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SPRINT
SUSTAINABLE PLANT PROTECTION TRANSITION

Applicability of the toolbox to be expanded to low- and middle-income countries via the Pesticide Registration Toolkit

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Table of Contents

Summary **4**

Objective **4**

Analytical Framework **4**

1. FAO Pesticide Registration Toolkit (PRT) 5
2. The SPRINT Toolbox (ST) 6
3. Comparison between the PRT and ST 7

SPRINT – FAO discussions **9**

Technical feasibility for adaptation 12

Relevance to LMIC context 14

Regulatory applicability 15

Specific SPRINT results of interest to pesticide regulators in LMICs 16

Indoor dust as a key monitoring matrix 16

Post-Registration monitoring and surveillance 16

Practical prioritization of mixtures 17

Economic "lock-ins" and barriers to transition 18

Links with other FAO projects 18

Overall conclusions and outlook 19

Limitations 19

Opportunities 20

Overall conclusions 21

Outlook: Practical implementation into the PRT 22

Summary

Deliverable 5.4 explores the potential for exporting the SPRINT Global Health Risk Assessment Toolbox to Low and Middle-Income Countries (LMICs). The report details a comparative analysis between the SPRINT Toolbox (ST) and the existing FAO Pesticide Registration Toolkit (PRT), identifying key similarities (e.g., target audience of regulators) and differences (e.g., SPRINT's focus on post-registration monitoring vs. PRT's focus on pre-registration authorization).

The feasibility of applying SPRINT results and tools was assessed against criteria such as relevance to LMIC context, immediate or future regulatory applicability, technical feasibility, and ease of use.

It concludes that while the ST is not yet a plug-and-play solution for daily registration tasks in LMICs, specific components - such as methods for monitoring indoor dust, prioritizing pesticide mixtures, and assessing wind erosion risks - are highly valuable and should be integrated into the PRT as reference materials to support post-registration surveillance and risk reduction strategies globally.

Objective

The possibility of applying the ST and/or other outputs of the SPRINT project by pesticide regulatory authorities in low- and middle-income countries (LMICs) will be examined, and the applicability of integrating SPRINT results into the existing FAO PRT will be tested.

The feasibility of applying SPRINT results and tools will be assessed against criteria such as relevance to LMIC context, immediate or future regulatory applicability, technical feasibility, and ease of use.

Analytical Framework

The analytical approach for assessing the feasibility of integrating SPRINT outputs into the PRT was informed by certain principles of technology transfer, particularly the concepts of technical feasibility, regulatory applicability, and relevance to LMIC context.

We explored also other specific SPRINT results, beyond the ST, revealed to be of interest to pesticide regulators in LMICs.

1. FAO Pesticide Registration Toolkit (PRT)

Introduction

The FAO Pesticide Registration Toolkit (PRT) (http://www.fao.org/pesticide-registration-toolkit/en) is a decision support system designed to assist countries, particularly low- and middle-income countries (LMICs), with the evaluation and authorization of pesticides.

Most pesticide registration authorities in LMICs have very limited human and technical resources to be able to conduct solid pesticide efficacy and risk assessments; however, they still need to make informed decisions about the authorization of pesticides under local conditions of use. The PRT was therefore developed by FAO to make optimal use of existing information, guidance, evaluations and methodologies with direct relevance for pesticide registration.

The PRT consists of a Toolkit website that is maintained by the Pest and Pesticide Management team of the Plant Production and Protection Division (NSPCD) at FAO. Since its launch in 2016, the PRT has been continuously updated and currently serves as a global reference tool for pesticide registration in LMICs.

This Toolkit is supported by a team of consultants and a global group of trainers with close ties to registration authorities in LMICs. The PRT team organizes national trainings (for one national registration authority) as well as regional trainings (to which 5-15 national authorities may be invited), with the aim to strengthen pesticide evaluation and authorization.

Training is available in English, French, Spanish and Russian and to date around 850 staff from 95 countries have participated in a PRT training.

E-learning modules are also available in addition to in-situ training.

Objectives

The primary objective of the PRT is to help national authorities implement the registration standards established by the **International Code of Conduct on Pesticide Management** (https://www.fao.org/pest-and-pesticide-management/pesticide-risk-reduction/code-conduct/en/). It provides practical methodologies and technical guidance that translate the Code's high-level principles into daily regulatory tasks, such as risk assessment and data evaluation, particularly for countries with limited resources.

The PRT serves as a web-based registration handbook that helps registration staff with their daily tasks, including:

- Finding data requirements for registration.
- Evaluating the technical aspects of a registration dossier.
- Choosing appropriate registration strategies and procedures.
- Reviewing risk mitigation measures.
- Getting advice on decision-making processes.

It also links to external information sources on individual pesticides, such as scientific reviews, hazard classifications, and Maximum Residue Limits.

Target audience

The main target audience is pesticide registrars and registration staff in LMICs or the "Global South". Pesticide regulatory authorities in LMICs are generally characterized by a severe lack of resources, compared to their counter parts in the Western countries. They often face severe staffing and funding limitations which results in a considerable number of dossiers per staff member, limited technical specialization and limited access to knowledge. In addition, funding limitations also imply a limited access to laboratory and research capacity.

2. The SPRINT Toolbox (ST)

Introduction

The Global Health Risk Assessment Toolbox (www.sprint-toolbox.eirene.eu; hereinafter the SPRINT Toolbox - ST) was developed within the SPRINT project (www.sprint-h2020.eu). It is an open-access, web-based platform with ten interlinked tools for integrated exposure, impact, and risk assessment of pesticides and their mixtures.

The ST brings together: i) interactive presentations of the SPRINT results (case study findings, toxicity and ecotoxicity studies, human health impact assessment); ii) modelling, upscaling and mapping approaches for pesticide occurrence, exposure and risks; and iii) data mining, analysis, and extrapolation tools drawing on national and European pesticide datasets. It combines outputs from different SPRINT work packages and spans from the local case study sites to the pan-European level.

Objectives

The ST aims to support diverse stakeholders in understanding pesticide exposure and risk and to improve their access to data, models, maps, and results on pesticide occurrence, fate, and effects. It streamlines the SPRINT project's impact into a single assessment hub for policymakers, researchers, and the public. It aims to integrate real data visualizations with predictions based on existing "big data" on pesticides, exposure modelling with impact and risk assessment, an ecosystem perspective with human health issues, and various levels and resolutions – from field to pan-European. The tools and data in the ST should demonstrate approaches to post-registration assessments and the potential of harmonized data, highlighting the critical need for public disclosure of robust pesticide usage statistics. The ST motivates further research on pesticide exposure and impacts.

Target audience

The primary end-users of the ST will be decision-makers and policy-makers at national and EU levels, regulatory bodies (e.g., European Food Safety Authority, European Commission, national authorities), risk managers, agricultural stakeholders, agri-food industry, and environmental scientists, but it may also be used by the general public interested in pesticide exposure and impact. The ST provides supporting tools for: improved access to data on pesticide occurrence, environmental fate, exposure, and (eco)toxicological effects; processing and visualization of big pesticide-related data; improved and geographically explicit risk assessment of pesticides and their mixtures; post-registration evaluation; information-based agri-environmental governance; identification of priority areas of pesticide exposure and cumulative risks for management interventions and targeted monitoring campaigns; designing and prioritizing pesticide-reducing strategies; monitoring, reporting, and valuating mitigation strategies; planning Farm-to-Fork-related policies for the sustainable use of pesticides. It should be stressed that most tools will be useful for the pesticide post-registration phase; however, new approaches for the registration phase are also included. Especially maps of predicted pesticide application input, environmental distribution, exposure, and risks of pesticides are a valuable contribution to discussions regarding pesticide use reduction and the transition towards a more sustainable agriculture in Europe.

3. Comparison between the PRT and ST

The ST and the PRT are both focussed on assessing and managing the risks associated with pesticides, but they serve different core objectives, target distinct audiences, and operate at different levels of scientific and regulatory complexity. The two tools have divergent / different primary objectives but convergent goals.

Similarities

Focus area

Both tools are dedicated to the management, evaluation, and assessment of pesticide risks and share the overarching goal of reducing pesticide pollution and promoting more sustainable agriculture.

Goal

Both contribute to the overarching goal of promoting safer and more sustainable use of pesticides and protecting health, whether through regulatory compliance (PRT) or integrated scientific assessment (ST).

Shared interest

The SPRINT project explicitly aims to integrate its Global Health Risk Assessment Toolbox into the existing FAO Pesticide Registration Toolkit, demonstrating that the two tools are complementary and could potentially merge to enhance global risk assessment capabilities.

Differences

While SPRINT is a science-driven research project (preventive/research focus) and the PRT is a compliance-driven regulatory system with an operational focus.

Feature	SPRINT Global Health Risk Assessment Toolbox	FAO Pesticide Registration Toolkit
Primary Objective	To integrate multi-scale **measured and modelled data** to enable policymakers, researchers, and the public to **assess the exposure and risk** of pesticides to ecosystems and human health, thereby **supporting the transition** towards sustainable plant protection.	To serve as a **decision support system** and web-based **handbook** for the **regulatory process** of pesticide registration and authorization.
Audience	**Scientists, regulators** (conducting advanced risk assessments), and different types of **stakeholders** (policy makers, farmers, industry, NGOs, civil society).	**Pesticide registrars** and **registration staff** (primarily in low and middle-income countries).
Scope	**Broad and integrated (One Health):** Focuses on cumulative, real-world exposure, and the complex impacts of pesticide mixtures across multiple species and environments. Research-driven.	**Practical and operational:** Focuses on the procedural steps, data requirements, technical evaluations, and risk mitigation measures necessary for regulatory compliance.
Level of Expertise	**High/specialized:** Requires and utilizes advanced scientific and technical expertise to perform complex, integrated risk modelling (e.g., generating risk maps, fate and exposure models).	**Practical/operational:** Intended for **day-to-day use** by regulatory staff for procedural guidance and compliance checks.
Geographic Focus	Developed and validated using extensive data from European case study sites (and Argentina), with the intention of achieving **global applicability**.	Explicitly targets **low and middle-income countries** to help them establish or strengthen their national pesticide registration capacity.
Regulatory context	The SPRINT project and its ST are settled into the **EU legislative framework** (i.e., EU regulation for	The **PRT** operates within a global regulatory framework established by the **International Code of**

	active substances approval, PPP authorization, pesticide sustainable use directive, EFSA risk assessment guidance, etc.). From this perspective, some of the tools are targeted on the **pesticide registration phase** (novel toxicity and ecotoxicity tests, improved environmental fate modelling, health impact assessment), while other tools are targeted on the **post-registration phase** (monitoring data, occurrence modelling, ecological risk of mixtures, dietary exposure).	**Conduct on Pesticide Management**, jointly published by the FAO and WHO. This Code serves as the **voluntary international standard** for the entire life cycle of pesticides, from production to disposal. Application of the PRT tools and recommendations always happens within the **national regulatory context**.

Summary

The PRT is a regulatory capacity-building tool, focused on how to register a pesticide (the process and compliance). The ST is a scientific research tool, focused on how to perform a more realistic and advanced integrated risk assessment (the science and modelling of environmental and health impacts, especially mixtures).

SPRINT – FAO discussions

Organisation of activities for D5.4 was influenced by the level of completion of the ST and the official launch date of the ST, mid-February 2026.

However, with a draft version of the ST ready for previewing by mid-November 2025 several discussions and presentations were organized to secure representation of different LMIC and address different adoption challenges.

Screening with regulators from LMICs was organized by presenting SPRINT and the ST during PRT training workshops. A short presentation on SPRINT was given plus a live tour of the ST. The feasibility of the ST tools for regulatory work in LMICs was then discussed in plenary, guided by questions

- How applicable are the SPRINT tools to the circumstances and daily work in your countries?
- What adaptation would be needed to the ST tools (e.g., soil parameters, climatic data) to make the SPRINT Toolbox relevant for you?
- Where do you see the best entry point for SPRINT results within the FAO PRT structure?

The outcomes from the meetings with regulators were then discussed online between a group of PRT trainers and SPRINT WP 5 team members, to focus the possibilities of integration of SPRINT results into the PRT.

Discussions organized

22 November 2025: Presentation of SPRINT to PRT Team and trainers

Organized by Joost Vlaming during a two-week Training of Trainers for the PRT at FAO HQ, Rome, Italy.

The objective of this two-hour meeting was to present SPRINT and the ST to a group of 27 experienced and new PRT trainers and initiate a discussion on how the SPRINT and ST results can be of use to registrars in LMICs.

17 December 2025: Presentation of SPRINT to registrars from Francophone Africa

Organized by Beatrice Grenier during a 10-day PRT training in Marrakech, Morocco.

SPRINT and the ST were presented during a one-hour meeting to a group of 14 PRT trainees, registrars from 14 French speaking African countries.

17 December 2025: Online meeting between Sprint Toolbox core members and PRT team core members

Organized by Joost Vlaming with participation of SPRINT (WP 5) team members and PRT core team members and (former) registrars.

The objective of this meeting was to identify the elements of ST that are useful for the PRT audience and review the possibilities of integrating ST into the PRT, considering the outcomes of previous meetings.

Internal discussions

Additional internal discussions were held with Harold van der Valk and Beatrice Grenier, (FAO consultants) and Jakub Hofman, (SPRINT WP5 leader).

Invitations to SPRINT webinars

Participants in the PRT Dgroups forum, accessible only to LMIC registrars and former PRT trainees have been invited to participate in the most recent general SPRINT webinars on

"SPRINT's key findings, recommendations and resources" (15th January 2026) and the "SPRINT Toolbox launch" (13th February 2026).

26 February 2026: FAO organized webinar on the SPRINT Toolbox Global Applicability

A dedicated webinar on the SPRINT Toolbox Global Applicability was organized for registrars in LMICs -targeted through the PRT Dgroups forum- and other individuals interested in the ST and the PRT. The objective of this webinar was to share and discuss the ST tools and SPRINT research of specific interest to registrars in LMICs.

Conclusions from the discussions

The following initial conclusions were derived from the discussions:

- **Divergent primary objectives, convergent goals**: While SPRINT is a science-driven research project (preventive/research focus) and the PRT is a compliance-driven regulatory system with an operational focus, both share the overarching goal of reducing pesticide contamination and promoting sustainable agriculture.
- **Resource constraints in LMICs**: Registrars in Low- and Middle-Income Countries (LMICs) face severe staffing and funding limitations. Therefore, any integration of SPRINT tools must be simplified, practical, and aimed at helping them prioritize decision-making rather than adding complex academic burdens.
- **Methodological value over raw data**: Direct data transfer is difficult due to geographical scope (Europe vs. Global South) and differences in agricultural practice (e.g., mechanized sprayers vs. knapsack sprayers). However, the concepts, methodologies, and prioritization approaches used in SPRINT are highly valuable for the global community.
- **Role of SPRINT**: SPRINT should serve as a "Reference Source" or "Information Source" within the FAO Toolkit, providing guidance on advanced research, emerging methodologies, and cumulative risk assessments.

Implementation consensus

Across both the Toolkit and Toolbox, the agreed approach for implementation is:

- **Location**: Reference to SPRINT project studies and the SPRINT Toolbox should sit in the "Information Sources" (or "References") section of the PRT, not the core registration workflow. However, some SPRINT key messages, approaches and tools can be integrated into existing and new-to-be-developed PRT modules.
- **Format**: Content must be simplified and condensed (e.g., "Key Messages," "Project Result Documents," and summaries) rather than raw academic papers.

- **Context**: Data must be contextualized and framed as global lessons rather than local realities (e.g., regarding residues in bedrooms).

Evaluation of SPRINT Toolbox tools

The SPRINT tools are canvassed against the following criteria:

- **Technical feasibility for adaptation**
  Can the tools be adapted for the use/application under conditions in LMICs.
- **Relevance to LMIC context**
  Are the tools relevant for use under conditions as prevailing in LMICs.
- **Regulatory applicability**
  Does the application of the tool require specific regulatory adjustments.

Technical feasibility for adaptation

- **Data requirements to adapt the tool:** Does the adaptation of the tool require extensive, high-resolution input data (e.g., EU-specific soil maps), or can it function with global datasets or minimal local inputs?
- **Resource requirements to adapt the tool:** Does the tool adaptation require high-performance computing or specialized software licenses? Are sophisticated laboratory equipment and analyses required to get the input data?
- **Scientific competence requirements:** Does adaptation of the tool require scientific education in environmental sciences, modelling or (eco)toxicology.
- **Transparency of data and models:** Are the data available and the models well described, and/or source code available?

Tool	Data requirements to adapt the tool	Resource requirements to adapt the tool	Scientific competence requirements	Transparency of data and models
Case study results	High (monitoring results)	High (sampling & lab)	Medium	Good (data available)
Ecological risks	High (monitoring results) /Low (PPDB ecotox database)	High (sampling & lab) Low (PPDB ecotox database)	Medium	Good (data, model, code available)
Concentration maps	High (PPP usage data, crop maps)	High (computational power, memory, servers)	High (multiple data processing and connecting)	Good (data, model, code available)
Ecological Risk maps	High (PPP usage data, crop maps) / Low (PPDB ecotox database)	High (computational power, memory, servers)	High (multiple data processing and connecting)	Good (data, model, code available)
Human dietary exposure	High (food basket, food monitoring results)	Medium (computational power, memory, servers)	High (multiple data processing and connecting)	Good (data, model, code available)
Animal dietary exposure	High (feed monitoring results)	Medium (computational power, memory, servers)	High (multiple data processing and connecting)	Good (data, model, code available)
Health impact assessment	High (literature data, exposure and disease frequencies)	Low (computational power, memory, servers)	High (epidemiological expertise needed)	Good (data, model, code available)
Toxicology studies	High (lab testing) / Medium (literature)	High (specialized laboratory capacity)	High (toxicology background needed)	Medium (data after publication)
Ecotoxicology studies	High (lab testing) / Medium (literature)	High (specialized laboratory capacity)	High (ecotoxicology background needed)	Medium (data after publication)
Fate model library	Medium (literature)	Low	High (links to models for environmental fate experts)	Good
Wind erosion model	High (new model, input parameters)	Low-Medium	High (model for environmental fate experts)	Good

Relevance to LMIC context

- **Climate & geography:** Is the data or model relevant to other than temperate European scenarios?
- **Exposure scenario:** Does the tool account for local use practices, such as manual knapsack spraying, lack of Personal Protective Equipment (PPE), and the presence of "highly hazardous pesticides" (HHPs)?
- **Crop specificity:** Are the exposure models adaptable to smallholder staple crops (e.g., cassava, millet, cocoa) rather than just industrial European crops?

Tool	Relevance to LMIC context
Case study results	The methodology can be applied anywhere.
Ecological risks	Calculation of Risk Quotients may need to be adapted to more relevant local species.
Concentration maps	The European maps were constructed using global data (pesticide sales, geographical model) and is applicable everywhere. National and field-resolution maps are relevant only for given countries. However, their methodology can be applied if the input data are available.
Ecological Risk maps	Same as for concentration maps, but reference species may need to be adapted to more relevant local taxa if ecotoxicological data exists
Human dietary exposure	If pesticide residue data in food are available and a locally relevant food basket has been established, the method can be applied
Animal dietary exposure	If pesticide residue data in feed are available and a locally relevant animal consumption data have been established, the method can be applied
Health impact assessment	Methodology is globally applicable but epidemiological expertise required.
Toxicology studies	No adaption of these studies is likely in most LMICs. If internationally validated protocols of the SPRINT studies become available, these can be conducted in some LMICs
Ecotoxicology studies	Adaption of these studies to more locally relevant species may be done in some LMICs. If internationally validated protocols of the SPRINT studies become available, they can be conducted in some LMICs
Fate model library	Pesticide fate models can be used in LMICs under the condition that they allow locally relevant parameters to be considered. Certain climatic or edaphic input data, however, may not be available in many LMICs
Wind erosion model	Applicable

Regulatory applicability

- **Compatibility with legislation**: Is the tool in line with existing legislation or does legislation need to be adjusted (e.g. evaluation of mixtures)
- **"Bridging" Potential:** Can the tool help a registrar take a European risk assessment and "bridge" it to local conditions (a core strategy of the FAO Toolkit)?
- **Regulatory Standard Alignment:** Does the output align with international standards (like the Globally Harmonized System or Maximum Residue Limits) and does it use Internationally accepted methods?
- **Transparency of logic:** Is the "black box" open? Can the registrar explain the rationale of the decision to stakeholders or industry based on the tool's output?

Tool	Regulatory applicability
Case study results	If post-registration monitoring is required in legislation.
Ecological risks	If post-registration monitoring is required in legislation. Requires regulatory criteria for risk to be defined.
Concentration maps	Spatial evaluations are not yet included in the pesticide registration. If sustainable pesticide use legislation exists, these tools are applicable for post-registration assessments, as an alternative or addition to monitoring.
Ecological Risk maps	Spatial evaluations are not yet included in the pesticide registration. If sustainable pesticide use legislation exists, these tools are applicable for post-registration assessments, as an alternative or addition to monitoring.
Human dietary exposure	Applicable if consumer risk evaluations are part of legislation.
Animal dietary exposure	Applicable if animal risk evaluations are part of legislation.
Health impact assessment	This type of methodology for health impact assessment is not yet required in pesticide registration.
Toxicology studies	Applicable after international validation of testing methods.
Ecotoxicology studies	Applicable after international validation of testing methods.
Fate model library	Not applicable.
Wind erosion model	If assessment of residential risks is required in legislation.

Specific SPRINT results of interest to pesticide regulators in LMICs

Indoor dust as a key monitoring matrix

- **SPRINT research (specifically the indoor dust study) found extensive pesticide residues in household dust, not just in farm homes but also in neighbouring homes**. In many cases, dust contained a higher variety of mixtures than the crops themselves.
- SPRINT contribution:
  Evidence that inhalation and ingestion of indoor dust can be a relevant, overlooked exposure route.
- PRT application:
  - Risk assessment for residents. Currently, residential risk assessment has not been incorporated into the PRT. SPRINT outcomes suggest that this is also an important exposure pathway.
  - Raise awareness about the issue of pesticide residues in household dust, and domestic pesticide use in general
  - Add an entry to the PRT Assessment Methods module (bystander and residential risk) that points to the related SPRINT content by FAO.
  - Toxicovigilance guidance by FAO. Registrars in LMICs often focus monitoring solely on food residues or drinking water. This finding justifies including indoor environment sampling (which is relatively low-tech) in post-registration monitoring plans, especially for farming communities where housing is often intermingled with sprayed fields [planned].

Post-Registration monitoring and surveillance

- **Monitoring is resource-intensive and expensive. SPRINT demonstrates how to use existing data (sales/usage statistics) combined with environmental modelling to predict contamination "hotspots."**
- SPRINT contribution:
  Methodologies for designing monitoring schemes and identifying relevant matrices (e.g., soil, water, indoor dust). Instead of random sampling, regulators can learn to use predictive modelling to target their limited budgets toward high-risk areas.
- PRT application:
  - A future Post-Registration or Toxicovigilance module will be created in the PRT. This module can borrow from and refer to the SPRINT insights [planned].
  - A link to the SPRINT results can be inserted into the PRT module on Registration Process, Post Registration [done].
  - Currently FAO Guidelines on Incident Monitoring are being updated. A reference to the SPRINT work can possibly be made.
  - Note that pesticide residue analysis remains difficult in many LMICs due to the lack of access to appropriate laboratories.

Practical prioritization of mixtures

SPRINT acknowledges that testing every possible "cocktail" is impossible and developed a practical approach to select which substances to prioritize for mixture risk assessment based on their co-occurrence in soil and water.

- SPRINT Contribution:
  A methodology to identify the "top offenders" in mixtures rather than trying to assess everything, during post-registration monitoring.
- PRT Application:
  - Awareness raising
  - LMIC registrars have limited risk assessment capacity. This methodology can be adapted into guidance for prioritizing which combinations of pesticides to screen for, making post-registration mixture assessment operationally feasible rather than theoretically overwhelming [applicability in pesticide registration to be further assessed].
- Limitations:
  - Although the proposed approach allows to prioritize compounds in mixtures, risk assessment in pesticide registration is still done on a single-compound basis.
  - The approach is not specifically applicable on tank-mixtures as common in LMICs

Specific models: Wind erosion and long-range transport

SPRINT findings highlight that pesticide residues are not stationary; they are transported over long distances via wind erosion of soil particles, contaminating areas far from the application site.

- SPRINT Contribution:
  The Wind Erosion Model and data on atmospheric transport.
- PRT Application:
  - Buffer zones and other risk mitigation measures. This supports registrars in justifying stricter buffer zones or requiring specific nozzle technologies (drift reduction) during the registration process to protect non-target areas and communities.
  - The Wind Erosion Model can be integrated into the PRT under Assessment Methods (Fate in Air) and being referred to from Assessment methods for residential assessments [planned].

Economic "lock-ins" and barriers to transition

SPRINT social science research identified that farmers often stick to hazardous pesticides not because they want to, but due to "lock-ins" like supply chain requirements, debt, or lack of insurance for yield loss.

- SPRINT Contribution:
  Policy briefs detailing non-chemical barriers to adoption of alternatives.
- PRT Application:
  - This helps registrars understand that registering biological alternatives is not enough; they must also address the regulatory or economic incentives. It provides evidence to support "fast-track" registration channels for lower-risk products to break these lock-ins.
  - A summary of the key messages from this research is integrated into the PRT "Assessment of Alternatives" module and being referred to from the Decision Making module.
  - FAO might be able to use SPRINT outcomes on this topic when updating pesticide legislation guidance.

Cost-benefit analysis: True cost accounting (health vs. economy)

SPRINT has worked on **quantifying the "hidden" health costs of pesticide exposure** (e.g., impact on gut microbiome and chronic diseases) to compare against the economic gains of pesticide use.

- SPRINT Contribution:
  Frameworks for socio-economic analysis that include public health costs.
- PRT Application:
  - Cost-Benefit Analysis. Many LMIC registrars face political pressure to approve pesticides for "food security." This framework provides them with the arguments and methodology to demonstrate the long-term economic burden of hazardous pesticides on the national health budget.
  - The specific SPRINT research relating to true cost accounting is too complex/data intensive for application by registrars in LMICs but SPRINT researchers might be able to provide true cost accounting methods which could be built into the Decision Making process for pesticide registration in LMICs because the cost-benefit analysis is currently an underdeveloped part of this Module.

Links with other FAO projects

FAO is the lead organization for the Global Biodiversity Framework (GBF) regarding the development of a methodology for *Headline Indicator 7.2: An approach for measuring pesticide risk reduction worldwide*.

It is being discussed at FAO whether SPRINT pesticide use and monitoring results for the 10 case study sites might be used to validate the developed GBF indicator.

Potential use of SPRINT pesticide monitoring datasets to validate the GBF Headline Indicator 7.2 presents an opportunity for broader international policy relevance beyond pesticide registration alone.

Overall conclusions and outlook

In general, most of the individual tools in the ST have limited applicability for the day-to-day work of pesticides regulatory authorities in LMICs. This hampers the wider application of the ST.

Limitations

The possibilities for applying the ST tools globally, and especially in LMICs, is limited by and because of the following reasons:

Setup and contents of the ST

The ST is partly a collection and demonstration of tools, models and methodologies and partly an interactive presentation of project results (CSS results) that are very specific to the European context. While some of the models and methodologies in the ST may be transferable to LMICs, they need to be made available in a user-friendly format.

Pesticide policy vs registration

In this document the applicability of the ST has been accessed specifically for pesticide registration in LMICs. However, the SPRINT results can be more widely applied in pesticide policy making.

Pre- vs post registration assessments

Most tools in the ST focus on post-registration monitoring and analysis and less on the pre-registration assessment of pesticides which is a major task of regulatory organizations (and the main topic of the PRT).

Resource requirements

Depending on the tool, its application and implementation require resources in terms of input data, specific knowledge and in some cases laboratory analysis which all translate to time and cost for data collection and processing.

This hampers the applicability of these tools in LMICs, where regulatory authorities often have limited capacity in terms of time per evaluated dossier and funds (or facilities) for pesticide residue analysis but also less specialization (data-analysts, (eco-)toxicologist, chemists).

Specificity

Several of the tools in the ST are specific to the (large) scale temperate agriculture in Europe and less to the tropical and smallholder practices as more common in LMICs.

Methods and tools not yet rooted in international standards and legislation

SPRINT, being a research project at the forefront of research on the impact of pesticides on human health and ecosystems, investigates and proposes new assessment methods and indicators. This, however, implies that the proposed methodologies have not yet been evaluated (inter)nationally and have not (yet) been included in national and international guidelines, which makes it more difficult to recommend them as evaluation tools for international organizations like FAO.

Opportunities

When considering the above limitations, the following tools have the best opportunities for global applicability:

Toolbox

As they are currently presented, none of the tools in the SPRINT Toolbox can yet be applied for pesticide registration purposes in LMICs.

This is because
i. many tools are not intended for use in prospective risk assessment;
ii. many tools require pesticide residue data in the environment which are not available in LMICs;
iii. most of the tools do not allow access to the actual model/algorithms, for external parties to enter data.

ST tools with the highest likelihood of adoption and application in LMICs are:

- CSS results/post-registration monitoring
- Dietary exposure
- Ecotoxicity studies
- Wind erosion model

Other SPRINT results

While direct operational transfer of individual ST tools to LMIC pesticide registration systems is limited, several SPRINT results show conceptual and methodological transfer potential. If further developed into a practical and user-friendly methodology, the following SPRINT results could be relevant for pesticide registration and post-registration in LMICs:

- Importance of exposure to house dust, if incorporated into residential risk assessment methodology
- Cost-benefit analysis, based on true cost accounting, if focussing on the authorization of a single pesticide on one or more crops
- Post-registration monitoring of pesticide residues in humans, animals and the environment, if translated into a pragmatic field protocol
- Proposing options to minimize of lock-ins and barriers preventing or slowing down the introduction of low-risk pest management options

Although not always directly applicable, SPRINT and ST results can be used in general terms

- To raise awareness about the risks of pesticides to human health and the environment, even after authorization.
- To influence policy for pesticide risk reduction in LMICs
- To function as a reference for future research and development (of PRT modules)
- As inspiration for the development of novel approaches to the research on impact of pesticides
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Overall conclusions

In summary, when evaluating the applicability of SPRINT results to pesticide registration in LMICs the following conclusion is drawn:

- **Strategic Alignment:** Strong
- **Operational Compatibility:** Moderate
- **Technical Feasibility in LMIC Context:** Conditional
- **Direct Data Transferability:** Limited
- **Methodological Transferability:** Moderate
- **Recommended Integration Model:** Reference within PRT
- **Main risks of adoption:** differences in regulatory requirements and lack of technical capacity, financial resources and data in many LMICs.

Outlook: Practical implementation into the PRT

The results, as presented in this report, have been shared with stakeholder (registrars from LMICs) during a webinar held on 26 February 2026, organized by FAO.

Around 230 invitations were sent through FAO NSP and the FAO Pesticide Registrars forum.

Some of the remarks and questions raised during the webinar.

- *The simplified visual messages (e.g. posters about indoor dust) are very useful and could be adapted to LMIC conditions.*
- *Costa Rica is developing new monitoring systems for pesticides, and they were interested in getting in contact with SPRINT researchers about monitoring and digitization of data.*
- *What kind of follow-up to the current SPRINT project is foreseen given that many results still require further work before they can be used by pesticide regulators?*
- *How can we make the tools available for daily use by registrars*

These will be accounted on next incorporation steps into the PRT. SPRINT project content and ST tools have been integrated into the PRT in the following ways:

- A **Special Topics** page in the PRT, describing and linking to the most relevant parts of SPRINT and the ST (https://www.fao.org/pesticide-registration-toolkit/new-regulatory-and-scientific-developments/sprint-project/en/)
- PRT **Assessment of Alternatives module**:
  - A reference is made to the SPRINT list of 14 initiatives from across Europe which have successfully transitioned away from a reliance on synthetic pesticides in the Case Studies part of this module.
  - A new page is inserted into Step 4 of the alternatives assessment process, linking to the "Pesticide lock-ins and barriers that can slow down the transition towards sustainable plant protection", as identified by SPRINT
- An information box was added to the Post-registration phase – Monitoring & evaluation step of the PRT Registration process module, linking to the SPRINT developed sampling methodology for case study sites.