food safety culture and the overall political and legal framework. Furthermore, it must be mentioned that the food market is a globally interconnected system, and even though such a surveillance system is developed for local producers in one country, they still need to rely on the control functions of exporting countries. Data-sharing among

national competent authorities can exist in the framework of regional cooperation, as it is shown in the European Union's Rapid Alert System for Food and Feed.

As added values, the performance analytics will monitor the different key activities of control or testing functions, such as the number of inspections or laboratory testing conducted for a product category, alert possible fraudulent activities among different actors or identify trends for under- or over-regulations. At the same time, it provides a more accurate picture of the social and economic outcomes, including the number of registered cases with foodborne illnesses or death. Once a solution for each function was developed and also inter-operability and inter-connectivity established, the verification of the gained data and identification of possible "silent trends" would become possible. An example for the latter would be the potentially more significant number of non-registered foodborne illnesses if the alert of a recommendation system is delayed and the risky products were not completely recalled. In terms of regulatory decision-making, besides more expeditious processes in identifying risks related to food, countries applying a similar approach would be more easily able to recognize a specific sector or the overall food control system as equivalent, thus improving the trade relations among each other.

3.2. Food risk assessment

One of the most significant challenges among current risk assessment practices and related regulations is that they are relatively static processes (Agroknow, 2019), and they do not necessarily evolve at the same pace as food-related risks in societies. The European Food Safety Agency (EFSA) also agrees with this and indicates that "a key feature of data use in risk assessment is timeliness and this will continue to increase in the future. Moving towards more real-time data analysis and risk communication is expected to be increasingly important. Making that analysis readily accessible to practitioners, scientists and consumers in a reproducible and transparent way will also be driven by modern data visualization and dissemination services" (Cappè *et al.*, 2019).

Another limitation is that food risk assessment serves the purpose of the regulatory mechanism, but most companies might not have the same level of information to ensure improved supplier management when it comes to corporate risk management. More and more applications are available to food business operators to improve their food safety

management practices and have better market intelligence, including food standards and laws in other countries. Open-source data systems in food safety, sharing specific data among food safety stakeholders, would provide equal opportunities for regulators and companies to develop their risk assessment practices. Open-source systems will also equalize opportunities for all regulators by creating access to the required data and not serving the work of few who can afford the purchase or collection of information.

As an example for improved risk assessment practices based on data, meteorological data on increased temperature will support decision-makers in foreseeing potential risks related to storage or application of chemicals. Both sectors can utilize this data due to the shared goal of product compliance, where the industry considers the compliance of suppliers and the competent authorities from the aspect of export compliance. Such an application for food regulators was developed and tested by Bouzembrak and Marvin (2018) based on the Bayesian networks' statistical model, which is considered one of the leading schools in artificial intelligence. The European Food Safety Authority (EFSA) also investigates the possibility "to work in collaboration with stakeholders to test complex predictive models and machine learning in the field of risk assessment, expert knowledge elicitation and the tracing of food contamination events throughout the food chain" (Cappè *et al.*, 2019). Establishing the required open data structure and developing APIs would be the first step for researchers to design new, more fluid, and responsive solutions in risk assessment.

Data-driven food risk assessment can have numerous positive results in regulators' decision-making process and its outcomes. Although risk assessment steps (hazard identification, hazard characterization, exposure assessment, and risk characterization) would be continuously applied, their accuracy and magnitude could be enhanced, addressing areas related to scientific certainty. For example, a more accurate cost-benefit analysis for selecting the most adequate regulatory option would become less time-consuming with more accurate predictions. Concerning the decision-making mechanism, in this case, as part of risk management, regulators can take prompter decisions on food recalls and warn consumers on the harmful effects of specific food products. These assessments also contribute to identifying different risk management options and the more rapid calculation of their impact on consumers and industry by having all data available in the same ecosystem. This along with

the food safety-related policies will determine the short-, medium- and long-term performance objectives of a food control system.

3.3. Policy setting

The Codex guideline (CXG 91-2017) states that such performance monitoring frameworks are only helpful "if the findings are used to inform and influence the policy setting design and implementation." Policy setting was described in detail in the Codex *Principles and Guidelines for National Food Control Systems* (CAC/GL 82-2013) as part of the initial step for a national food control system's development framework. The Codex guideline emphasizes the need to consider a broad range of factors and carefully assess policy options, setting short-, medium- and long-term goals. Setting and monitoring more realistic goals would allow regulators to focus on achieving them.

An artificial intelligence system would allow easier identification of risks and trends and analyze public policy measures. It would also allow better engagement and participation of other stakeholders, particularly food business operators, industry associations, and consumers. As a possible conceptual framework for policy setting, researchers at the Alan Turing Institute have developed the policy priority inference (PPI) model. This concept states that it "is a computational framework created to understand the complexity of policy prioritization and to support governments who wish to distribute transformative resources across numerous policy issues with the aim of reaching specific development goals" (Castañeda, Chávez-Juárez and Guerrero, 2018). As a result, the model was created by using the 17 sustainable development goals (SDGs) and their 232 development indicators in order to "identify the policy priorities that governments need to set if they are to adopt a specific development strategy" (The Alan Turing Institute, 2020). The conceptual framework developed by Castañeda, Chávez-Juárez and Guerrero (2018) could be quickly adopted and deployed for data-driven decision-making of a food regulatory system. Policy setting using the policy priority inference (PII) can contribute to improved policy setting in the following three areas:

1. Enhancing relevant functions of food safety competent authorities by identifying required capacity building investment;

2. Discovering data gaps as well as data standards to improve the trustworthiness of data;

3. More accurate prediction and comparison of possible policy options.

Although the PPI has only been piloted at this stage, without actual deployment by any government, a more comprehensive capacity building framework could already be followed, as also outlined in this research. For the potential application of this model for a food control system, a more detailed comparison would be required, along with possible piloting at least for a target sector, both of which are outside of the scope of this research.

4. Conclusion

The data-driven food regulatory system outlined in this chapter discusses the possibility that formulation of food safety capacity building initiatives could become more effective and therefore more marketable by reducing the required investments in terms of money and time. As observed in the previous chapter, typical needs assessment practices of national food control systems in developing countries can sometimes take years and often do not occur regularly. Indeed, under current approaches, a needs assessment provides a snapshot of the system in a given time, whereas a data-driven system could provide immediate status analysis whenever required. Such costs could be reduced by tracking the actual performance of a national food control system based on the existing Codex guidelines and creating a data-driven performance monitoring framework for improved decision-making. Developing data-driven regulatory decision-making would have the following advantages for capacity building investments:

1. Faster, more efficient identification, monitoring, and prioritization of investments;

2. Expeditious assessment of capacity building needs and predictions of required investments;

3. More accurate verification of the results achieved by capacity building activities and assessment of their impact;

4. Effective and proactive performance monitoring of stakeholders' capacities and practices to identify potential capacity building needs;

5. Reducing corruptive practices by making investments more traceable and linked to concrete outputs of development partners;

6. Enforcement of stakeholders' ownership by continuously involving them in monitoring food safety practices and in turn creating food safety mindset or culture[40] as a shared responsibility among them.

On the downside, developing a data-driven food regulatory decision-making process is a time and resource-consuming process which some stakeholders might oppose. This resistance often originates from the fact that the stakeholders do not follow regulatory requirements or best practices or might reveal other shortcomings of a country. It may also be justified by the costs associated with designing and deploying the digital tools required to implement such an approach.

The COVID-19 Pandemic (Galanakis *et al.*, 2021) accelerated digitalization trends all around the world. The developing countries have the opportunity to embark on a "reset" of their food regulatory systems by introducing data-driven regulatory decision-making systems. This can accelerate efforts to transform their food regulatory functions, lead to more robust, sustainable, and inclusive systems.

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[40] The food safety culture initiative is developed by the Food Standards Australia New Zealand (FRANZ), targeting the industry to improve its food safety compliance. More information on the food safety culture is available on the website: http://www.foodstandards.gov.au/foodsafety/culture/Pages/default.aspx

Conclusion

Current food safety capacity building investments face numerous challenges, such as lack of scalability, unsatisfactory outcomes of initiatives, and the long and expensive transformation of food safety culture. Increasing the effectiveness and marketability of these investments would facilitate access to safe and nutritious food to consumers and contribute to the economic flourishing of rural areas in developing countries. Undoubtedly, there is still plenty of room to improve current food safety capacity building practices, allowing for better support to food safety stakeholders towards a more robust national food control system. Current initiatives might continue to struggle to achieve their intended outcome unless developing countries, the development community, and donor agencies endorse a more robust approach for enhancing food control systems.

Through the review and analysis of current practices and shortcomings in food safety capacity building, this research has uncovered that investments therein have a higher likelihood of success when they are multi-faceted, large in size, and comprise integrated approaches. In addition, this research offers short- and long-term solutions to achieve more impactful food safety capacity building investments that would contribute to enhancing and maintaining a robust national food control system.

More specifically, this research resulted in:

- A systematic review of international organizations' policy documents and capacity building tools leading to a comparative analysis of the current capacities and practices of these organizations and offering them several recommendations for more advanced and structured food safety capacity building practices and global governance structure.
- A comprehensive set of tools and guidelines as featured in Annex A labeled based on a coding used for the different functions of the food control system in the FAO/WHO Food Control System Assessment Tool (2019). This catalog of tools can serve as a toolkit for regulators to quickly identify the most relevant capacity building guidelines depending on the intervention approach.
- Food safety capacity building design, implementation, and evaluation tools derived from the lessons learned gathered as a result of a comparative analysis of the

performance of recently implemented initiatives based on a robust methodological approach, which comprised:

- o A new project planning tool (Annex C) to improve the marketability of investments and the identification of lessons learned;
- o A project evaluation tool specific to food safety capacity building adopted from the Rainbow Framework (Annex D).

These transformed approaches and tools are readily available for stakeholders' use and are summarized in Annex D.

Recent experience from data-driven public decision-making show that poorly planned deployment of new technologies can have severe consequences. Competent authorities need to study the proper use of digital technology in their daily operations to avoid any potential disturbance for the food industry. On the other hand, developing countries will have the chance to leapfrog towards a more robust national food control system where most information and knowledge are available for everyone through the Internet. With this, the main difficulty of competent authorities in developing countries will remain the change of mindset among their staff and how they can adopt new technologies in an inclusive and sustainable manner.

Most recent trends in regulatory decision-making, particularly during the COVID-19 pandemic, have shown the acceleration of using new digital solutions and data to optimize regulatory decision-making. This offers the opportunity to be further propagated towards more systematic use in the setup and operations of food safety regulatory programs. Although many of these applications were only introduced to allow continued enforcement practices during this period, they might also create more data-driven and digitalized practices among regulators. If the application of digital technologies among competent authorities maintains the same pace in the post-pandemic world, developing countries will have a better chance to accelerate the enhancement of their food control practices and capacities.

Based on the assumptions that most food control systems do not have a data-driven food regulatory decision-making mechanism in place, the research provides a capacity building-oriented approach by utilizing existing Codex guidelines developed for competent

authorities. Through the application of performance analytics solutions, food regulators will be able to identify capacity building needs in a more rapid and accurate manner, further enhancing the effectiveness and marketability of investments in the long term. The new practices in performance analytics, policy setting, and risk assessment applications presented by this research are fundamental to build the capacities of food safety stakeholders and maintain the robustness of any food control system.

The research offered a structured review to take stock of the current practices and tools used in food safety capacity building. It has also developed a methodology to compare food safety capacity building investments in two countries, resulting in several recommendations for improvements. The replication of this comparative analysis with other case studies is beyond this research's scope and is recommended for future research. Furthermore, the analysis has faced certain limitations regarding the availability of the project documentations, which would need to be addressed by the global development community to allow researchers to explore possible improvements. Based on the recommendations and best practices, new tools were developed for project formulation and evaluation. However, their testing would require a practical pilot, highlighting any further fine-tunings for widespread rollout within food safety capacity building. This can be a future perspective of this research. To support these tools and simultaneously contribute to improved food safety capacity building practices based on a data-driven food regulatory decision-making mechanism, the research developed the concept of multifunctional indicators, allowing to measure the impact of investments against the performance monitoring of a food control system. Although an example was given for such multifunctional indicators, food regulators and the development community would need to develop further guidelines and a list of performance indicators. Finally, the concept of data-driven regulatory decision-making was discussed from a development perspective, but no concrete application was developed as part of this research. Testing this approach by developing this data-based framework will require substantial investment by the development community and political buy-in by a potential beneficiary competent authority. As this research has also emphasized, these data-driven solutions need to be continuously scrutinized if they are to benefit consumers as well as national economies through the facilitation of enhanced trade.

Deploying data-driven food regulatory decision-making will facilitate enhanced trade through more rapid recognition of system equivalence and simultaneously encourage food regulatory collaboration at the national and international levels. These will be key outcomes for the world to create access to safe and nutritious food for the 9.3 billion individuals populating the earth by 2050.

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Annex A. Tools developed by International Organizations

Code 1	Code 2	Code 3	Year	Organization	Title	Objective	Technical area	Type of tool	Link
C.1.1.			1989	WHO	Safe food handling: A training guide for managers of foodservice establishments	Overcome the problems associated with educating food handlers	compliance practices	trainer guide	Link
A.3.2.			1990	WHO	Food, environment, and health: A guide for primary school teachers	Planning and implementation of health education programs	health education	guide	Link
D.1.3.			1995	FAO/WHO	Risk management and food safety	Description of food safety risk management framework, its general principles, and best practices	risk management	consultation	Link
A.1.1.			1995	FAO/WHO	Application of risk analysis to food standards issues	Application of risk analysis to food standards issues	risk analysis	consultation	Link
A.2.2.			1995	WHO	Food technologies and public health	Nature and extent of foodborne diseases and highlights the contribution of food technologies in their prevention	food technology	working paper	Link

B.1.1.			1996	WHO	Essential safety requirements for street-vended foods	Overall framework to improve the food safety situation of street-vended food	food safety requirements for street food	intervention approach	Link
A.3.2.	B.1.1.		1998	FAO	Food quality and safety systems: A training manual on food hygiene and the Hazard Analysis and Critical Control Point (HACCP) system	Support the development of standardized GMPs and HACCP training based on Codex Principles.	regulatory and business compliance practices	training manual	Link
C.1.2.	C.1.3.		1998	FAO	The application of risk communication to food standards and safety matters	Development of guiding principles, examination of barriers, and identification of strategies for effective risk communication	risk communication	consultation	Link
A.3.2.			1999	WHO	Basic Food Safety for Health Workers	To facilitate the training of health workers (trainers of primary health care workers, physicians, nurses, midwives, nutritionists, etc.)	food handling	training kit	Link
A.3.1.	A.3.2.		1999	WHO	HACCP Principles and Practice: Teacher's handbook	Facilitate the training of food inspectors and food industry personnel, and support the consistent interpretation and	compliance practices	handbook for trainers	Link

						application of HACCP worldwide		
B.2.1.			2001	FAO	Manual on the application of the HACCP system in mycotoxin prevention and control	Support understanding on the application of HACCP to mycotoxin control	mycotoxin control through HACCP	manual	Link
D.1.2.	D.1.3.		2003	FAO/WHO	FAO/WHO Hazard characterization for pathogens in food and water	Characterization of hazards in food and water using a structured, six-step approach	risk analysis	guidelines	Link
A.3.2.	B.1.1.	B.1.3.	2004	FAO	Improving the quality and safety of fresh fruits and vegetables: a practical approach. Manual for trainers	To train the trainers focus on the practical application of technical concepts, supporting the implementation of quality assurance and safety initiatives for fresh fruits and vegetables from private and public institutions at the local, regional, national, and governmental levels	horticulture	manual	Link

A.1.1.	A.1.3.		2005	FAO	Perspective and guidelines on food legislation, with a new model food law	Description of existing legal and regulatory frameworks and identification of best legislative practices	food law	guidelines	[Link](#)
C.2.1.	C.2.2.		2005	FAO/WHO	Enhancing participation in Codex Activities: An FAO/WHO training package	Support countries in developing a national framework and training programs in Codex involvement	Codex participation / SPS coordination	training package	[Link](#)
B.2.1.			2005	WHO	Stop the Spread	Measures to stop the spread of highly pathogenic bird flu at its source	bird flu	guideline	[Link](#)
A.1.2.	C.1.1.	D.2.1.	2006	FAO	Strengthening national food control systems: Guidelines to assess capacity building needs	Guide officials through the needs assessment process for the five core competencies of food control systems	governance / regulatory framework / capacity assessment	needs assessment	[Link](#)
D.1.2.	D.1.3.		2006	FAO	Food safety risk analysis: A guide for national food safety authorities	Provide a background on food safety risk analysis	food safety risk analysis	guide	[Link](#)
B.1.1.	C.1.2.		2006	WHO	A guide to healthy food markets	Fostering Healthy Food Market vision	informal markets	guide	[Link](#)
A.1.2.	C.1.1.	D.2.1.	2007	FAO	Strengthening national food control systems: A quick guide to assess capacity building needs	Five steps process to assessment and capacity building of entire food control systems	governance/ capacity assessment	needs assessment	[Link](#)

B.2.1.			2008	FAO	GM food safety assessment: tools for trainers	Implementation of a harmonized regulatory approach based on international standards on GM, information on internationally accepted approaches on the evaluation of foods derived from recombinant-DNA plants; endorsement of a science-based approach to the safe introduction and use of food derived from recombinant-DNA plants	GM food safety management	training toolkit	Link
B.1.1.	D.1.2.		2008	FAO	Risk-based food inspection manual	Support national food control agencies to improve and harmonize their food inspection activities	food inspection	manual	Link

B.2.1.			2008	FAO/WHO	FAO/WHO Principles and methods for the risk assessment of chemicals in food	Two-folded purpose: 1) Providing descriptive guidance by JECFA and JMPR to ensure the continuation of transparent and sound expert evaluation of scientific data for risk assessments of chemicals in food; and 2) to be informative for users of the outputs from JECFA and JMPR, such as risk managers and other risk assessment bodies in Member countries and authorities	risk analysis	guide	Link
D.1.2.	D.1.3.		2008	FAO/WHO	FAO/WHO Exposure assessment of microbiological hazards in food	Provision of a practical framework and approach for undertaking exposure assessment of microbiological hazards in foods	risk analysis	guidelines	Link

| A.1.2. | A.2.1. | A.3.2. | 2008 | IICA | Performance, Vision, and Strategy (PVS) for National Food Safety Services | To assist national food safety services to determine their current level of performance, create a shared vision with the private sector on how the services should perform in the future, individually and with other services within the national food safety system, establish priorities, and facilitate strategic planning to fulfill their enormous responsibility towards the consumer, and to take full advantage of the new opportunities and commitments brought about by globalization | food safety services | evaluation tool | Link |
| A.1.2. | A.2.1. | A.3.2. | 2008 | IICA | Performance, Vision, and Strategy for Sanitary and Phytosanitary Measures: An Institutional Vision | To help characterize a country's institutional level of performance and capacity to implement SPS regulations and take advantage of the international forums where such | SPS measures | evaluation tool | Link |

						regulations are discussed.			
B.1.1.	B.2.1.	B.2.2.	2009	FAO	Guidelines for risk-based fish inspection	Support fish inspection systems and adaptation of adequate food safety practices, including at the small-scale level	fish inspection	guideline	Link
D.1.2.	D.1.3.		2009	FAO/WHO	FAO/WHO Risk Characterization of Microbiological Hazards in Food	Practical guidance on the conduct of risk characterization as part of the risk assessment framework.	hazards in food	guidelines	Link
A.1.2.	A.2.1.	A.3.2.	2009	IICA	Performance, Vision, and Strategy (PVS) for National Veterinary Services	To help countries gauge their current level of performance, achieve a shared vision with the private sector, establish priorities and carry out strategic planning, to fulfill their obligations and take advantage of new opportunities	veterinary services	evaluation tool	Link

A.1.2.	A.2.1.	A.3.2.	2009	IICA	Performance, Vision, and Strategy (PVS) for National Plant Protection Organizations	To help NPPOs gauge their current performance level, set priorities, and carry out strategic planning. This tool can also help NPPOs form a shared vision with the private sector to fulfill their obligations and take advantage of new opportunities.	plant protection organizations	evaluation tool	Link
A.2.3.			2009	STDF	Guidelines on the Use of Economic Analysis to Inform SPS-related Decision-Making	To guide priority-setting for SPS capacity building in developing countries highlights the challenges faced in using a method and provides general guidance to decision-makers on which economic analysis approaches are best applied in particular decision scenarios.	economic analysis	guideline	Link
C.1.2.			2009	UNIDO	Agro-Value Chain Analysis and Development: The UNIDO Approach	It outlines the different aspects for a comprehensive analysis of value chain issues and their upgrade.	agro-value chain analysis	staff working paper/guide	Link

B.2.3.				2010	FAO	Strategic Plan of Emergency Prevention System (EMPRES) for Food Safety	To describe EMPRES Food Safety's strategic plan to deal with global food safety emergencies to contribute towards protecting human health and ensuring the safe trade of food	emergency response	strategic plan	Link
B.1.1.				2010	FAO	Linking people, places, and products	Explanation of origin-linked products and provision of tools and methodology for its implementation	geographical Indication / GI	guide	Link
B.2.3.				2010	FAO/WHO	FAO/WHO framework for developing national food safety emergency	Formulation and implementation of national food safety emergency response plans	food safety emergency	guide	Link
B.1.1.				2010	OIE	OIE Tool for the Evaluation of Performance of Veterinary Services (OIE PVS Tool)	To identify the current level of performance, critical competencies (CC) with five possible levels of advancement	system performance / veterinary assessment	assessment tool	Link
A.2.2.				2010	OIE	OIE Quality Standards for Veterinary Laboratories	Based on ISO/IEC 17025:2005, interpretation specifically to requirements for veterinary laboratories, including the	veterinary laboratory	guidelines	Link

						validation of test methods.		
B.2.3.	D.1.2.		2011	FAO/WHO	FAO/WHO guide for the application of risk analysis principles and procedures during food safety emergencies	Application of risk analysis during emergencies, within the framework of their Food Safety Emergency Response	risk analysis for emergencies	guide	Link
A.1.2.			2011	IPPC	Phytosanitary Capacity Evaluation Tool	Identification of strengths and gaps in existing and planned phytosanitary systems	phytosanitary measures/system	assessment	Link
B.2.3.	C.1.2.		2012	FAO/WHO	FAO/WHO guide for developing and improving national food recall systems	Establishing and implementing an effective national food recall system to respond to food safety events	recall system	guide	Link
A.3.1.			2012	OIE	OIE Recommendations on the Competencies of graduating veterinarians ('Day 1 graduates')	Setting out the minimum competencies needed by graduating veterinarians to be adequately prepared to participate in national veterinary services	veterinary education	guidelines	Link

A.1.1.			2012	WHO	Guidelines for developing and implementing a National Food Safety Policy and Strategic Plan	The manual aims to provide practical step-by-step procedures for countries on the formulation of food safety policies and plans to strengthen all aspects of national food control	food control measures	guide	Link
B.1.1.	A.2.2.		2012	WHO	Five keys to growing safer fruits and vegetables: promoting health by decreasing microbial contamination	Support food safety education of rural workers by describing key practices to reduce microbial contamination of fresh fruits and vegetables during planting, growing, harvesting, and storing	food handling / fruits / vegetables	manual	Link
B.2.2.			2013	IPPC	Market access	Description of a process for market access and prevention of introducing and spreading of pests to new areas	market access	guide	Link

A.3.1.				2013	OIE	Evaluation Tool for OIE Day 1 Graduating Veterinary Competencies	Through this tool, administrators and stakeholders can assess new veterinary graduates' level of understanding and competency of the skills and knowledge outlined in the OIE Day 1 Competencies	veterinary education	tool	Link
A.3.1.				2013	OIE	OIE	Provide recommendations on required competencies of graduating veterinarians to assure the quality of the public and private components of National Veterinary Services	veterinary education	guideline	Link
C.1.3.				2013	UNIDO	The UNIDO Approach to Sustainable Supplier Development Programme	To assist food business operators to adopt a food safety management system through a voluntary capacity building scheme and access to mentoring and certification services	industry compliance	guideline	Link

D.1.1.				2013	WHO	State of the art on the initiatives and activities relevant to risk assessment and risk management of nanotechnologies in the food and agriculture sectors	National and international risk assessment and risk management approach to identify and implement strategies on potential hazards associated with the use of nanotechnology-related products or techniques	risk analysis /nanotechnologies	guidance	Link
B.2.2.				2014	IPPC	Transit	Identification and management of phytosanitary risk related to consignments	trade and phytosanitary risk	guide	Link
B.2.2				2015	FAO	Enhancing Early Warning (EW) Capabilities for Food Safety Training Handbook	Awareness-raising, the establishment of sustainable and collaborative national EW systems for food safety. Practical tools and approaches for improving EW capacity at national, regional, and global levels	surveillance	training handbook	Link

			2015	IPPC	Establishing an NPPO	Principal requirements to establish an organization to protect national plant resources from pests as the competent and legally responsible body for regulatory plant protection functions	institutional development	guide	Link
A.1.2.			2015	IPPC	Establishing an NPPO	Principal requirements to establish an organization to protect national plant resources from pests as the competent and legally responsible body for regulatory plant protection functions	institutional development	guide	Link
A.1.2.	B.1.3.		2015	IPPC	Operation of an NPPO	Information on the operational procedures and actions required for a functional NPPO	governance / institutional capacity on plant protection	guide	Link
C.1.3.	C.2.1.		2015	IPPC	Managing Relationships with Stakeholders	Guidance on the kinds of stakeholder relations that can be maintained	communication and public relations	guide	Link
B.1.2.			2015	IPPC	Import verification	Setting the basis for import verification and the operation of its related system	trade and phytosanitary measures	guide	Link
B.1.3.			2015	IPPC	Export Certification	Establishment of phytosanitary export certification system through adequate procedures for credible certification and accountability	phytosanitary export certification	guide	Link

A.1.1.	C.2.1.		2015	IPPC	Good practices for Commission on Phytosanitary Measures (CPM) participation	To prepare, participate and follow up from the CPM, outline specific characteristics of the CPM and how to prepare for these specific features, present an overview of the IPPC organizational structure and clarify the various procedural processes involved in facilitating international phytosanitary policy	awareness raising	guide	Link
B.1.2.			2016	FAO	Risk-based imported food control	Implement imported food controls at the regional and national level based on FAO & Codex Mandates	food control measures	manual	Link
B.2.1.	D.2.2.		2016	FAO	Applications of Whole Genome Sequencing (WGS) in food safety management	Useful vital elements relevant to the application of WGS, thus enabling regulators to make more informed decisions about the usefulness of WGS	whole genome sequencing (WGS)	guidance	Link

B.2.1.	B.2.2.		2016	FAO	Statistical Aspects of Microbiological Criteria Related to Foods: A risk managers guide	Illustration on the essential mathematical and statistical aspects of microbiological criteria (MC) related to food	statistical aspects of MC	guide	Link
D.1.2.	D.1.3.	C.1.3.	2016	FAO/WHO	FAO/WHO Risk communication applied to food safety: Handbook	Practical principles and best practices of risk communication to support risk management of adverse food safety events	risk analysis	handbook	Link
B.2.2.			2016	IPPC	Plant Pest Surveillance	To develop the surveillance activities	surveillance	guide	Link
A.2.2.	B.1.1.	B.2.2.	2016	IPPC	Plant diagnostic	To assist establishment, operation, and maintenance of diagnostic laboratories and services	diagnostic laboratories	guide	Link
B.1.3.	B.2.2.		2016	IPPC	Trade in forest commodities and the role of phytosanitary measures	To provide a comprehensive background on phytosanitary measures for forest commodities	phytosanitary measures / trade / forest commodities	online training kit	Link
B.1.1.	A.2.2		2016	WHO	Five keys to safer food manual	To support food safety education programs by describing key or best practices in food safety management	food handing	training manual	Link

B.1.1.			2016	WHO	Five keys to safer aquaculture products to protect public health	To support food safety education programs for small scale fish farmers by describing key or best practices needed to ensure the production of safe fish	food handling/aquaculture	manual	Link
C.1.2.			2016	World Bank	Food Safety Toolkit	To assist companies in the identification of gaps in their existing practices and develop a more efficient food safety system	industry compliance	toolkit	Link
A.1.1.	D.1.2.		2017	FAO	Food safety risk management: Evidence-informed policies and decisions, considering multiple factors	Guidance material to develop evidence-informed policies	policy framework development	guide	Link
C.2.2.			2017	FAO/WHO	Diagnostic tool for assessing the status of National Codex Programmes	Asses national Codex program and its capacity	national Codex programs / SPS coordination	assessment	Link
A.1.2.			2017	IPPC	Preparing a national phytosanitary capacity development strategy	Development of a strategy for national capacities and abilities to perform effectively and sustainably	governance (phytosanitary capacity)	guide	Link

B.1.3.			2017	STDF	Electronic Sanitary and Phytosanitary (SPS) Certificates in the Context of Paperless Trade	To Provide SPS practitioners involved in trade transactions with basic information on the concepts of paperless trade, the role of electronic SPS certification, and how it relates to other trade procedures.	electronic certification	guideline	Link
A.1.2.			2017	UNIDO	Setting up Accreditation Bodies in Developing Countries: A guide to opening the door for global trade	To provide information on the required supportive infrastructure in place and establish a body that meets applicable international standards and best practices.	governance / legal and regulatory framework/ accreditation	guide	Link
A.2.1.	B.2.1.	C.1.3.	2017	WHO/OIE	Handbook for the Assessment of Capacities at the Human-Animal Interface (2nd edition)	To advocate their Member Countries to take advantage of existing frameworks and benefit from coordinated actions to prevent the spread of animal diseases of high impact on public health.	system performance / veterinary services	handbook	Link
A.1.2.	D.1.2.	D.2.2.	2018	FAO/WHO	FAO/WHO framework for the provision of scientific advice	Explanation of the FAO/WHO scientific advisory system to Member states	scientific function	guide	Link

						on food safety and nutrition			
A.1.2.			2018	IPPC	NPPO Establishment training kit	Facilitate the understanding of the main elements for establishing an NPPO	governance (plant protection)	training kit	Link
A.1.2.			2018	IPPC	NPPO Operations Training Kit	Facilitate the understanding of the operations of an NPPO	plant protection services	training kit	Link
D.2.1.			2018	IPPC	Capacity development and Training Resources	Explanation of how to utilize the existing toolkits	capacity building in plant protection /phytosanitary measures	training kit	Link
A.3.1.			2018	OIE	OIE Competency Guidelines for Veterinary Paraprofessionals (VPPs)	Ensure the integration of required competencies for public and private sector entities based on a developed core curriculum for VPPs	veterinary education	guideline	Link

A.1.1.	A.1.2.		2018	UNIDO	Quality Policy: A Practical Tool	Basic government instrument to establish, formalize and oversee the development and performance of quality infrastructure. This tool provides a framework around the five stages of quality policy development.	governance / quality infrastructure / conformity assessment	tool	Link
A.1.1.	A.1.2.		2018	UNIDO	Quality Policy Technical Guide	To set out the five core principles for QP development, namely Ownership, Inclusiveness, Coherence, Optimization and Sustainability	policy / quality infrastructure / conformity assessment	guideline	Link
A.1.1.	A.1.2.		2018	UNIDO	Quality Policy Guiding Principles	To provide a technical guide for governments on policy elements, implementation, and QP context to build quality infrastructure in developing countries.	policy / quality infrastructure / conformity assessment	guideline	Link

NA	NA	NA	2019	UNIDO	Certification of Measuring Instruments	To provide information on the structure and related documents of the OIML-Certification System (OIML-CS) as well as on the requirements and application process to become an OIML Issuing Authority (OIML IA), with associated Test Laboratories (TL).	certification / metrology	guide	Link
C.1.2.			2020	World Bank	Food Safety Handbook: A Practical Guide for Building a Robust Food Safety Management System	To guide food business operators in adopting food safety management practices for their operation	Industry compliance	toolkit	Link
B.2.1.			2021	IPPC	Pest Risk Analysis Awareness tool	Awareness-raising materials and e-learning on PRA and related fields incl. trade, agriculture, invasive species, and technical justification	pest risk analysis	training kit	Link
C.2.1.	C.2.2.		NA	FAO	Codex E-Learning Course – Enhancing participation in Codex activities	Explaining the organization, management, and procedures of Codex and its subsidiary bodies.	Codex participation / international standards setting	course	Link

A.1.2.			NA	FAO	Assuring food safety and quality. Guidelines for strengthening national food control systems	Enable national authorities to improve their food control systems	governance/ policy framework development	guidelines	Link
C.1.2.			NA	FAO/WHO	FAO/WHO guidance to government on the application of HACCP in small and/or less developed food businesses	Assist in the development of national policy, strategies, and action plans aimed at improving food safety and trade through the application of HACCP	policy development for business compliance	guide	Link
C.2.1.			NA	IPPC	IPPC meeting participation support materials	Prepare for attending the Commission on Phytosanitary Measures (CPM) and other IPPC meetings	external relations	guide	Link
C.2.2.			NA	IPPC	Introduction to the International Plant Protection Convention	Explanatory course on phytosanitary measures and related national and international frameworks	external relations	online training kit	Link
A.2.1.	D.2.1.		NA	STDF	Prioritizing SPS Investments For Market Access (P-IMA)	To inform and improve SPS planning and decision-making processes by linking SPS investments to public policy goals.	investment	guideline	Link

B.1.1.			NA	World Bank	Sanitary and Phytosanitary Requirements and Developing Country Agro-Food Exports: Methodological Guidelines for Country and Product Assessments	To review the status of SPS management capacity in the focal country, considering the implications for the most important agricultural and food product exports and related technical assistance requirements.	SPS management capacity	assessment	Not available
Not relevant	Not relevant	Not relevant	NA	ITC	NTM Business Survey	To assist food business operators to adopt a food safety management system through a voluntary capacity building scheme and access to mentoring and certification services	industry compliance	guide	Link
Not relevant	Not relevant	Not relevant	NA	ITC	GFSI Global Markets Programme Online Tool	To support food manufacturers to learn and adhere to best practices in food safety and generate diagnostic profiles online, thus sharing those with partners and certification bodies.	industry compliance	tool	Link
Not relevant	Not relevant	Not relevant	NA	ITC	Sustainability Map	As part of this, all standards, including food safety and quality schemes, were collected in one database	Food standards	tool	Link

Annex B. List of projects identified among the pre-selected countries

Country	Title of the project	Implementing agency / entity	Investment	Period
Pakistan	The Agribusiness Project (TAP) (funded by USAID)	Agribusiness Support Fund	$ 39.9 million	2011-15
Pakistan	Trade-related Technical Assistance (TRTA): Phase I & II[41]	UNIDO	$ 17.5 million First 2 phase + 3 bridging funds	2004-14
Pakistan	Phytosanitary Risk Management Programme (PRMP) in Pakistan (USAID-USDA)	USDA, Texas A&M, Center for Agriculture and Bioscience International (CABI)	$1.5 million	2014-19
Pakistan	Pakistan Sanitary and Phytosanitary (SPS) Distance	Texas A&M University (TAMU) & CABI	$1.5 million	2013-17

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[41] The TRTA had three phases, out of which two were implemented by international organizations and the third phase by a private contractor.

	Learning Program			
Pakistan	Agribusiness Development Project (funded by Asian Development Bank)	Ministry of Food and Agriculture Asian Development Bank (ADB) provided some small-scale technical assistance	$ 21.6 million	2011-16
Pakistan	Strengthening Capabilities to Monitor and Control Veterinary Drug Residues in Foodstuffs	International Atomic Energy Agency (IAEA)	€208 321	2012-14
Pakistan	Capacity enhancement assistance to the Ministry of Food, Agriculture and Livestock	FAO	$ 677,000	2005-10
Pakistan	Agricultural Market Development	Cultivating New Frontiers in	$20.4 million	2014-19

	(funded by USAID)	Agriculture (CNFA)		
Viet Nam	Livestock Competitiveness and Food Safety Project (LIFSAP)	World Bank	$108 million	2010-19
Viet Nam	Food and Agriculture Product Quality Development and Control Project	WHO (Canadian International Development Agency (CIDA))	$ 16 million	2005-10
Viet Nam	Quality and Safety Improvement in Agriculture Project	Asian Development Bank	US$110 million	NA
Suriname	Suriname Agriculture Market Access Project	FAO (European Union)	$13 million	2016-21
Nigeria	National Quality Infrastructure Project for Nigeria	UNIDO (European Union)	$15 million	2013-18

Nigeria	Expanding sesame seed and shea nut butter exports	Nigeria Export Promotion Council (STDF)	$565,000	2010-16
Nigeria	Strengthening the Nigeria National Food Control System and Safety	FAO	$495,000	2014-16
Nigeria	Aflasafe™ Pull Mechanism Pilot Project to Incentivize Adoption of aflasafe	AgResults	$12,680,000	2013-17
Ukraine	Agricultural Competitiveness and Food Safety Project	World Bank	$150,000,000	2006-14
Montenegro	Development of the Food Safety and Phytosanitary Services in Montenegro	AESA (EU)	$800,000	2015-17

Annex C. Quality control checklist for project formulation

Quality criterium definition	Elements of the quality criteria
PROJECT CONCEPTUALIZATION PHASE	
IDENTIFICATION OF GAPS AND NEEDS — The identification of gaps and needs based on existing evidence (data and/or information) was undertaken and stakeholder consultation on needs held.	1. Would the project address an emergency with high food safety and SPS risk and at which scale (national, regional, or global)? 2. Was there any previous assessment undertaken in the last three years using tools developed by international development agencies which can be used to assess the current development/performance level of the food control/food safety system? 3. Was any assessment or system evaluation tool developed by international organizations, or is it planned to be applied during the project formulation phase? 4. Was the assessment tool selected based on the envisaged scope of the intervention? 5. Were local professionals/practitioners trained on using the selected assessment tool, or do external consultants undertake it? 6. Is there an existing performance monitoring framework in place that follows Codex's guidelines and principles (CXG 91-2017 Principles and Guideline for Monitoring the Performance of National Food Control Systems)? 7. Is there any indicator, particularly for performance monitoring, in place which is collected and verified by the competent authority(ies) on a timely defined basis? Is this data publicly available?
PROJECT VISION — A clear and evidence-based approach with relevant development goals was explained in a concept note and discussed or validated at least by the main project stakeholders (main counterpart, donor, and development agency).	9. Was a project concept note developed with the inclusion of at least the following areas/segments: 1) background, 2) intervention approach, 3) objective with key pillars (outcome and output) of the proposed intervention, and 4) envisaged level of investment? 10. Is the project vision based on a demand- or a supply-driven approach to improving capacities and practices? 11. Does the project accommodate investments for regulatory and industry-specific improvements? 12. Are current regulatory practices and capacities around the different functions and food standards based on Codex principles and guidelines? Did, do, and will the competent authority have sufficient resources to deliver these functions? 13. If not for the previous point, was a co-regulatory approach considered for the project vision to deliver food safety and SPS services by private or non-profit entities, including risk assessment? 14. If the project vision is about improving food safety management practices by the industry, was a value chain approach considered to pilot good practices from farm to fork? 15. In case of value chain projects, is there a direct linkage with poverty reduction, particularly among women and youth? 16. Can the proposed vision lead to any market distortion?
DESIGN OF PROJECT DOCUMENT	

STAKEHOLDER COORDINATION	Project vision and approach were shared/discussed with potential stakeholders to assess their existing capacities and ability to improve them and ensure ownership and commitment after the project closure.	17. Did you develop a plan or checklist for the project formulation, covering all required activities? 18. Was there any meeting/discussion held with the counterpart to define their gaps and needs? 19. Are the expected counterparts and wider project stakeholders aware of their gaps and needs? 20. Have the beneficiaries been assessed and selected using the skills engagement matrix to identify "early adopters" among beneficiaries? 21. If the project vision is supply-driven, was the importance of the intervention clearly explained to stakeholders who, as a result, are committed to undertake the required changes during the project implementation? 22. Was any coordination held with other development agencies active in the region to identify potential linkage and avoid the exhaustion of beneficiaries' absorption ability? 23. Did the beneficiaries ensure their long-term commitment to achieve project impact? 24. Have the required financial and human contributions been analyzed and attitudes to measure risk and identify potential bottlenecks? 25. Was this project vision discussed and validated by the main counterpart, donor, and development agency?
RESULTS-BASED MANAGEMENT TOOLS	The proposed intervention was designed based on the results-based management (RBM) tools to assist the future achievement of the project objectives.	26. Does the results-chain address the identified problems through the required logical chain from the output through outcome to impact level? 27. Are the expected deliverables/results clear, realistic, measurable, and single-layered? 28. Do outputs express deliverables controlled directly by the project? 29. Do outcomes express a change in the beneficiaries' performance regarding practices and capacities or behavior through food control and/or food safety management system(s) and related functions and related services?[42] 30. Is the impact a result of the intervention, describing a change/improvement related to public health of society, trade, and/or economic development of communities/society? 31. Are multifunctional indicators developed at each level of the results-chain to measure project and simultaneously system performance? 32. Are these indicators qualitative or binary indicators to allow comparability of system equivalence between countries? 33. Are reliable and cost-effective data sources defined to collect data on each indicator? 34. Have assumptions about stakeholders' behavior and other external factors added to the logical framework, contributing to high-level results?

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[42] Outcomes are not the direct control of the project but still within its influence.

CROSS-CUTTING THEMES (GENDER & YOUTH, ENVIRONMENT & INNOVATION)	Cross-cutting issues were considered to achieve the envisaged objectives of the proposed interventions.	**Gender and youth** 35. Was a preliminary gender (and youth) analysis conducted, looking into the relevant groups' *status quo* and perceived role from food safety compliance capacities and practices perspective? 36. Regarding the value chain or industry-related interventions, were women and youth groups approached/invited to stakeholder discussion(s)? 37. In the case of regulatory interventions, does the project ensure the adequate involvement of women wherever it is possible? 38. Are the new technologies proposed by the project gender equitable? 39. Were women- and/or youth-owned/led/inclusive/focused enterprises equally considered for the project interventions? 40. Were activities supporting the integration of youth budgeted/planned for the project? **Environment** 41. Do the proposed activities/technologies contribute to the increase of waste or the impact of climate change? 42. Wherever it is possible, can more climate-resilient technologies be introduced? 43. Was adequate budget allocated to introduce these technologies to project beneficiaries at a sustainable level? **Innovation** 44. Was the involvement of local research and higher-education institutes considered for the intervention at any level? 45. Are the required scientific capacities in place, including food as well as data science higher education programs? 46. Do the project actors use any industry 4.0 application?
SYNERGY & LINKAGE	Potential overlaps, lessons learned, and facilitation of information and data sharing were identified in collaboration with external partners through transparency planned into the intervention.	47. Is there any periodically organized round-table coordination on ongoing food safety and SPS capacity building initiatives chaired by the government and participated by development agencies active in the country? 48. Were past and ongoing investments in food safety, SPS, or food control capacity building for the targeted geographical area (province, country, or region) identified and their lessons learned identified? 49. Was potential linkage established with development partners on their ongoing initiatives, particularly in the case of the same beneficiaries? 50. Does the project have the ability to publish reports on a website thus accessible for the general public, contributing to disseminating knowledge and future research?

SUSTAINABILITY	Continued long-term benefits will be increased as a result of the project intervention.	51. Are there specific sustainability measures embedded in the overall capacity building approach by building local resources? 52. Is there an exit strategy developed or planned to be developed during the implementation phase? 53. Does the project address financial, social, political, technical, institutional and governance, and environmental sustainability? 54. Does the project result in the establishment of new practices, services, and institutions? If yes, were any business model and feasibility plan developed for those? 55. For the sake of technical sustainability, did, do, or will the project assign responsibility to specific actors for post-implementation delivery and maintenance of developed food safety-related practices? 56. Do the selected actors have the technical capacity to continue delivering the result without project supervision? 57. Are there any social and/or political factor which might risk the sustainability of project results? 58. Will the food safety legislative and policy framework, processes, and related governance structure facilitate the delivery of expected services and functions in a sustainable and continuous manner? 59. Will competent authorities, the industry, and food safety-related service providers have the required financial and human resources to sustain the project outcomes? 60. Was environmental sustainability considered based on the broader and closer outcomes of project activities and in turn its impact on the climate change status quo?
MRE	Monitoring, reporting, and evaluating project results were developed to support expeditious decision-making, adequate management, and transparency throughout and beyond the project/program.	61. Has or will the monitoring, reporting, and evaluation (MRE) system be designed for the sake of adequate planning, responsive decision-making, and monitoring of outcomes? 62. Is this MRE system established for a single investment or as part of some complementary initiatives? 63. Can this MRE system be integrated into a broader/national/regional performance monitoring framework of food control system(s)? 64. Does the MRE system identify "what, who and how often / frequently" should undertake the data collection and reporting? 65. Was a sufficient budget allocated for the MRE system?

Annex D. Rainbow Framework adapted to food safety capacity building evaluation

1. MANAGE an evaluation or evaluation system

Manage an evaluation (or a series of evaluations) for food safety capacity building investments, also selecting the evaluator and identifying the decision-maker involved in the evaluation.

Define the parties of the evaluation

What is the financing source of the food safety capacity building investment?

Who will be involved/informed about the evaluation and its outcome?

Origin of funding for investment:	*Possible parties:*
1. Self-funded / government;	4. Competent authorities;
2. Donor-funded;	5. Donor agency;
3. Private-sector funded;	6. Regional economic communities – other countries to learn more about best practices;
4. Co-funded.	7. Implementing agency;
	8. Other governmental authorities in the fields of public health and trade;
	9. Private sector: chambers, associations, or selected enterprises.

Understand and engage stakeholders involved in food safety

Who should be involved in the evaluation? How can stakeholders be identified and engaged?

Understand food safety stakeholders:	*Engage:*
1. Key informant interview	4. Community fairs
2. Stakeholder mapping and analysis	5. Fishbowl technique
3. Performance profile developed/maintained by authorities	6. Formal meeting
	7. Reporting / Commenting on outcomes
	8. Informal meeting

9. Key informant Interview

Establish decision-making process

Who will have the authority to make what type of decision about the evaluation?

Who and how will provide advice or make recommendations about the evaluation?

What processes will be used for making decisions?

Types of structures:	*Type of decision-making applied*:
1. Project Steering Committee;	7. Consensus-based
2. Food safety competent authority;	8. Hierarchical
3. Food safety thematic group with the involvement of all public sector and UN agencies;	9. Majority
Way of exploring issues:	
4. Formal meeting processes	
5. Informal meeting processes	
6. Six Hats Thinking for exploring decision making through groups that develop tactics together for a complex process or particular issue (de Bono, 1985)	

Decide who will conduct the evaluation

Who will undertake the evaluation, also considering the size of investment and added value of a comprehensive evaluation?

1. Self-evaluation – personnel in charge of the implementation of the project responds to a pre-defined set of questions;

2. Internal evaluator/expert;

3. External independent evaluator selected by the donor

4. External evaluator as a staff of the donor agency

5. Hybrid – internal and external

6. Learning alliances

Determine and secure resources

What internal (and external) resources (expertise, money, and time) are required for the evaluation, and how can they be obtained?

Determine resources needed:	*Secure resources needed*
1. Evaluation budget matrix;	3. Designated staff time
2. Evaluation costing;	4. Grant funding
	5. Institutionalized budget allocation
	6. Leveraging partnerships
	7. Strategies to reduce costs

Define ethical and quality evaluation standards

What will be considered high-quality and ethical evaluation?

How should ethical issues be addressed during the evaluation?

What are the required competencies which an evaluator for food safety capacity building projects should possess?

1. Ethical guidelines

2. Evaluation standards

3. Institutional Review Board (IRB)

4. Competence framework for the practitioners evaluating food safety capacity building

Document management processes and agreements

How will the evaluation's management processes and agreements be documented?

Document what is needed in an evaluation:	*Document how different organizations will work together in the evaluation:*
1. Expression of Interest (EoI)	
	5. Contractual agreement
2. Request For Proposal (RFP)	
	6. Memorandum of Understanding (MoU)
3. Scope of Work (SoW)	
4. Terms of Reference (ToR)	

Develop planning documents for the evaluation process

What needs to be done to design, plan and document the evaluation?

What planning documents need to be created?

1. Aide Memoire

2. Evaluation framework

3. Evaluation plan

4. Evaluation work plan

5. Gantt chart

6. Inception report

Develop evaluation capacity

What types of tools can be used to strengthen the individuals, groups, and organizations involved in the conduct and use of evaluations?

1. Conferences	6. Evaluation library and learning circle
2. Coaching, training & mentoring	7. Peer coaching
3. Set evaluation competencies and standards	8. Peer review for meta-evaluation
4. Develop evaluation policies and procedures	9. Conducting research on evaluation to improve practices and capacities
5. Establish local evaluation societies & associations	

2. DEFINE what is to be evaluated

Formulate a description of what is to be evaluated and how it is supposed to work.

Develop an initial description of the object being evaluated

What secondary resources are used to conduct some basic assessment?

1. Documentation developed by the project

2. Other reports and documentation which can reveal correlation and abnormalities claimed by the project

3. Performance monitoring indicators

Assess programme vision / logic model

How is the planned intervention imagined/understood to work? Was there any model designed for easier understanding among food safety stakeholders?

1. Backcasting – envisaging alternative scenarios

2. Five whys

3. Previous research and evaluation

4. SWOT analysis

5. Key informant interview (KIIs)

Ways of representing logic models:

6. Logical framework

7. Bennet hierarchy

8. Results chain

9. Theory of change

Identify potential unintended results

How can unintended (positive and negative) results be identified, which should be addressed by the evaluation

1. Key informant interviews

2. Negative program theory

3. Risk assessment

4. Six Hat Thinking

5. Identification of statistical outliers and understanding their consequences

3. FRAME the boundaries of an evaluation

Set the characteristics of the intended evaluation, including its purposes, key evaluation questions, and applicable criteria and standards.

Set primary objective

For which reason is this evaluation conducted?

1. Ongoing project's mid-term evaluation

2. Evaluation at project end

3. Meta-evaluation of projects to evaluate the performance of capacity building initiatives

4. Evaluation of specific activities and functions.

Decide purpose

What are the primary purposes and intended uses of the evaluation?

Utilizing the findings:	*Using the process:*

1. Define trends based on a broader evidence base for evaluation of policy practices of the food control system	6. Build trust and legitimacy across stakeholders
	7. Promote accountability
2. Identify improvements for decision-makers on policies/strategies	8. Capture diverse perspectives at all levels and existing shortcomings
3. Inform decision-makers aimed at selection, continuation, or termination of investment, particularly the capacity building of personnel in specific areas;	9. Analyze the ability of food safety stakeholders to fulfill their roles and responsibilities
4. Lobby and advocate for additional investments and development/adoption of new policies and strategies	
5. Define additional capacity building needs among the food safety functions, capacities, and practices	

Determine what success looks like

What should be the criteria and standards for judging performance?

Formal statements of values:

1. Sustainable development goals

2. OECD-DAC Criteria and principles

3. Stated goals and objectives of the food control system, mainly if a performance monitoring framework is in place, e.g., number of foodborne illnesses/diseases / daily adjusted life expectancy (DALY) and percentage change in increased food trade

4. DESCRIBE activities, outcomes, impacts, and context

Collect & retrieve data to answer descriptive questions about the project/program/policy activities and their various results.

Sample

What sampling strategies will you use to collect data on the food control system if there are no digitalized data collection strategies?

Probability:	*Purposive (or Purposeful):*
1. Multi-stage	7. Confirming and disconfirming

2. Sequential	8. Criterion
3. Simple random	9. Critical case
4. Stratified random	10. Homogenous
	11. Intensity
Convenience:	12. Maximum variation
5. Convenience	13. Outlier
6. Volunteer	14. Snowball
	15. Theory-based
	16. Typical case

Use measures, indicators, or metrics

What measures or indicators will be used?

Is there a strategy / approach developed to digitalize data collection on food safety functions, including capacity building activities and their outcomes?

Is there a performance monitoring framework for food control system in place which collects and shares information with other authorities, such as public health and trade?

Collect and/or retrieve data

How will the data be collected or retrieved on the activities, results, and context?

Information from individuals:	*Observation:*
1. Interviews (convergent, in-depth & key-informant)	13. Field trips
	14. Photography, video recording
2. Questionnaires or surveys (email, face-to-face, internet, mail, and telephone)	
3. Mobile data collection	Existing documents and data (as per existing data collection mechanisms within a food control system):
4. Reports on activities	
5. Photovoice	15. Big data
6. Project techniques	16. Logs and diaries
	17. Official statistics

Information from groups:	18. Previous evaluations and research
7. Brainstorming	19. Project records
8. Concept mapping	20. Sensor data
9. Delphi study	
10. Focus group discussion	
11. Q-methodology	
12. SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats)	

Manage data

How will the data be organized and stored to ensure its quality and security?

Are there required policies, laws, and regulations in place to protect persons' privacy and business interest?

1. Consistent data collection and recording	5. Secure data storage
2. Data backup	6. Archive data for future use
3. Data cleaning	7. Ensure network security
4. Effective data transfer	

Analyze data

How can patterns in numeric or textual data be revealed?

Are possible biases questioned/investigated by policymakers?

Numeric analysis:	8. Multivariate descriptive
1. Correlation	9. Non-parametric inferential 10. Parametric inferential
2. Cross-tabulations	
3. Data mining	11. Summary statistics
4. Exploratory techniques	12. Time series analysis
5. Frequency tables	
6. Measures of central tendency	Textual analysis
	13. Content analysis

7. Measures of dispersion	14. Framework matrices
	15. Thematic coding
	16. Timeline and time-ordered matrices

Visualize data

How can data be visualized for improved decision-making?

Do the decision-makers have the required competencies/abilities to interpret received data visualization?

Examples for possible data visualizations:

Relationships among data points

1. Scatterplot

2. Matrix chart

3. Network diagram

4. Dendrogram

Relationship as part of a whole:

10. Icon array

11. Pie chart

12. Treemap

13. Decision tree

Compare a set of values:

5. Bar chart

6. Block histogram

7. Bubble chart

Analyze text:

14. Phrase net

15. Word cloud

16. Word tree

Track rises and falls over time:

8. Line graph

9. Stacked graph

Location / social linkage:

17. Demographic mapping

18. Geotagging

19. GIS mapping

20. Interactive mapping

21. Social mapping

5. UNDERSTAND CAUSES OF outcomes and impacts

Collect or retrieve and analyze data to respond to questions aimed at identifying causal relationship between outcomes and impacts.

In case of existing performance monitoring framework, other statistical method like covariance or regression could be deployed to investigate association between two criteria and certain patterns in the performance.

Check the results support causal attribution

How will you assess whether the results consistent with the theory that the intervention produced them?

Collection supplementary data:	*Analysis:*
1. Modus operandi	3. Check intermediate outcomes, if any
2. Process tracing	4. Results matching of a statistical model
	5. Results matching of an expert prediction
	6. Qualitative comparative analysis

Examples for approaches:

- Contribution analysis
- Collaborative outcomes reporting
- Multiple lines and levels of evidence
- Rapid outcomes assessment

Compare results to the counterfactual

How will you compare the factual with the counterfactual – what would have happened without the intervention?

Experimental:	7. Regression discontinuity
1. Control group	8. Sequential allocation
	9. Statistically created counterfactual
Quasi-experimental:	
2. Difference-in-difference	*Non-experimental*
3. Instrumental criteria	10. Key informant
4. Judgmental matching	11. Logically constructed counterfactual
5. Matched comparisons	
6. Propensity score matching	

Investigate possible alternative explanations

How will you investigate alternative explanations?

1. Key informant	5. Ruling out technical explanations
2. Force field analysis	6. Searching for disconfirming evidence
3. Process tracing	7. Statistically control for extraneous criteria
4. Rapid outcomes assessment	

6. SYNTHESISE data from one or more evaluations

Combine data to form an overall assessment and track performance and insert to a database of a performance monitoring framework for analysis of best practices and potential projection of additional investments.

Synthesize data from a single evaluation

How will you synthesize data from a single evaluation?

Processes:	*Techniques:*
1. Internationally agreed KPIs for performance monitoring framework of food control systems	4. Cost-benefit analysis
	5. Cost-effectiveness analysis
2. Consensus among national stakeholders following the principles of performance monitoring framework (CXG 91-2017)	6. Multi-criteria analysis
	7. Numeric weighting
3. Expert panel	8. Qualitative weight and sum
	9. Value for money

Synthesize data across evaluations

How can data gained from evaluation be synthesized

Qualitative	Quantitative:
1. Best evidence synthesis	1. Network analysis
2. Lessons learned	2. Multivariate correlation analysis
3. Meta-analysis	
4. Meta-ethnography	

5. Rapid evidence assessment

6. Realist synthesis

Generalize findings / identify counterfactuals

How can the findings from this evaluation be generalized for other food safety capacity building investments?

1. Explanatory data analytics

2. Predictive analytics

7. REPORT AND SUPPORT USE of findings

Develop and present findings of the evaluation for evidence-based decision-making in upscaling best practices, identifying potential improvements, and suspend "unsatisfactory" activities/processes

Identify reporting requirements

To whom the outcomes of the evaluation report will be presented will determine the level of reporting and the content. This needs to be predefined and not changed based on the findings of the evaluation.

Type of reporting:	3. Communication plan
1. Internal detailed report for access of limited policymakers	4. Reporting needs analysis/compliance with a standardized format
2. External detailed report for donors, beneficiaries, and implementing agencies	

Develop reporting media

What types of reporting formats will be appropriate for the intended audience/readers?

Will the selected reporting format support the intended follow-up activity of the evaluation?

1. Written document

2. Presentation events

3. Presentation materials

4. Creative solutions

5. Graphic design

6. Data visualization

Ensure accessibility

In case the stakeholders endorse full transparency of the evaluation report, how can the report or material be understood by the audience/readers?

General accessibility:	*Specific accessibility barriers:*
1. Applied graphic design principles	8. Color blind audience
2. Descriptive chart titles	9. Low vision and blind audience
3. Eliminate chart junk	
4. Emphasis techniques	
5. Headings as summary statements	
6. One-Three-Twenty-Five (1:3:25) principle	
7. Plain language	

Develop recommendations

Are recommendations planned to be developed, if yes, how and by whom?

1. Beneficiary exchange	5. Senior expert critical reflection
2. Chat rooms	6. Participatory recommendation screening
3. External review	
4. Group critical reflection	

Support use beyond evaluation

How will you support the use of evaluation findings beyond this exercise?

1. Annual reviews	4. Policy briefings
2. Conference co-presentations	5. Recommendations tracking
3. Data use calendar	6. Social learning

Annex D. Improvements identified for food safety capacity building investments

Food safety capacity building initiatives receive increased attention due to their transformative power in economic and social development. Even though some research and international consultation took place in the past, no concrete solution was offered to improve food safety capacity building investments. Therefore, the research has resulted in the following new solutions or recommendations scattered throughout the research.

Stage of capacity building	Formerly applied practices	Research discussed this in the following section	Results of the research
Project formulation	There was no meaningful guidance for the formulation of food safety capacity building investments.	Chapter 3 / Section 3.2	Project formulation was split to project conceptualization and project document design. A set of quality criteria with corresponding questions (Annex B) established to ensure required content.
	Application of results-based management separate from the operation of national food control system where data collection through performance indicators are disengaged.	Chapter 4 / Section 1.1.	The development of a notion of multifunctional indicators in order to allow integration of food safety capacity building under the national food control system in terms of data operation and measuring the performance of its functions. The research also provided responses to the existing challenges in developing indicators.

Initial assessments and identification of tools	International organizations developed many tools, but they were spread out on the Internet.	Throughout Chapter 1: different sections based on international organizations.	The author categorized and labeled the existing assessment tools into a catalog (Annex A), allowing easier identification and use for food safety capacity building investments.
Project monitoring and reporting (implementation of initiatives)	Best practices identified by STDF and OECD (STDF and OECD, 2008) were more than a decade old and focused on the broader aspect of sanitary and phytosanitary measures.	Chapter 3 / Section 4.	As a result of the comparative analysis of country cases, the author has identified several conditions for success that shall be ensured during the project implementation, and these were explicitly described to food safety initiatives.
Project evaluation	No standardized processes or guidelines to undertake project evaluation practices.	Chapter 3 / Section 5	The Rainbow Evaluation Framework (Annex D) was adapted to evaluate food safety investments. The most important competencies of evaluators working on food safety capacity building initiatives were defined.