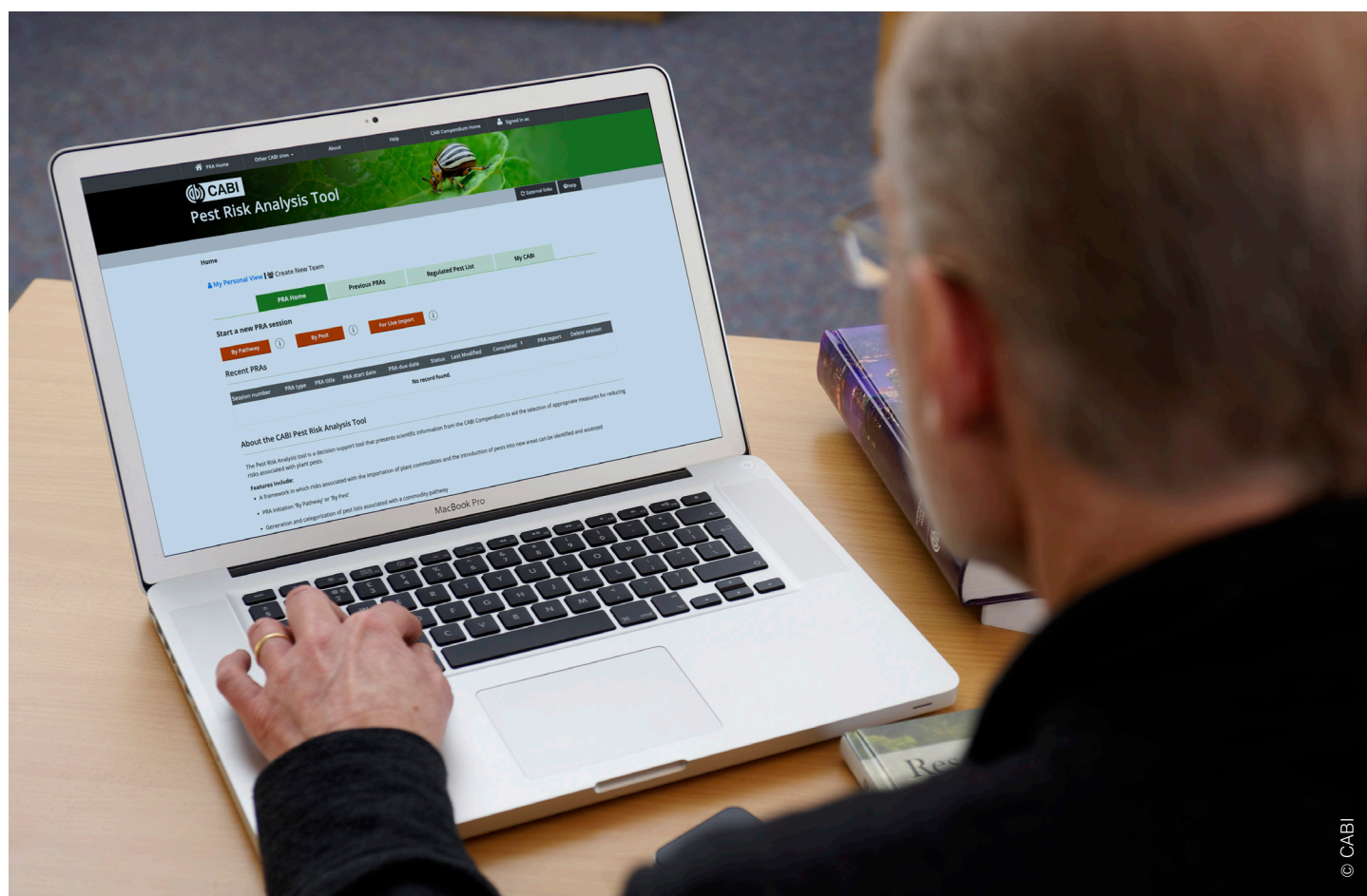CABI

Assessment of the use of CABI's decision support tools for biosecurity – Pest Risk Analysis Tool and Horizon Scanning Tool

Authors

Mariam Kadzamira
Lucinda Charles
Walter Hevi
Chapwa Kasoma
Adewale Ogunmodede
Frances Williams

September 2023

© CABI

KNOWLEDGE FOR LIFE

Mariam Kadzamira, CABI, Bakeham Lane, Englefield Green, Egham, TW20 9TY, UK. Email: M.Kadzamira@cabi.org; ORCID: 0000-0003-3652-508X

Lucinda Charles, CABI, Nosworthy Way, Wallingford, Oxfordshire, OX10 8DE, UK. Email: l.charles@cabi.org; ORCID: 0000-0003-1362-1300

Walter Hevi, CABI, CSIR Campus, No.6 Agostino Neto Road, Cantonments, Ghana. Email: w.hevi@cabi.org; ORCID: 0000-0002-9821-8264

Chapwa Kasoma, CABI, 5834 Mwange Close, Kalundu, PO Box 37589, Lusaka, Zambia. Email: c.kasoma@cabi.org; ORCID: 0000-0002-0176-7823

Adewale Ogunmodede, CABI, Bakeham Lane, Englefield Green, Egham, TW20 9TY, UK. Email: A.Ogunmodede@cabi.org; ORCID: 0000-0001-6388-2870

Frances Williams, CABI, Canary Bird, 673 Limuru Road, Muthaiga, PO Box 633-00621, Nairobi, Kenya. Email: f.williams@cabi.org; ORCID: 0000-0002-6772-0753

Table of contents

Abstract

CABI's Horizon Scanning Tool (HST) and Pest Risk Analysis (PRA) Tool were launched in 2018 and 2019, respectively, and have since undergone enhancements to improve their design, usability and technical content in response to user needs. An assessment of their use, benefits and outcomes of use show that both tools are valuable resources as pest risk decision support tools for biosecurity. Although used globally, the tools are a relatively more valuable resource for lower-income countries in the global south, whose National Plant Protection Organizations have been granted gratis subscription. However usage in the global south is limited by the tools' internet dependency. Despite this, we find that the HST has a diverse range of users and the PRA Tool is being used by the target user group, i.e. those mandated to carry out pest risk assessments within National Plant Protection Organizations. Case studies from Ghana and Zambia show that the PRA Tool can become part of the favoured workflow for National Plant Protection Agencies, superceding paper-based questionnaires. The study finds that the tools have been used to establish more robust pest risk assessment practices and have resulted in important trade and policy outcomes and inter-agency collaboration. Furthermore, there are cases that show that PRA results have helped to highlight weak links in national plant health systems and processes.

Acronyms

CPC	Crop Protection Compendium
GA	Google Analytics
HST	Horizon Scanning Tool
IPPC	International Plant Protection Convention
ISC	Invasive Species Compendium
NPPOs	National Plant Protection Organizations
PPRSD	Plant Protection and Regulatory Services Directorate
PQPS	Plant Quarantine and Phytosanitary Service
PRA	Pest Risk Analysis

Introduction

Assessments of risk are essential for managing the threat of invasive species cost-effectively and facilitating safe and fair trade under World Trade Organization (WTO) rules (www.wto.org). Decision support tools have assumed a key role in supporting pest risk prioritization processes and regulatory functions because the mere availability of large sets of data and information is not sufficient for decision making in trade negotiations and phytosanitary policy (Taechatanasat and Armstrong, 2014; Rossi *et al.*, 2019; MacLeod and Spence, 2020*)*. Decision support tools are applications that are designed to help users with making optimal decisions based on appropriate scientific evidence. They can provide users with information, a standardized approach and alternative decision paths for evidence-based decision making (Dicks *et al.*, 2014; Rose *et al.*, 2016).

CABI's decision support tools for biosecurity

To define how four key groups (Plant Protection Officers, Risk Assessors, Quarantine Officers, and Protected Area Managers) prefer to access and use online invasive species management information; in May and June 2015, CABI commissioned the market research company Maverick to conduct 60 in-depth telephone interviews, lasting 15–30 minutes, with individuals representing both the developed and the developing world. Interviewees were asked about their daily routine and tasks, problems and challenges encountered, and preferred information resources.

The results of the interviews and additional contributions from CABI invasive species experts were fed into a standard user-centred design approach known as affinity mapping to identify possible decision support applications to address their needs and feed into their work practices. These identified features were then prioritized by Kano analysis.

The need for expert-system support for risk assessment and risk analysis (RA) was highlighted by all four user groups. CABI's response was to develop the Horizon Scanning Tool (with the support of the UK Department for International Development [DFID], Ministry of Foreign Affairs of the Netherlands [DGIS] and United States Department of Agriculture – Animal and Plant Health Inspection Service [USDA-APHIS]), and the PRA Tool (funded by DFID and DGIS). The invasive species Horizon Scanning Tool (HST) was launched in 2018. Horizon scanning is a rapid process for screening invasive species and pest risks based on a systematic study of possible future risks, leading to non-native species being prioritized for further inquiry (Roy *et al.*, 2014) The Horizon Scanning Tool was created to help users identify potential invasive species threats to a country, state or province. The tool was developed to provide a quick and user-friendly means of selecting "source areas" and criteria for categorizing and prioritizing potential invasive species that are not present in the "area at risk". It is driven by invasive species data and pest datasheets held in the CABI Compendium (until November 2022 published as the Invasive Species Compendium [ISC] and Crop Protection Compendium [CPC]).

The open access version of the Horizon Scanning Tool provides onward links to the invasive species datasheets whilst the premium version for subscribers provides access to the full set of pest datasheets as well as additional filters for plant hosts and "plant parts in trade" that

may indicate potential commodity pathways for entry. Target users include but are not limited to risk assessors, plant protection officers, quarantine officers, protected-area managers and researchers. Since its launch, the tool has been widely used in different settings to develop lists of potential invasive alien plant pests for specific geographic areas (Boice, 2021; Kendig *et al.*, 2021; Kenis *et al.*, 2022;).

In the same year, development began on the Pest Risk Analysis (PRA) Tool to build on a previous PRA module that had been included in the CD-ROM version of the CPC (last published in 2007). User needs research was conducted using online surveys, interviews with expert risk assessors and the first of two product development workshops held in Nairobi, Kenya, with representatives from 12 National Plant Protection Organizations (NPPOs) from sub-Saharan Africa. The beta version of the PRA Tool comprised a workflow for conducting a pathway PRA arising from a request to import a plant commodity. This was presented back to the 12 NPPOs at a second workshop in December 2018 along with a plan for a second PRA type for assessing the risk of a single pest. Participant feedback determined the next steps for development, ready for the launch in 2019. The PRA Tool uses pest and crop data from the CPC to generate a commodity pest list and provides links to the pest datasheets to assist the user to assess the likelihood of pest entry, establishment, spread and impact and then, if required, select appropriate measures to reduce the risk of introduction. The framework is closely integrated with the International Standards on Phytosanitary Measures (ISPMs) established by the International Plant Protection Convention (IPPC) (Cameron *et al.*, 2018) The tool helps the user to produce a PRA report that includes scientific evidence for setting import conditions or justifying other regulatory actions. The outputs are also used to support market access requests. As a result of this, risk assessors and risk managers working in or with NPPOs have used the PRA Tool for crucial decision-making (Taylor et al., 2021) Examples of use include issuing of phytosanitary certificates, export and import licences and generation of lists of priority pests. Since the launch of the PRA Tool, enhancements have been made to improve the design, usability and technical content, thus responding to user needs and incorporating emerging innovations.

Both tools were developed to support national biosecurity efforts and the PRA Tool in particular was envisaged for lower-income countries without well-developed PRA processes already in place. To enable access to the tools and also the full set of pest and crop datasheets in the Compendium, CABI offers gratis subscriptions to NPPOs in 117 countries. By providing access in this way, CABI provides sustainability to the Compendium and the PRA Tool by raising revenues through subscriptions from higher-income countries, whilst providing it free-of-charge to NPPOs of lower-income countries. With remote access vouchers there is some flexibility for NPPOs to include external contributors in their work.

The use, benefits and evolution of CABI's pest risk decision support tools have been documented (Coles, 2018; Doughty *et al.*, 2019; Lowry *et al.*, 2019; Boice, 2021). In addition, examples of how the tools are used are emerging in the literature (Kendig *et al.,* 2021; Mulema *et al.*, 2021; Kenis *et al.*, 2022). However, studies documenting the consequences of use or courses of action following the user of the tools, both immediate and long term, are scarce or unavailable. The current study addresses this gap.

Study approach

The study aimed to assess the benefits of use of CABI's PRA and Horizon Scanning tools. Specifically, the study also aimed to unearth the unseen (policy) consequences of using the tools and to understand the type of 'linked' actions that subscribers/users have taken as a result of using the tools. In so doing, the study aimed to provide insights on real-world usage of CABI's pest risk decision support tools. Mixed methods were employed to sample respondents and to collect data (Table 1). First, product usage trends and behaviour over a one-year period (March 2021 to March 2022) were collected from Google Analytics (GA). The GA data that we analysed included number of users and the frequency of use of the products, geographical location of users, the content that they used most, how they accessed the products and the type of device used.

Second, user experiences for the HST were collected using a Hotjar survey (Annex 1) with respondents self-selecting into the survey. The Hotjar survey was live on the HST website from mid-May to end of August 2022. In total, 80 respondents completed the survey. During the same time, a survey of PRA Tool users (see Annex 2) was also launched using Survey Monkey targeting registered PRA subscribers who had given permission to be contacted for user feedback. A total of 104 respondents completed the survey. In addition, this current study includes data from a user requirements survey that CABI conducted in 2018 ahead of tool development and before workshops with selected NPPO staff. This survey was emailed to 366 NPPOs or risk assessors known to CABI generating a total of 112 responses.

Table 1. Summary of data used in study.

Data set	Time period	No of respondents
CABI Analytics	Focus on March 2021 to March 2022	NA
PRA Requirements Survey	2018	112
HST Hotjar Survey	May to August 2022	80
PRA Subscriber Survey Monkey		104
In-depth Interviews – Ghana	August to September 2022	19 informants from 8 institutions
In-depth Interviews – Zambia		25 informants from 7 institutions

Finally, in-depth interviews with key stakeholders from Ghana and Zambia (i.e. research institutions, universities and colleges, regulatory institutions), who had been trained and sensitized on the two tools, were conducted between July and August 2022. The focus of the in-depth interviews was two-fold, first to better understand the benefits that various users incurred from using the tools; and second to unearth the consequences of use and 'courses of action' taken as a result of using the tools. In Ghana, in-depth interviews included representatives from the University of Ghana; University of Cape Coast; Kwame Nkrumah University of Science and Technology; University of Development Studies; the Plant Protection and Regulatory Services Directorate of the Ministry of Food and Agriculture, Crop Research Institute, Savannah Agriculture Research Institute, Oil Palm Research Institute (all part of the Centre for Scientific and Industrial Research); and Cocoa Research Institute of

Ghana. An in-depth face-to-face interview was conducted with each participant based on a semi-structured questionnaire (Annex 3). Where a primary respondent introduced a third person to the tool, a follow up was made to understand the use and challenges with the tool by the third person. In all, a total of nineteen direct respondents and two indirect (secondary) respondents were interviewed in Ghana.

In Zambia, the process was similar, with twenty five in-depth interviews conducted with representatives of institutions that had undergone training by CABI on the use of the tools. Institutions were headquartered in different geographies; hence the in-depth interviews were held in different cities including Lusaka, Chilanga, Kabwe, Chirundu, Kafue and Choma, namely with Mulungushi University; Natural Resources Development College (NRDC); Plant Quarantine and Phytosanitary Service (PQPS); University of Zambia (UNZA); Zambia Agriculture Research Institute (ZARI) and Zambia Environmental Management Agency (ZEMA).

Findings

Usage of the HST and PRA

Between March 2021 and March 2022, the HST had nearly 19,000 users who viewed multiple pages (Fig. 1a) with an average visit time per user of approximately three minutes. The HST had more visits over that time period than users, implying that some of the users were repeat visitors. This trend is also observed at the country level, amongst the top 10 countries of users. For the PRA Tool, between March 2021 and March 2022, the site had just over 1,000 registered users who visited the site 4,508 times with 38,803 page views, with an average visit time of 19 minutes (Fig. 1b). The differences in number of users between the HST and the PRA is expected. This is because the PRA Tool addresses a specific and complex task, i.e. that of preparing a PRA report with sufficient evidence to justify the regulation of pests or implementation of other phytosanitary measures to prevent pest introduction and spread. PRAs are mainly conducted by a small team of trained risk assessors in, or assisting the NPPO as the designated authority with responsibility for this function according to the International Plant Protection Convention (IPPC).
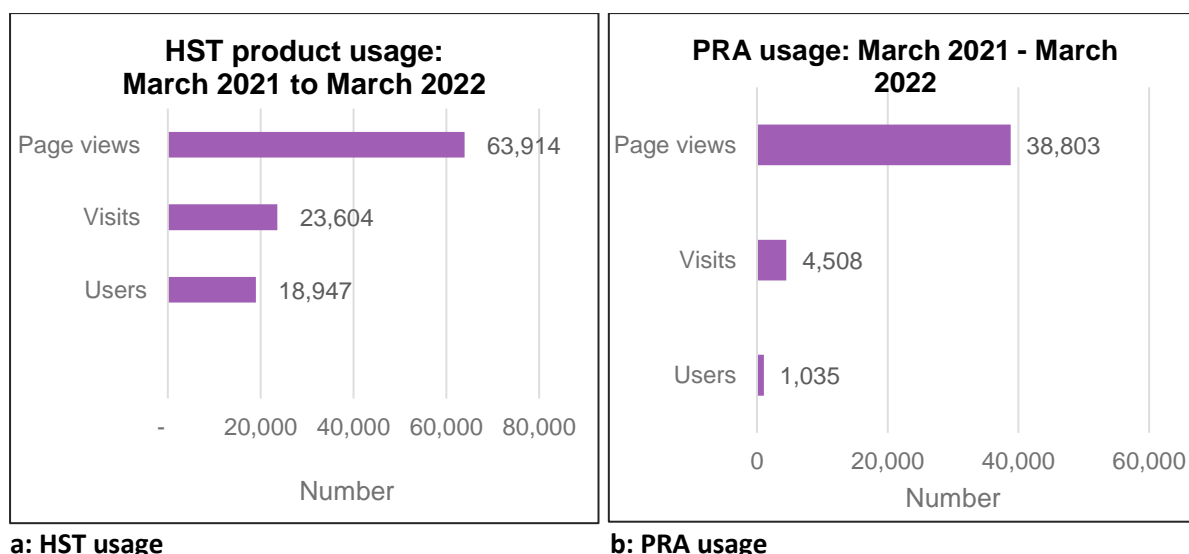

a: HST usage   b: PRA usage

Fig. 1. HST and PRA product usage - March 2021 to March 2022.

The HST is also mainly targeted at biosecurity authorities but the tool is simple to use and has a broader range of applications extending beyond NPPOs to land and resource managers and researchers working in various fields. In addition, the HST has broader species coverage, i.e. not only plant pests but also invasive plants, animals and animal pathogens. The HST can be used for identifying species for pest-initiated PRA, pests in neighbouring regions for surveillance, awareness raising, pathway management and general invasive species data comparisons.

The type of users that responded to the 2022 HST Hotjar survey, the 2022 PRA survey as well as the 2018 PRA user requirements confirm these insights. For the HST, the survey respondents were diverse, classifying themselves across 14 different occupations. This is the case with researchers (20%), quarantine officers (12.5%) and risk assessors/analysts (10%) being the most dominant occupations. In addition, other less prominent occupations included plant protection officers (8.8%), trainers (8.8%), government extension officers (8.8%), risk managers (7.5%) and students (7.5%). Other occupations including farmers/growers, NGO/civil society staff, policy makers, private extension service providers and university staff also responded to the HST Hotjar survey with each making up less than 5% of the survey respondents. For the PRA, as expected, we found that the users were less diverse. In the 2018 PRA user requirements survey and the 2022 PRA Survey Monkey survey, respondents were asked to describe their role. Three occupations, in combination, made up the majority of respondents with 72% and 74% of all respondents identifying themselves as plant protection officers, quarantine officers and risk assessors/analysts, in 2018 and in 2022, respectively. The remaining proportion of PRA survey respondents for both surveys was made up of a combination of researchers, government extension workers, university staff, trainers, risk managers, policy makers and project managers. These findings agree with practice on the ground. In Ghana for example, the main institutions using the PRA Tool are the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture and the Cocoa Research Institute of Ghana. The former is mandated to organize, regulate, implement and coordinate the plant protection services of the country. The PPRSD has a free subscription to the PRA as part of CABI's support to their national plant health systems. This gratis access to the PRA Tool is on offer for 117 NPPOs of lower- and middle-income countries: however not all have taken up the offer. Understanding whether PRA is a primary activity and, if so, what alternative tools are being used is outside the scope of this study. However, it is an area that should be considered for future research.

In terms of the geographical location of the users, we find that the UK accounted for the largest number of users as well as the most visits to the HST between March 2021 and March 2022 (Fig. 2a). The UK is followed by the USA and India, but with each country contributing less than 10% of all users and visits to the HST between March 2021 and March 2022. Apart from these top three user countries, the HST had, during this time period, users from a diverse range of countries, but with all of them contributing less than 4% each to the total number of users or visits (Fig. 2a). Despite the fact that two of the top three countries with the most users and visits to the HST are developed countries, the majority of countries in the top ten are from Asia (33% of all users) and Africa (22% of all users) (Fig. 2b). This is attributed in part to CABI's training and outreach activities which have been supported by various donor-funded

projects prior to or during the survey period in those regions. However it is noted that the number of users and visits per country are fewer as compared to developed countries.
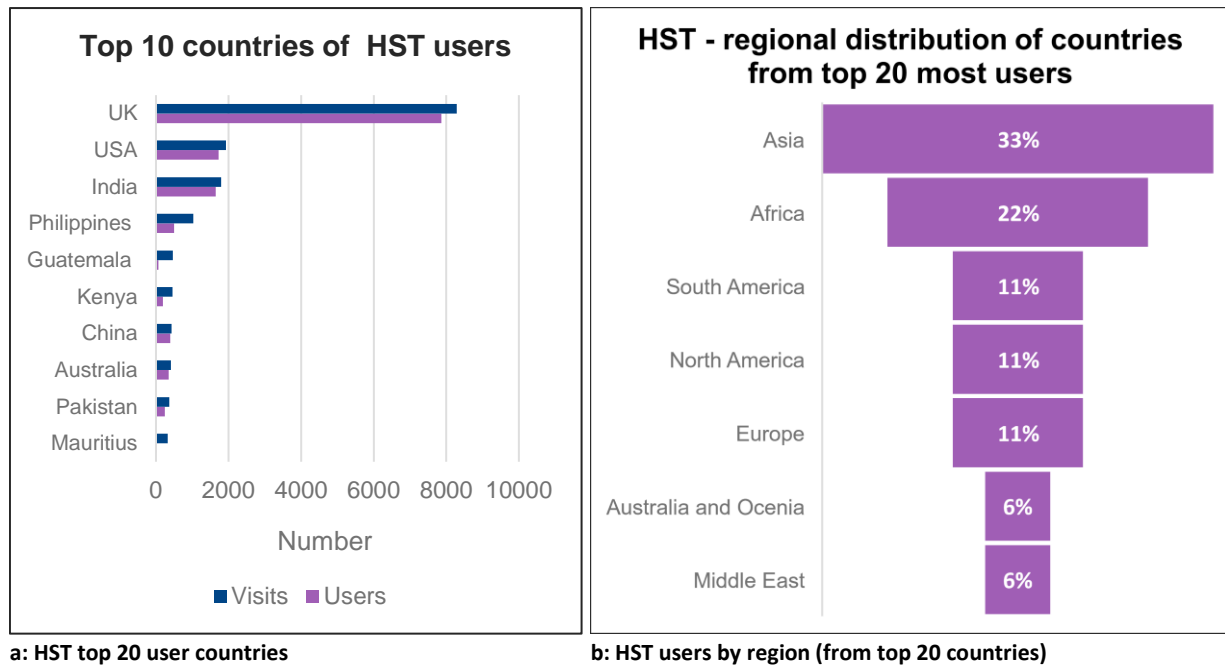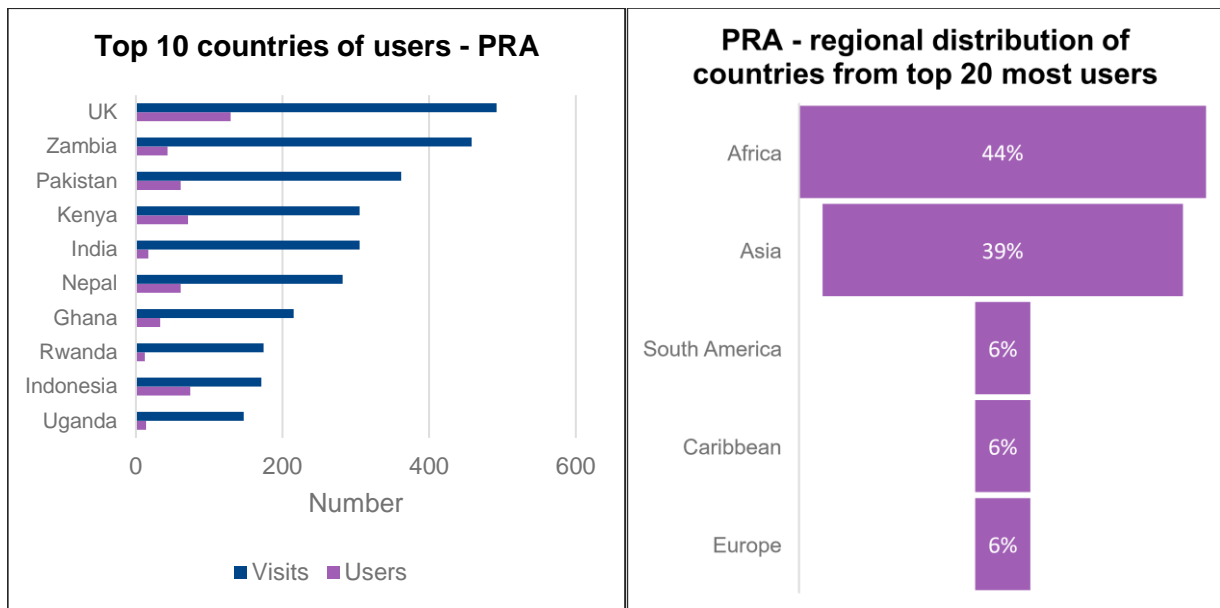

a: HST top 20 user countries   b: HST users by region (from top 20 countries)

Fig. 2. HST users by country and region. Source: CABI Analytics.

For the PRA Tool, Nepal accounted for the largest proportion of users between March 2021 and March 2022 (Fig. 3a), contributing 22% of the total number of users. This is followed by the UK (20%), Indonesia (12%), Kenya (11%) and Pakistan (10%). Generally, PRA Tool usage is closely linked to CABI's national and regional PRA training workshops which have been provided in Africa, South East Asia and the Caribbean since 2018. During the COVID-19 pandemic, training was moved online and could be extended to include more participants than would have been possible in face-to-face meetings (Fig. 3b). However, most traffic to the PRA Tool is not generated by those countries with the most users. For the PRA, the UK accounts for the most visits (14%; probably due to CABI staff remote access which it has not been possible to exclude), followed by Zambia (13%) and Pakistan (10%). Nepal which had the largest proportion of users during the study period, accounted for less than 10% of the total number of visits to the site. This may indicate that more people are being introduced to the tool than actually end up using it for their work.

Top 10 countries of users - PRA

a: PRA top 20 user countries

PRA - regional distribution of countries from top 20 most users

b: PRA users by region (from top 20 countries)

Fig. 3. PRA users by country and region. Source: CABI Analytics.

Most of the countries in the top 10 list of user countries for both the HST (Fig. 2a) and the PRA (Fig. 3a) are countries where the NPPOs are receiving the gratis subscriptions.

The majority of the users for both the HST and the PRA Tool used a desktop computer for access (Fig. 4). This can be attributed to the nature of the tasks the tools support. Both are designed for desktop use because they assist tasks and users that are generally office based in government departments or research institutions. Both provide spreadsheet downloads for further analysis of species lists which is usually done by researching other online resources, office reports or gathering input directly from experts. The PRA Tool is specifically designed to help a risk assessor to input the required information for a PRA report and in some parts of the PRA this can be lengthy text accompanied by reference citations. In-depth interviews from Zambia concurred with this finding, with respondents stating that many users in the country access the tool through institutional desktop computers due to the need for internet connectivity. Consequently, this was cited as a limitation in exploring the tool further among users in Zambia because it meant their interaction with the tool was limited to their working hours.
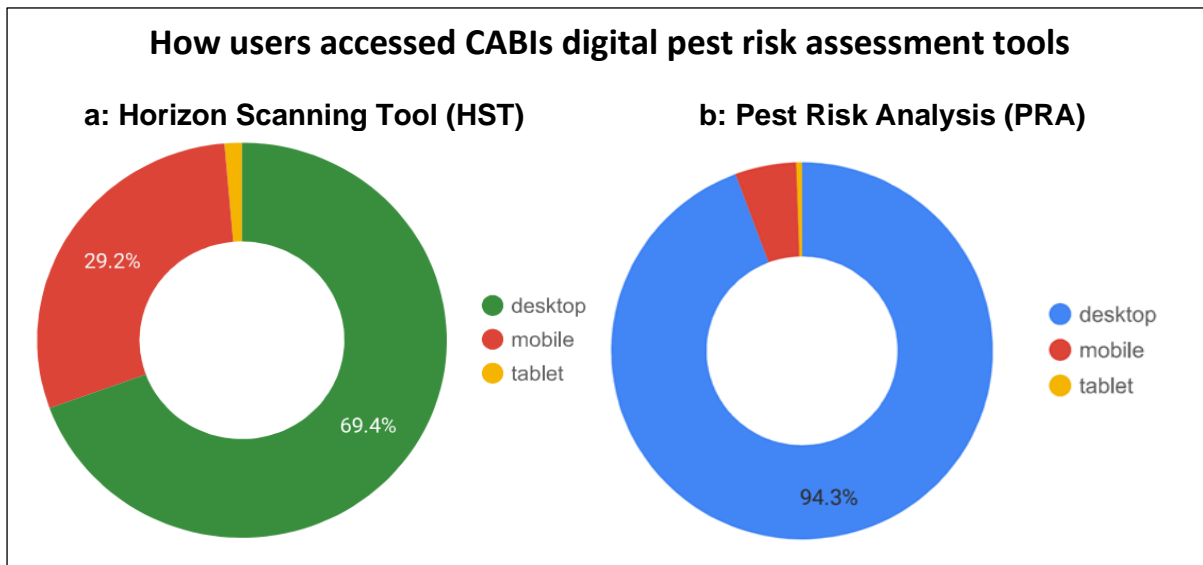
Fig. 4. HST and PRA Tool users by type of device used.

Respondents feel that offline usage of the PRA Tool would go far in improving user efficiency. However complete offline use of the tools is not recommended nor is it feasible. This is because for both tools it is critical that the user has the most up to date invasive species/pest data, particularly for distribution and host range. This therefore necessitates an internet connection because databases linked to both tools that provide the invasive species/pest data are updated daily by CABI. Currently both tools have options that allow work when there is limited internet. The HST scan is quick to run and produces a CSV/ Excel download file for use/sharing outside the tool (i.e. offline) where the results can be analysed by the user. The PRA Tool has an option for a user who is logged in online to download a Word form to be edited outside of the tool. This enables the risk assessment of individual pests to be edited offline and imported back into the online tool at a later date. This also allows the PRA work to be shared with a wider group of species experts or reviewers who do not necessarily have a subscription.

Usage and outcomes of usage of the HST and PRA

In the 2022 HST Hotjar survey, respondents were asked to share an example of how they used the tool. The most frequent responses pertain to using the HST for analysing pest risks related to imported plants or plant products and to come up with information which can be used to generate pest lists and/or quarantine regulations (Fig. 5).

Fig. 5. Key words identified from Use question in the 2022 HST Hotjar survey.

A large proportion of the HST Hotjar survey respondents (26%) stated that they used the HST for their work because it helps them in identifying and categorizing pests or invasive species associated with particular pathways of introduction. Other frequently stated benefits of the HST were that it helps them to build lists of pests present in a specific geographical area (25% respondents) and it provides quick access to relevant information (21%). In addition, some of the survey respondents also stated that the HST benefits their work as it saves them from searching many different websites for information (15%), it provides accurate and up to date information (13%) and it increases the quality of their (research or project) work (13%). Similar findings were gathered from the in-depth interviews: stakeholders in Ghana stated that they use the HST because the tool is more detailed than other available tools. In Zambia, stakeholders stated that the HST is used because it is a rapid way of identifying priority pests, thus helping users to quickly narrow down a list of pests to better focus on what matters and to use time efficiently.

When asked what type of PRA the tool users conducted, most of the survey respondents (55%) said they carried out both pathway-initiated and pest-initiated PRAs, whereas about 30% focused on pathways and 15% on PRAs for single pests of concern (Fig. 6). This confirms that the current tool subscribers are conducting both types of PRA and that the tool is useful for both approaches. When comparing the 2018 PRA requirements survey, which was before the tool was developed, with the 2022 user survey there is a close match between requirements and the main reasons for using the tool. Sixty per cent of subscribers stated that they use the PRA Tool to determine pest risks and phytosanitary measures for plant commodity imports and 59% used it for generating a pest list for a commodity import. This compares with 32% to support export market access. The PRA Tool is also used for pest-initiated PRA to decide whether a pest should be regulated (41% of users), to assess a proposed intentional introduction (39%), in response to an interception (23%), or to assess a pest that is already recorded as present (19%). It should be noted that the CABI training has been focusing on PRA for the country's own biosecurity and less on market access which was the predominant activity reported from many participants in some regional workshops prior to CABI training. In particular, pest-initiated PRA has been introduced to some NPPOs as a new priority, often following on from a horizon scanning activity to identify priority pests of concern.

Although not designed specifically as a training tool, the PRA Tool has proved useful for learning and teaching the basic principles of the PRA process. The fact that it is closely aligned to international standards, linked to real data and can provide a platform for team working has enabled it to be used quite effectively by CABI trainers, external trainers and indeed for extending training in-country to additional team members.
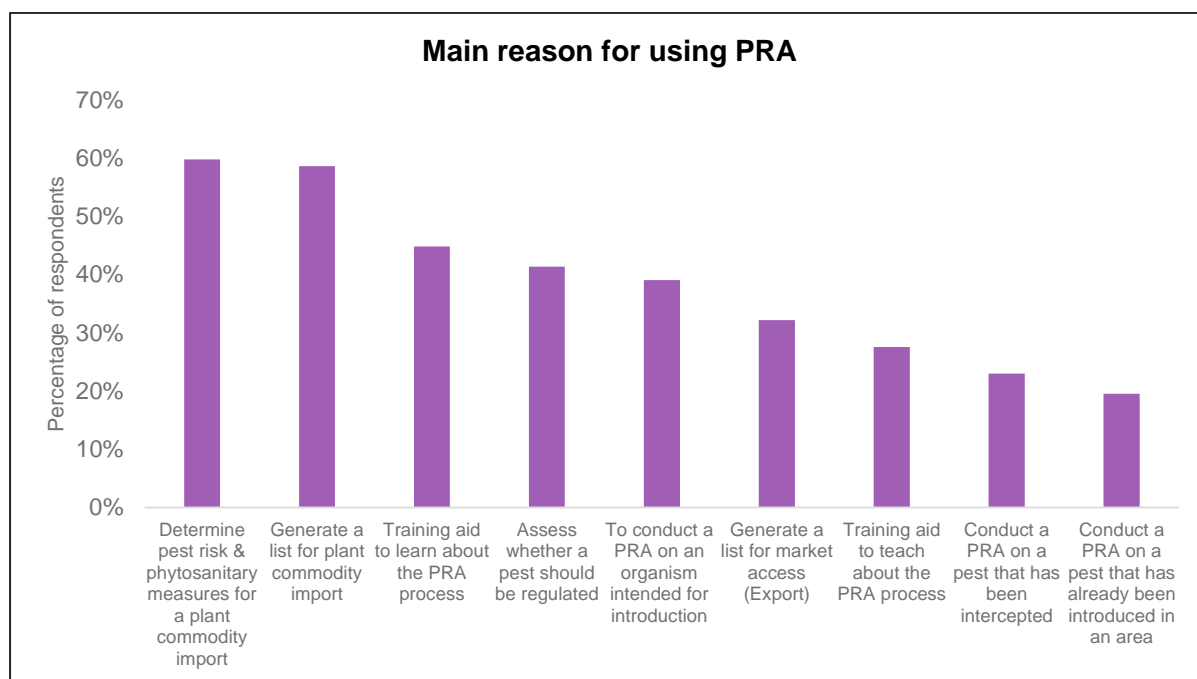

Fig. 6. Main uses of the PRA Tool – 2022 PRA survey.

Key informants from Ghana stated that they use the PRA Tool as opposed to other available tools as it is time saving (i.e. it reduces the hours needed to conduct a PRA) and it generates a thorough and comprehensive list of pest species and pest information associated with a commodity of interest. In addition, key informants in Ghana feel that CABI's PRA Tool is the only available tool providing information on pests associated with particular commodities and it provides a systematic approach to conducting a PRA, thereby making it reliable and easy to use. Stakeholders in Ghana also like to use the PRA because it provides guidance in making recommendations for issuing import permits. Previously stakeholders in both Ghana and Zambia used paper based questionnaires to conduct rapid PRAs. Adoption of CABI's PRA Tool provides access to CABI's most up to date pest information and an improved workflow and is therefore one step towards strengthening and improving the phytosanitary capacity of both countries' NPPOs.

Outcomes of use

For both the HST and the PRA Tool the results are not an end in itself. For the HST we find that all respondents to the 2021 Hotjar survey carried out follow-on activities using the HST results (Table 2). The most common follow-on activities after an HST scan include using the results for research (17%), conducting surveillance activities (15%) and conducting a detailed PRA (13%). In-depth interviews in Zambia, with current users of the HST, reveal that only a few of the institutional users have had any follow-on activities after conducting a horizon scanning exercise. This is because most of the users were only recently trained on the tool.

Those that have used the HST for longer, have used the results for a wide variety of purposes. For example, an academic institution has used the HST results to make a decision on whether or not to proceed to a detailed PRA. Another has used the HST results to develop an academic paper which has been shared with students and other academics within professional research fora as well as policy makers responsible for pest risk management. Another research institute has used the HST result to generate pest lists and to develop protocols on how the listed pests could be managed. The protocols were then shared with the relevant government ministries and departments responsible for pest management and control, with private farmers, agricultural corporations and the private sector. The other institutions that were part of the in-depth interviews in Zambia, who have not carried out any follow-on activities after conducting a scan, stated that they have plans to do some activities in future. Some of the plans in place include using the information for pest surveillance, improving border inspections and import control, and for contingency planning.

Table 2. HST follow-on activities, 2021 Hotjar survey respondents.

Follow-on activity after HST	% of respondents
Research	17.2
Used information for surveillance	14.9
Conducted detailed pest risk analysis (PRA)	12.6
Training/teaching	12.6
Used information for rapid response and contingency planning	11.5
Used information for raising public awareness	8.0
Developed projects/proposals	8.0
Took direct action to prevent pest introduction and spread	5.0
Policy/regulatory framework development	4.6
Journalism	3.4
Other	1.1
No follow-on activity or no response to question	0.4

Box 1. Ghana case study.

Introduction

Various stakeholders in Ghana have been trained by CABI on how to access and use the HST and the PRA Tool. Some of those that have been trained have gone on to train others. About 20 individuals representing different institutions who had been trained on the tool were engaged in an in-depth stakeholder discussion in August 2022.

HST and PRA Training outcomes for Ghana

63% Accessed and used tool after training

19% Did not use tools due to lack of sufficient time

19% Failed to access the tool due to user difficulties or poor internet connectivity

The objective was to better understand the outcomes of using the tools. The majority of those in the discussion had been trained on both tools (36.8%), with the remaining having been trained on either one of the tools.

Ghana NPPO use of the PRA: Between 2018 and 2022, 15 staff members of the Plant Protection and Regulatory Services Directorate (PPRSD), Ghana's National Plant Protection Organization (NPPO), were trained in the use of CABI's PRA Tool. Since its introduction in 2018, the PRA Tool has become the main tool used by the PPRSD for pest risk assessments in the country. The tool has been used to conduct pest risk assessment for different commodities. **Example of use:** One recent example of its use (from 2021), is the case of a PRA conducted on tomatoes imported from Morocco into Ghana. The result from the PRA showed an invasive viral pathogen – *Tomato Torrado Virus* (ToTV) which is associated with production of tomatoes in Morocco. The results of the PRA resulted into two main actions. First, the whole tomato consignment that was imported into Ghana was destroyed. Second, a ban on tomato imports from Morocco was put in place to prevent the possible introduction of the disease into Ghana. During this process, it was revealed that some importers had brought in Moroccan tomatoes without the appropriate permits. Therefore, destroying all imported tomatoes was not a straightforward task. As a result of this realization, the inspectors at all entry points (border posts) were taken through a series of sensitization programmes in order to capacitate them to curb illegal importation of commodities. Furthermore, there is a plan in place to train staff from the PPRSD to be in charge of collating all data on commodity imports at a central point. **Future plans:** The NPPO plans to use the PRA Tool to re-assess the country's quarantine pest list which was developed some time ago because the list was based on expert opinions and not empirical evidence. The PRA Tool offers a more robust process to update Ghana's quarantine pest list.

In Ghana, the HST was used to identify and categorize pests that were not recorded in CABI's Crop Protection Compendium as present in the country but were identified as a potential threat according to the scan criteria. As a result of this process, a nationwide field survey was carried out for selected high-ranking pests that appeared in the scan results and were already present in neighbouring countries, to determine whether they were in fact already present in Ghana. The pests surveyed included *Thrips palmi, Liriomyza sativae, Liriomyza trifolii,* Cassava Brown Streak Virus and tomato bacterial canker among others. Samples collected from the survey were subjected to molecular identification and the results showed the absence of *Thrips palmi* in the country. However, the presence of *Liriomyza sativae and Liriomyza trifolii* were confirmed. The negative result for *Thrips palmi* was used to inform European Union (EU) trade negotiations.

Similarly, in the 2022 PRA subscriber survey, we asked survey respondents what courses of action they had undertaken after using the tool. Respondents provided what they had intended the PRA results to be used for (Fig.7). The most common responses were related to users intending to put in place, or changing, commodity import restrictions and regulations as a result of pest risks. This included the intention to put in place import permits, phytosanitary measures and quarantine regulations. Specifically, the PRA results are intended to be used to update import regulatons to remove pests that should not be regulated and add those that should be regulated, thus influencing trade flows between countries. To better understand how PRA results have been used in practice, we asked the same question to groups of PRA users in Ghana and Zambia (Box 1 and Box 2).

Fig. 7. Intended courses of action followed after a PRA, 2022 PRA survey.

Box 2. Zambia case study.

Introduction

A total of twenty-five institutional representatives participated in the in-depth stakeholder

discussions. All the respondents had participated in CABI training in the use of PRA and HST. Stakeholder discussions were held in various locations including Lusaka, Chilanga, Kabwe, Chirundu, Kafue and Choma. Discussions included researchers, academics and staff of regulatory institutions. Half had used the HST after their training, a few (37%) had utilized only the PRA Tool, while a much smaller proportion (13%) had used both tools after their training. Although most representatives had used **both tool** without any difficulties, they all felt that thei**r** internet dependency reduces their usage as they have limited internet connectivity.

Zambia NPPO use of the PRA: Findings from a PRA were used to develop an addendum which prescribes the requirements or preconditions for importation of a specific commodity

with the aim of preventing cross-border spread of pests. The completed addenda pertaining to various commodities are deposited in the Phytosanitary Information Management System (PIMS) and periodically updated as needed. The addendum as well as the PRA results are shared digitally with key stakeholders in the country. Results have been shared either by email or via the Zambia Electronic Single Window - a trade facilitation platform that brings Transparency, Efficiency & Predictability (PEP) in the international trade supply chain of the country. The platform aims to facilitate trade by enabling stakeholders to obtain permits (such as trade import/export permits) for all Cross Border Regulatory Agencies. The inclusion of the Plant Quarantine and Phytosanitary Service (PQPS) addendum on the national trade facilitation platform means that both public and private stakeholders are able to access regulations (i.e. sanitary/phytosanitary measures) and subsequent changes. The system creates transparency thus reducing inconsistent practices by border officials.

Key lessons learnt

Case studies from Ghana and Zambia as well as follow-up interviews with different users who responded to the PRA survey provide key insights on some of the outcomes and impacts of the use of the PRA Tool (see Box 1 and Box 2 for key insights from Ghana and Zambia), as follows:

- *A PRA can provide justification for government policy actions*: The PRA Tool can and has been used to support policy actions for different sectors. In Ghana, the result of a PRA was used to impose a ban on imported tomatoes from Morocco as a means to reduce the risk of introducing the *Tomato Torrado Virus* (ToTV).
- *PRA results can lead to a series of different courses of action, intended and unintended, which can affect stakeholders differently.*
- *Follow-on actions from a PRA can highlight weak links in government/policy systems and processes*. In the case of Ghana, in the process of enforcing the import ban on tomatoes from Morocco, the government could only 'track and trace' those importers that had brought in the tomatoes via the legal route i.e. with an import permit. Other importers, it turned out, had imported tomatoes into the country illegally – hence even after the known tomato consignments from Morocco were destroyed, infected Morocco tomatoes were being reported in the country (either by consumers or found via random testing). The source of the tomatoes however could not be traced to any known importer. As a result of this, the government put in place a programme to better protect the border to curb illegal importation.
- *A PRA can enable the mainstreaming of pest risk assessments into other national policies.* In the Zambia case, the integration of the PQPS addenda with the preconditions for importation of a specific commodity with respect to pest risks is a case in point.

Conclusion

CABI's Horizon Scanning Tool (HST) and PRA Tool were launched in 2018 and 2019, respectively, and have since undergone enhancements to improve their design, usability and technical content in response to user needs. An assessment of their use and outcomes of use show that both tools are valuable resources as pest risk decision support. CABI's provision of free subscriptions and training has resulted in higher usage in countries receiving attention. This has been enabled by CABI's funded programmes such as Action on Invasives (2018–2021), Plantwise Plus (2021 onwards), regional projects funded by various donors and training

partnerships with other organizations. Despite this, the study finds that poor internet connectivity in the global south hinders utilization of both tools. Furthermore not all NPPOs have taken up their gratis access to the PRA.

Finally, the study finds that use of the tools can result in far-reaching policy outcomes, if used to trigger the use of risk information for market access negotiation. The study demonstrated that the PRA tool has been used to provide justification for trade negotiations and to facilitate multi-sectoral inter-agency collaboration. Furthermore, there are cases that show that PRA work using the tool has led to the inclusion of pest risk assessment in related national policies and strategies and that the results have helped to highlight weak links in government/trade policy systems and processes that require a different approach.

Study limitations

The main limitation of the study is that some of the users for the in-depth country case studies had been trained very recently on the use of the tools. As a result of this, they were not able to provide long term insights on the consequences of use of either tool. This limitation was overcome by focusing on the tool that such users had been trained on first and with which they had most experience. Future studies should build on this, and make efforts to interview users who are in the earlier training cohorts. A second minor limitation was lack of availability of users for scheduled interviews for the in-depth country case studies. This was overcome by rescheduling interview dates and times to suit their availability.

Recommendations

The key recommended actions from the study for which CABI should seek funding or should incorporate into current funded programmes are as follows:
- Support users in the global south faced with poor internet connectivity and high internet costs to learn how to utilize the tools using both the online platform and offline facilities available for both the HST and the PRA. This can be incorporated in training programmes, thus ensuring that users are knowledgeable as to how they can fully utilize the tools even when faced with limited internet.
- Continue to monitor usage and gather user requirements for enhancements. This can be done through the PRA mailbox, training events, networking opportunities and direct consultations.
- Support users, such as NPPOs and other regulatory bodies, to use the results from PRA processes to influence policy towards risk based phytosanitary regulations.
- Conduct research to better determine the motivations or hinderances to taking up the PRA Tool for eligible NPPOs. Understand whether alternative, appropriate tools are being used in target regions. Other areas of research should foucs on quantifying the benefits accruing to users of the tools, i.e. at institutional level for example, to determine how many person-hours are saved by using the PRA tool as compared to paper-based versions.

Acknowledgements

Funding

References

Boice, J. (2021) Review of the CABI Horizon Scanning Tool (https://www.cabi.org/Horizonscanningtool). Reviewed by Jocelyn Boice, Colorado State University Libraries, Fort Collins, Colorado. *Journal of Agricultural & Food Information* 22(3–4), 138–140. https://doi.org/10.1080/10496505.2021.1967219

Cameron, K., Otieno, W., Richards, G., Oronje, M., Day, R. *et al.* (2018) Pest risk analysis decision support. CABI. https://www.cabi.org/wp-content/uploads/Product-and-services/publishing-Docs/PRA-tool-summary_v2.pdf

Coles, W. (2018) CABI launches invasive species Horizon Scanning Tool. *International Pest Control* 60(3), 158–158.

Dicks, L.V., Walsh, J.C. and Sutherland, W.J. (2014) Organising evidence for environmental management decisions: A "4S" hierarchy. *Trends in Ecology and Evolution* 29(11), 607–613. https://doi.org/10.1016/j.tree.2014.09.004

Doughty, L., Charles, L., Richards, G., Curry, C., Parr, M. *et al.* (2019) Combatting the threat of globalization and pest invasions with a workflow tool for risk assessment. CABI Action on Invasives. Presentation at the International Pest Risk Research Group (IPPRG) 2019 annual meeting. https://pestrisk.org/wp-content/uploads/2019/10/1_5_IPRRG2019_Doughty.pdf

Kendig, A., Canavan, S., Anderson, P., Flory, S., Gettys, L. *et al.* (2021) Scanning the horizon for invasive plant threats to Florida, USA. *ARPHA Preprints* 1, e76705. https://doi.org/10.3897/arphapreprints.e76705

Kenis, M., Agboyi, L.K., Adu-Acheampong, R., Ansong, M., Arthur, S. *et al.* (2022) Horizon scanning for prioritising invasive alien species with potential to threaten agriculture and biodiversity in Ghana. *NeoBiota* 71, 129–148. https://doi.org/10.3897/neobiota.71.72577

Lowry, A.L., Gonzalez-Moreno, G., Andriaens, T., Beale T., Doughty, L. *et al.* (2019) Semi-automatic prioritization of species for pest risk analysis using the CABI Horizon Scanning Tool. Presentation made at the International Pest Risk Research Group

(IPRRG) 2019 annual meeting. https://pestrisk.org/wp-content/uploads/2019/10/1_12_IPRRG2019_Lowry.pdf

MacLeod, A. and Spence, N. (2020) Biosecurity: tools, behaviours and concepts. *Emerging Topics in Life Sciences* 4(5), 449–452. https://doi.org/10.1042/ETLS20200343

Mulema, J.M.K., Day, R., Nunda, W., Akutse, K.A., Bruce, A.J. *et al.* (2021) Prioritization of Invasive Alien Species With Potential to Threaten Agriculture And Biodiversity in Kenya Through Horizon Scanning. Research Square. https://doi.org/10.21203/rs.3.rs-886417/v1

Rose, D.C., Sutherland, W.J., Parker, C., Lobley, M., Winter, M. *et al.* (2016) Decision support tools for agriculture: towards effective design and delivery. *Agricultural Systems* 149, 165–174. https://doi.org/10.1016/j.agsy.2016.09.009

Rossi, V., Sperandio, G., Caffi, T., Simonetto, A. and Gilioli, G. (2019) Critical success factors for the adoption of decision tools in IPM. *Agronomy* 9(11), 710. https://doi.org/10.3390/agronomy9110710

Roy, H.E., Peyton, J., Aldridge, D.C., Bantock, T., Blackburn, T.M. *et al.* (2014) Horizon scanning for invasive alien species with the potential to threaten biodiversity in Great Britain. *Global Change Biology* 20(12), 3859–3871. https://doi.org/10.1111/gcb.12603

Taechatanasat, P. and Armstrong, L. (2014) Decision Support System Data for Farmer Decision Making. Proceedings of Asian Federation for Information Technology in Agriculture, 472–486. https://ro.ecu.edu.au/ecuworkspost2013/855/

Taylor, B., Casey, J., Annamalai, S., Finch, E.A., Beale, T. *et al.* (2021) Minimising pest and disease risks in uncertain climates: CABI initiatives developing new technologies and tools for outreaching early warning to farmers. *AgriRxiv*. https://doi.org/10.31220/agriRxiv.2021.00064

Annexes

Annex 1: HST Hotjar survey

We are currently carrying out a study to investigate the benefits of use of the Horizon Scanning Tool (HST). We are collecting stories about its impact, to help us demonstrate its value. We would like to ask some simple questions about your use.

The survey will take about 5 minutes of your time. The information from this survey will remain anonymous. Would you like to take part in the survey?

-- If yes, takes you to the questions below --------------------------

1. What is your main occupation?
   a. Plant protection officer
   b. Risk assessor/analyst
   c. Risk manager
   d. Quarantine officer
   e. Policy maker
   f. Researcher
   g. Trainer
   h. Government extension officer
   i. Private extension service provider
   j. Farmer/grower
   k. Student
   l. University staff
   m. NGO / Civil Society staff
   n. Other (please specify) FREE TEXT BOX (only appears when choose this option)

2. How does the use of the HST help in your work? (Tick all that apply)

   a) Identifying and categorizing pests or invasive species that might enter a particular area from another area
   b) Identifying and categorizing pests or invasive species associated with particular hosts or plant commodities that might enter a particular area from another area
   c) Identifying and categorizing pests or invasive species associated with particular habitats that might enter a particular area from another area
   d) Identifying and categorizing pest or invasive species associated with particular pathways of introduction that might enter a particular area from another area
   e) Building lists of pests present in a specific geographical area
   f) Provides quick access to relevant information
   g) Saves searching many different websites for information
   h) Provides accurate and up to date information
   i) Provides information not available elsewhere
   j) Presents information in a useful format for my needs
   k) Increases the quality of my research or (project) work
   l) I have not used the HST for my work
   m) Other (please specify) FREE TEXT BOX (only appears when choose this option)

3. What follow-on actions/activities did you take as a result of the information that you gathered from the HST?
   a) Conducted detailed risk assessment/analysis (PRA)
   b) Information used for surveillance
   c) Used information for rapid response and contingency planning
   d) Used information for raising public awareness

e) Took direct action to prevent pest introduction and spread
f) Research
g) Training/teaching
h) Project proposal
i) Policy / regulatory framework development
j) Journalism
k) Other (please include details below) FREE TEXT BOX (only appears when choose this option

4. Please could you share an example of how you have used the HST in your work? FREE TEXT BOX

- May we cite this example in a public report on the use and benefits of the HST? (The information will remain anonymous, unless you wish to be cited) YES/NO OPTION

- Please provide your contact details including your name and email address:
  o Name: FREE TEXT BOX
  o Email address: FREE TEXT BOX
- May we contact you for follow up questions on this example? YES/NO OPTION

Annex 2: PRA subscriber survey

We are currently carrying out a study to investigate the consequences of using the Pest Risk Analysis (PRA). We are collecting stories about its impact, to help us demonstrate its value. We would like to ask some simple questions about your use.

The survey will take about 5 minutes of your time. The information from this survey will remain anonymous. Would you like to take part in the survey?

-- If yes, takes you to the questions below --------------------------

1. What is your main occupation?
    a. Plant protection officer
    b. Risk assessor/analyst
    c. Risk manager
    d. Quarantine officer
    e. Policy maker
    f. Researcher
    g. Trainer
    h. Government extension officer
    i. Private extension service provider
    j. Student
    k. University staff
    l. NGO / Civil Society staff
    m. Other (please specify) FREE TEXT BOX (only appears when choose this option)

2. What is your most frequent approach for initiating a PRA?
    a. 'By Pathway'
    b. 'By Pest'
    c. I have used both on different occasions.

3. Why have you used the PRA Tool? Choose all that apply.
    a) To generate a pest list for a plant commodity import
    b) To generate a pest list for market access (export)
    c) To determine pest risk and phytosanitary measures for a plant commodity import
    d) To assess whether a pest should be regulated
    e) To conduct a PRA on a pest that has been intercepted
    f) To conduct a PRA on a pest that has already been introduced to the area
    g) To conduct a PRA on an organism intended for introduction (e.g., biological control agent, plant for planting, research)
    h) As a training aid to learn about the PRA process
    i) As a training aid to teach the PRA process
    j) Other (please specify) FREE TEXT BOX (only appears when choose this option)

4. What courses of action have been undertaken as a result of using the PRA? FREE TEXT BOX

5. May we contact you for follow-up questions? YES/NO OPTION

6. If yes, please provide your contact details including your name and email address:
    a. Name: FREE TEXT BOX
    b. Email address: FREE TEXT BOX

Annex 3: In-depth interview guide

Use and benefits of the PRA and HS tools
In-depth interview guidelines

Thank you for consenting to this in-depth interview. As you already know from the survey that you filled in, CABI is conducting an assessment to determine the benefit of use of the PRA/ HST tool. We would like to use this interview to better understand your use of the tool, specifically what follow on actions were taken as a result of using the tool as well as to capture any other useful information, about the impact of use, that was not captured in the survey.
The interview should take about 1 hour to complete.
Note for interviewer: Refer only to the relevant tool where PRA/HST appears.

Classifying questions
1. Which CABI tool have you used?
   a) PRA
   b) HST
   c) Both the PRA and HST

2. Have you had any problems with access or use of the tool? If yes, please explain.
Depending on tool selected, questions should be asked pertaining to the tool. For institutions that have done both, conduct two separate interviews with focus on each tool.

Guiding Questions for interview
3. Why did you decide to use the *PRA/HST* tool in your work? *Probe to get understanding of the details around the context that lead to the decision to choose the tool.*

4. Which of the two tools (PRA/HST) do you use frequently and why? *Only for those that have used both tools.*

5. Who was involved in the work? In terms of staff within the institution, other stakeholders in cases of collaboration.

6. Did using the PRA tool allow you to do a PRA in a new/different way from in the past?
For PRA users only

7. Apart from the CABI's PRA/HST, where any other risk assessment tools used and risk assessments conducted? Please provide details, how are these linked to CABI's PRA/HST?

8. What actions were taken after the results from the PRA/HS? *Probe to determine i) what happened after the prioritized pest lists were produced; ii) if results were shared and with whom? iii) what channels were used to disseminate results; and iv) what decisions were made as a result of the PRA/HST findings; v. If results were not shared what could be the reason(s)?*

9. Were any of the following conducted or put in place after the PRA/HS results? Where any changes made to how these are implemented as a result of the HS/PRA work? *If these were mentioned above in question 6, refer back to their response – determine where any of this conducted, what actions were taken after these, what has been the impact.*
   a) Surveillance (quarantine pests)
   b) Border inspections
   c) Import controls & conditions
   d) Contingency planning
   e) Emergency response

10. How was data generated from the implementation of actions in question 9 used or are there any plans to use data from the activities in question 6 for future pest risk assessments? Explain.

Final questions

11. Is more training or time needed for more familiarization with the tool? Yes/No, explain.

12. What are your expectations/plans for using the tool in the future?

13. Are there any particular changes that would make the tool more useful for their work?

14. Will your institution be willing to assist other institutions, willing to subscribe to the tool, on how to use the PRA? Yes/No. Explain.

15. Are you aware that you can contact the Compendium team to update pest records in the Compendium/tools (PRA@cabi.org (tools), compend@cabi.org (general compendium content) or support@cabi.org (technical)?

contact CABI

Africa

Kenya
CABI, Canary Bird
673 Limuru Road, Muthaiga
PO Box 633-00621
Nairobi, Kenya
T: +254 (0)20 2271000 / 20
E: africa@cabi.org

Ghana
CABI, CSIR Campus
No. 6 Agostino Neto Road
Airport Residential Area
P. O. Box CT 8630, Cantonments
Accra, Ghana
T: +233 (0)302 797 202
E: westafrica@cabi.org

Zambia
CABI, Southern Africa Centre
5834 Mwange Close
Kalundu
P.O. Box 37589
Lusaka, Zambia
T: +260 967 619 665
E: southernafrica@cabi.org

Americas

Brazil
CABI, UNESP-Fazenda Experimental
Lageado, FEPAF (Escritorio da CABI)
Rua Dr. Jose Barbosa de Barros 1780
Fazenda Experimental Lageado
CEP:18.610-307
Botucatu, São Paulo, Brazil
T: +55 (14) 3880 7670
E: y.colmenarez@cabi.org

Trinidad & Tobago
CABI, 59 Gordon Street, St Augustine
Tunapuna 331323
Trinidad and Tobago
T: +1 868 6457628
E: caribbeanLA@cabi.org

USA
CABI, 6 Liberty Square #2775
Boston, MA 02109, USA
T: +1 (617) 682-9015
E: h.jansen@cabi.org

Asia

China
CABI, Beijing Representative Office
Internal Post Box 85
Chinese Academy of Agricultural Sciences
12 Zhongguancun Nandajie
Beijing 100081, China
T: +86 (0)10 82105692
E: china@cabi.org

India
CABI, 2nd Floor, CG Block,
NASC Complex, DP Shastri Marg
New Delhi – 110012, India
T: +91 (0)11 25841906
E: india@cabi.org

Malaysia
CABI, PO Box 210,
43400 UPM Serdang
Selangor, Malaysia
T: +60 (0)3 89432921
E: cabisea@cabi.org

Pakistan
CABI, Opposite 1-A,
Data Gunj Baksh Road
Satellite Town, PO Box 8
Rawalpindi, Pakistan
T: +92 51 9292062
T: +92 51 8434979
E: cabi.cwa@cabi.org

Europe

Switzerland
CABI, Rue des Grillons 1
CH-2800 Delémont, Switzerland
T: +41 (0)32 4214870
E: europe-CH@cabi.org

UK
CABI, Nosworthy Way
Wallingford, Oxfordshire, OX10 8DE, UK
T: +44 (0)1491 832111
E: corporate@cabi.org

CABI, Bakeham Lane
Egham, Surrey, TW20 9TY, UK
T: +44 (0)1491 829080
E: cabieurope-uk@cabi.org
E: microbialservices@cabi.org

KNOWLEDGE FOR LIFE