



The Socioeconomic Impact Assessment of Red Palm Weevil in Egypt and Saudi Arabia: An Ex-ante Evaluation

R4D BRIEF

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HIGHLIGHTS

- Persistent devastating effects and considerable negative socioeconomic impacts of the Red Palm Weevil (RPW) were observed in Date palm farming systems of Egypt and Saudi Arabia.
- The RPW, widely spread in Egypt affecting about 7% of the current date palm population in the country, was detected on 94% of the surveyed farms. In Saudi Arabia, the RPW infestation is equally upsetting, impacting about 2% of the Date palm population in the country and was detected on 53% of the surveyed farms.
- Ongoing control and treatment programs annually cost Egypt and Saudi Arabia more than USD 5.7 million and USD 34.4 million, respectively.
- The ongoing control and treatment programs have achieved less than 75% success, inducing annual losses of more than USD 213 million and USD 401 million in Net Present Worth of investment in the form of falling Date palms and associated forgone revenues in Egypt and Saudi Arabia, respectively.
- All Egypt governorates were similarly ranked in terms of perception risk related to RPW. Compared to Aswan and Al-Wahaat Albahria, As-shargia was the most vulnerable governorate in terms of perception risk and governance effectiveness related to RPW, characterized by lower training and public support index levels.
- All Saudi governorates were similarly ranked at the medium perception risk level but differently at the governance effectiveness level. The best level of Riyadh governorate to the governance effectiveness was due mainly to the high appreciation of its farmer's perception of government support and to the high performance of the inspection and control team.
- The risk of further spread of the RPW in both countries is looming.
- Thus, reforming the governance of the Date palm farming system and devising mitigation strategies are urgently required to enhance the resilience of the Date palm ecosystem in both countries.
- Enhancing early detection of infestation, strengthening plant quarantine systems (external or internal), promoting farmers' knowledge and awareness to facilitate the adoption of good agricultural practices, and actively engaging farmers and their supportive stakeholders in pest control efforts are key policy actions needed in both countries.
- Strengthening the governance of the date palm ecosystem is essentially concerned with enabling effective and efficient problem-solving in ways that are regarded as legitimate by the stakeholders who are directly affected by the decisions and actions undertaken within or by any governance structure or regime.

Introduction

Dates are economically, socially, culturally, and ecologically important fruit crops in the Near East and North Africa (NENA) countries. Dates also play important roles in the history, heritage, and socioeconomic life of the Arab population. They are one of the basic sources of income and employment and are among the main staple foods for local inhabitants, especially in the oases. Date palms give multiple benefits and services, including high-energy food, medicine for some diseases, shelter, microclimate, protecting plants growing under its shade from wind and high temperature, secure inputs to food industries and handicrafts, and providing by-products useful for many purposes. The Arab or the NENA Region dominates in Dates production and trade. About 75% of the global area of 1.35 million ha under date palm is in the Arab Region, producing more than 77% of the world's production of about 9.2 million metric tons in 2020 (Ahmed and Ijaimi, 2022).

However, the Red Palm Weevil (RPW) (*Rhynchophorus ferrugineus*) is identified as a major transboundary pest in NENA countries, adversely affecting the date palm industry. The Food and Agriculture Organization of the United Nations designated the pest as a Category-1 pest of date palms for the NENA countries (FAO, 2017). The pest attacks around 40 palm species in more than 50 countries and is believed to have significant negative socioeconomic impacts (Ahmed and Ijaimi, 2022). The pest results in huge loss in production, productive assets

(date palms), income, added costs for the measures taken to control and restrain its spread, as well as environmental hazards and negative externalities associated with over-dependence on pesticides.

Moreover, the RPW is a major destructive pest for many palm species, including date palms, and has a high potential for spread. Originating in southeast Asia, the RPW has spread mainly through infested planting material and reached almost every corner of the globe (Manee et al., 2023). Ever since it was reported from Rass-El-Khaima in the UAE in 1985, it spread rapidly to all countries of the Gulf region in the Middle East. In 1987, it was reported in the Al Qatif area in the Eastern Region of Saudi Arabia, and in November 1992, it crossed to Africa and reached the Salehia locality in Egypt. The increased and rapid movement of date palm seedlings and inappropriate management practices have contributed to the rapid spread of RPW across these countries. The infestation spreads almost all over the two countries, except Toshka and East Owenite oases in the Western Desert in Egypt and Jizan and the Northern Borders regions in Saudi Arabia (Ahmed and Ijaimi, 2022, Alotaibi et al, 2022).

In this context, FAO and the Arab Organization for Agricultural Development (AOAD) have made enormous efforts to eradicate the RPW. In 2018, the “strategic framework for the sustainable development of date palm value chain in the Arab region – Horizon 2030” was jointly formulated by the

AOAD and FAO. The first strategic pillar of the framework was the intensification of national programs for the prevention and control of the RPW, including early detection of infestation. The follow-up “Framework Strategy for Eradication of the RPW” developed in 2019 by FAO and key international partners included regional technical working groups (TWGs) designed to assist the NENA countries in improving their strategies and programs of RPW management to contain its infestation and spread across countries and to limit crop damage (FAO, 2023). Assessing the socioeconomic and environmental impacts of the RPW spread and control regimes constitutes one of the TWGs. Egypt and Saudi Arabia were selected by the collaborating partners in the regional program for the impact assessment of the RPW.

1.2. Objectives of the Research

The overall objective of this project is to assess the socioeconomic impact of RPW spread, contributing to the design of socially sensitive and economically sustainable measures for enhancing the resilience of dates production systems against the threats of RPW. The specific objectives include:

- Characterize the existing state of the Red Palm Weevil (RPW) spread and control in Egypt and Saudi Arabia.
- Quantify the socioeconomic impacts of the RPW spread and identify the main intervention measures in Egypt and Saudi Arabia.
- Elucidate the perceptions of farmers in dates production and

protection of RPW spread as well as efforts to contain it.

- Assess the perception risk and governance effectiveness indicators of RPW

2. Methodological Framework

The Ex-ante assessment of the socioeconomic impacts of RPW along the supply chain of date palms in the two countries took 34 weeks (October 2021- May 2022). Quantitative and qualitative methods were used to assess the economic and social impacts of the RPW spread, its control regimes, and the perceptions of the RPW-impacted groups (stakeholders). Primary and secondary data were used for the ex-ante impact assessment. More specifically, a review of the literature, scoping mission, key informant interviews, focus group discussions, and perception surveys were conducted to gather data and analyze the impact of RPW.

The scoping study and literature review were done to identify useful research methods and cost-effective tools for the assessment of the impacts of the RPW spread and its control mechanisms. The scoping study helped frame the data

collection process and methods used for the socioeconomic evaluation of RPW, identify the types of information needed and the sources of the information, the types of groups impacted, and their selection for the study sample¹, and resources required for data collection.

Quantitative analyses were done for the socioeconomic impact of RPW using analysis of simple accounts and Partial Budgets. The Partial Budget Analysis (PBA) technique evaluates the economic consequences of an adjustment or a change that impacts part of the farm organization through direct changes to cost and revenue streams (Horton, 1982; Soha, 2014). The benefit-cost² comparison was made with and without situations by comparing cost and revenue parameters under RPW infestation situation versus without RPW infestation. The economic consequences of RPW infestation should consider the dynamics of both investment/cost and revenue streams. This is because the consequences of RPW normally extend beyond one year in the case of treated trees (nearly 10 years) until the new replacement offshoots reach stable production in the case of falling down trees. The total economic consequences over more

than one year should be expressed as net present worth discounted at an appropriate discount rate to calculate NPW for the whole 10-year period. The appropriate discount rates reflecting the inflation figures were obtained from the National Banks of the respective study countries.

Qualitative analyses were also done to evaluate the perceptions of stakeholders and support the financial results of PBA. The qualitative analyses provided an in-depth explanation of the socio-economic implications and cost-effectiveness of the various preventative and adaptive measures for the control of RPW. The qualitative studies also ensured effective participatory action, providing in-depth information on complex issues and explaining why the current RPW spread situation occurred and facilitating dialogue with key informants to identify the right participants for the farm survey and their perceptions³ about the pest. Furthermore, we identified a group of indicators to evaluate the perception risk of the RPW establishment and spread, and the effectiveness governance of the pest management system (ex-ante interventions) for RPW, inside the supply chain. The conceptual framework was based on FAO Sustainability Assessment

- 1 The sampling frame for the selection of respondents for primary data collection was based on the territorial distribution of Date palms within each country, and the associated incidence of RPW infestation, the variations in farming systems, and the type of control measures adopted.
- 2 The key informants as well as small-and large-scale producers interviewed in the targeted countries believed that the RPW infestation neither affected the quality of Dates nor reduced production to the extent that significantly influenced market forces, prices, and market changes. Hence, econometric tools that could capture market changes such as partial and general equilibrium analysis were not done.
- 3 The perception assessments include knowledge of the pest, the devastating nature of the pest, the efficacy of applied detection and control measures, experiences and attitudes towards extension and other service providers, farmers' involvement in the pest control program, and the constraints impeding their participation, and general views on related policies and attributes.

of Food and Agriculture Systems (SAFA) tool, particularly the dimension of sustainability “Good governance” at the farm level. The concept was a structured system of indices that ranks and scores the concerned countries and their selected governorates according to their likelihood and suitability for RPW establishment and spread. As such, we divided the assessment of the concerned farms into two macro areas: (i) Perception risk (P) and (ii) Governance effectiveness (G) towards RPW invasion. At “perception risk” level, the target countries and their selected governorates were scored and ranked for each index (indicator), according to obtained survey data, assembled into five relative score/rank categories, and then arranged so that each country and governorate is positioned between the following evenly-spaced percentiles: Least risk (value 1) is below the 20th percentile; Lower risk (value 2) is between the 20th and 40th percentiles; Medium risk (value 3) is between the 40th

and 60th percentiles; High risk (value 4) is between the 60th and 80th percentiles, and Highest risk (value 5) is above the 80th percentile. The percentile compares the category risk of one governorate to the others. In other words, it is the percentage of data (i.e., indices) for which the assessed governorate falls at, below or above a certain observation. Therefore, it shows where a governorate’s score falls in comparison to other governorates.

3. Major Empirical Findings

The key results indicate persistent devastating negative impacts with huge losses to the national economy of Egypt and Saudi Arabia despite enormous efforts to control the RPW. Ongoing treatment programs annually cost Egypt and Saudi Arabia more than USD 5.7 and 34.4 million, respectively. The treatment programs also achieved less than 75% success. The treatment programs failed to

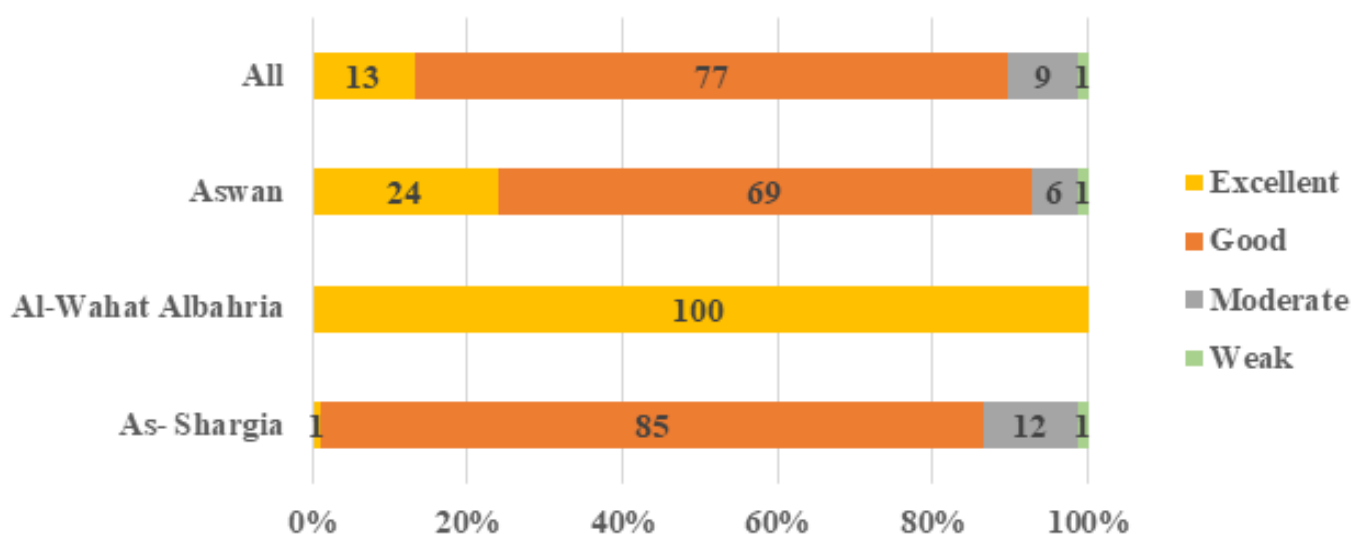
recover the annual loss of more than USD 213 million and 401 million net present worth of investment in the form of falling Date palms and associated forgone revenues in Egypt and Saudi Arabia, respectively. We describe key findings in more detail for the case of Egypt and Saudi Arabia.

3.1 The Case of Egypt

3.1.1. Existing state of RPW

The scale of detected infestation in Egypt over the last 25 years progressively expanded from 5% during 1996-2000 to 76% of the total infestations during the decade 2011-2020. Most farmers (77%) declared that detection efficiency in identifying palms infected with red palm weevil was good. By location, all farmers in Al-Wahat Albahria stated that the detection efficiency was excellent (Figure 1). Nearly 5% of the infestation occurred just during the last year (2021-2022). Head

Figure 1. The detection efficiency percentage of identifying infested palms with red palm weevil in Egypt.



Source: Elaborated from AOAD Report, 2022

infestation is the most serious (76%), followed by infestation at the bottom (19%) while the middle of the trunk infestation is the least of a problem as it is more visible and easier to treat. The results also indicated that RPW spread from neighboring farms accounted for more than 68% of the infestations. The risk of infestation is further aggravated with neglected and abandoned farms because of inheritance laws, land fragmentation, and multi-ownership. Such infestation is more noticeable in the traditional flood-irrigated Date palm farming systems as in the Aswan region where 95% of the farmers reported neighboring farms as the main source of infestations.

The results also indicate a positive correlation between the adoption of

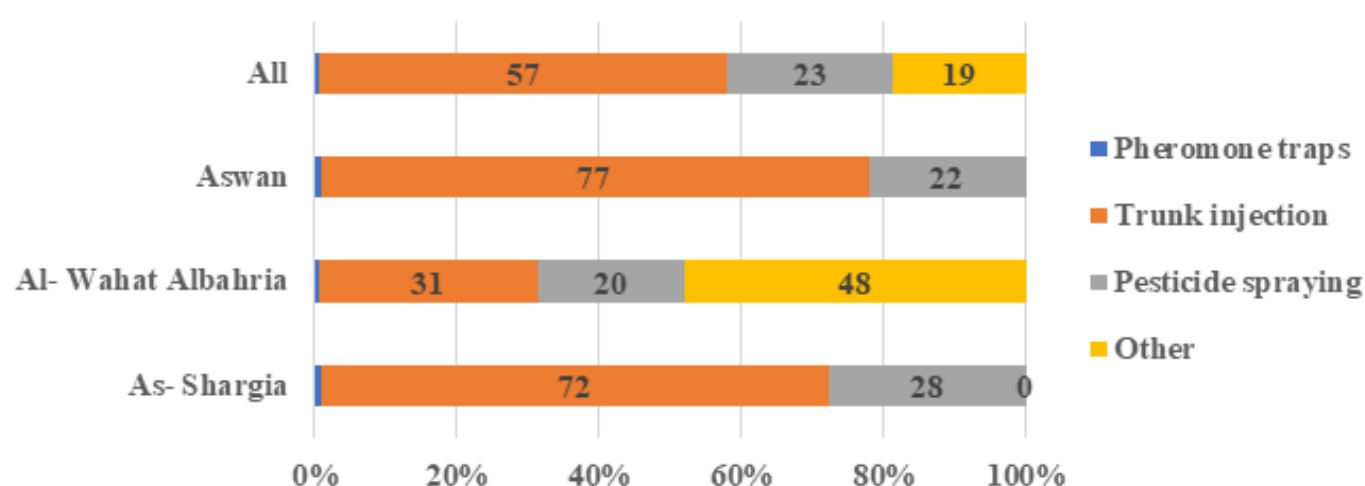
good agricultural practices and the level of RPW infestation. Generally, date palm growers in Egypt are dedicated and mindful of adopting good agricultural practices (GAP), where most date palm farms (86%) are managed by their owners. Most of the farmers were middle-aged (average of 50 years) and were reasonably educated, with more than 76% attending schools at the intermediate level and beyond, and 70% had experience in date palm farming for at least ten years. Almost all respondents (93%) understand the importance of adhering to the time and procedure specified for offshoots separation and spraying detachment place using contact pesticides or covering injuries with appropriate material/fluid to make it unsuitable for the RPW to lay

its eggs. More than 87% of the respondents reported knowledge of applying moderate irrigation to reduce moisture and lower humidity surrounding the date palm. About 86% of the respondents also reported understanding the importance of maintaining the recommended distance between trees⁴.

3.1.2. Socioeconomic impacts and farmers perceptions towards RPW management

A package of routine⁵ treatments is often applied to infested date palms at discrete points in time in Egypt. Figure 2 shows that the most preferred method of RPW control in Egypt is an injection of chemicals through the trunk of the date palm (57% of the respondents), followed

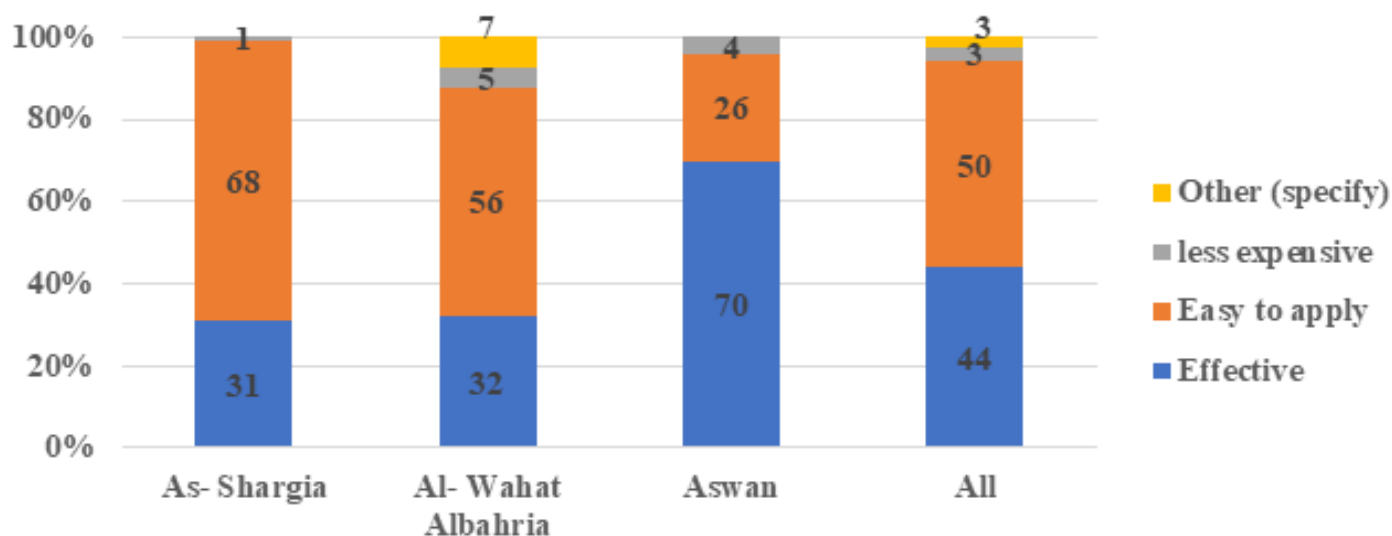
Figure 2. Farmers' preference percentage of RPW control methods in Egypt.



Source: Elaborated from AOAD Report, 2022

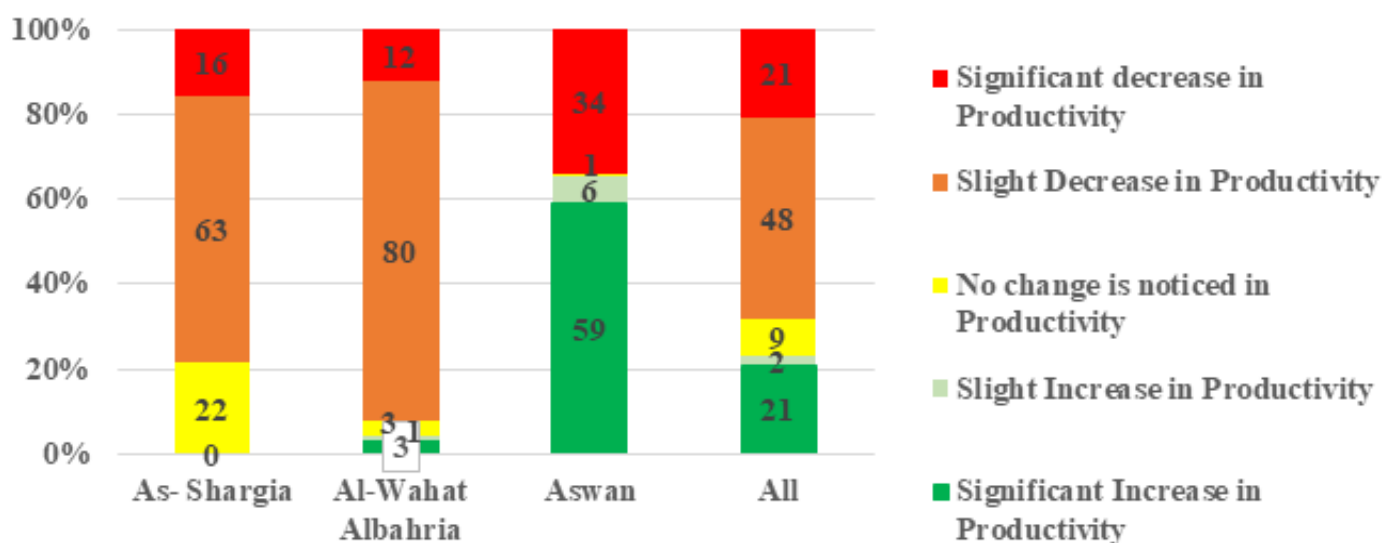
- 4 Some farmers malpractice due to their low financial capacity and poverty. In some instances, pruning was done with harvesting to save the cost of hired labor. The injuries resulting from pruning provide suitable habitat for insects to lay eggs. This malpractice of pruning increases the probability of infestation by almost 90%. Equally, failure to dispose of waste and felling date palms properly create a suitable environment for the spread of the weevil. Flood irrigation is also practiced because of the lack of finance to invest in modern localized irrigation systems in damp and humid environments at the surrounding base of the date palm which creates suitable conditions for the insect to penetrate and lay its eggs.
- 5 These practices include manual clearance of infested date palms, dipping with solutions of pesticides, injection of chemicals in the trunk, and fumigation.

Figure 3. Assessment of RPW control methods percentage by farmers in Egypt.



Source: Elaborated from AOAD Report, 2022

Figure 4. Farmers perception percentage of the impact of RPW infestation on tree productivity in Egypt.



Source: Elaborated from AOAD Report, 2022

by chemical spraying (23% of the respondents). By location, almost 48% of the farmers of Al Wahat Albahria used other RPW control methods than the pheromone traps (1%), pesticide spraying (20%) and trunk injection (31%) (Figure 2).

The preference for these two methods is mainly due to their effectiveness in the control of

the pest, as reported by 44% of the respondents and easiness of application, reported by 50% of the respondents (Figure 3). By location, most of the farmers of Aswan (70%) stated that the RPW control methods were effective, while 68% of farmers of As-Shargia declared that these methods were easy to apply (Figure 3).

Regarding the impact of RPW infestation, almost 48% and 21% of farmers perceived a slight and significant decrease in tree productivity, respectively (Figure 4). By location, nearly 80% of farmers of Al-Wahat recorded a slight decrease in tree productivity, while 34% of farmers of Aswan registered a significant decrease (Figure 4).

The national treatment cost is borne by farmers, except for the associated extension services, which is estimated at nearly USD 5.7 million. Upper Egypt region invests the lowest (21%) in the national treatment program, corresponding to the persisting high level of infestation (34%) in the region. The annual loss from a single tree average more than USD 549, resulting in an annual national loss of about USD 213 million in total revenue forgone from falling down trees.

3.1.3. Assessment of the perception risk and governance effectiveness indicators

Concerning Egypt, the three governorates were ranked at the same medium level with a slight difference in terms of perception risk, but on the other hand, As-shargia (2/5) appeared to be

the most relatively vulnerable governorate in terms of governance effectiveness related to RPW (Figure 5). When we combined the risk rankings for perception risk and governance effectiveness, the governorate ranked as most vulnerable was also As-shargia. Additionally, Al-Wahaat Albahria and Aswan were ranked at a medium risk level. In As-shargia, the training and the public support indicators (Figure 6) may explain the overall lowest level of vulnerability to the RPW invasion in Egypt. On the contrary, the high information and communication in Al-Wahaat Albahria and technical management indicators in Aswan explain their combined medium level of vulnerability to RPW invasion. In the same way, the technical management indicator is generally high in As-shargia governorate, as depicted in Figure 2.

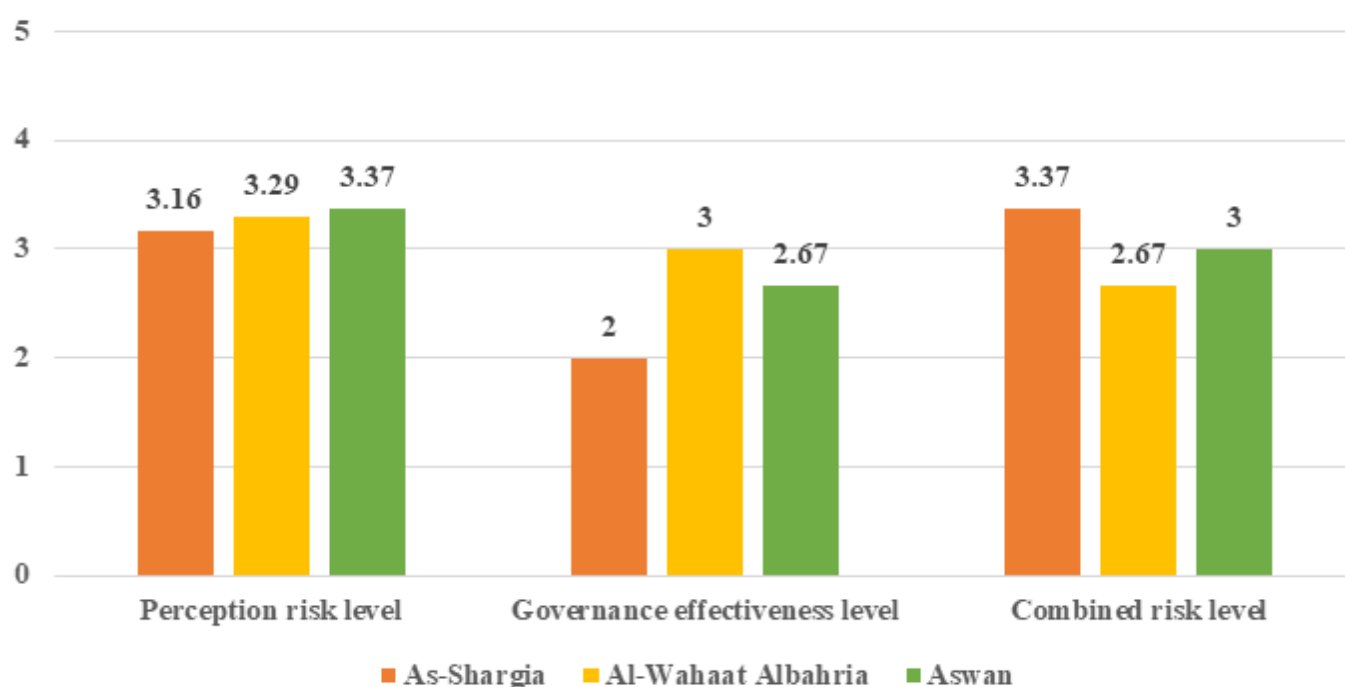
3.2 The Case of Saudi Arabia

3.2.1. Existing state of RPW

The rate of RPW spread has been rising in Saudi Arabia, with 8% of the total infestations reported during 1990-2000. It increased to 13% during the following decade (2001-2010) and almost 50% during 2011-2020. About 29% of the spread occurred last year (2021-2022).

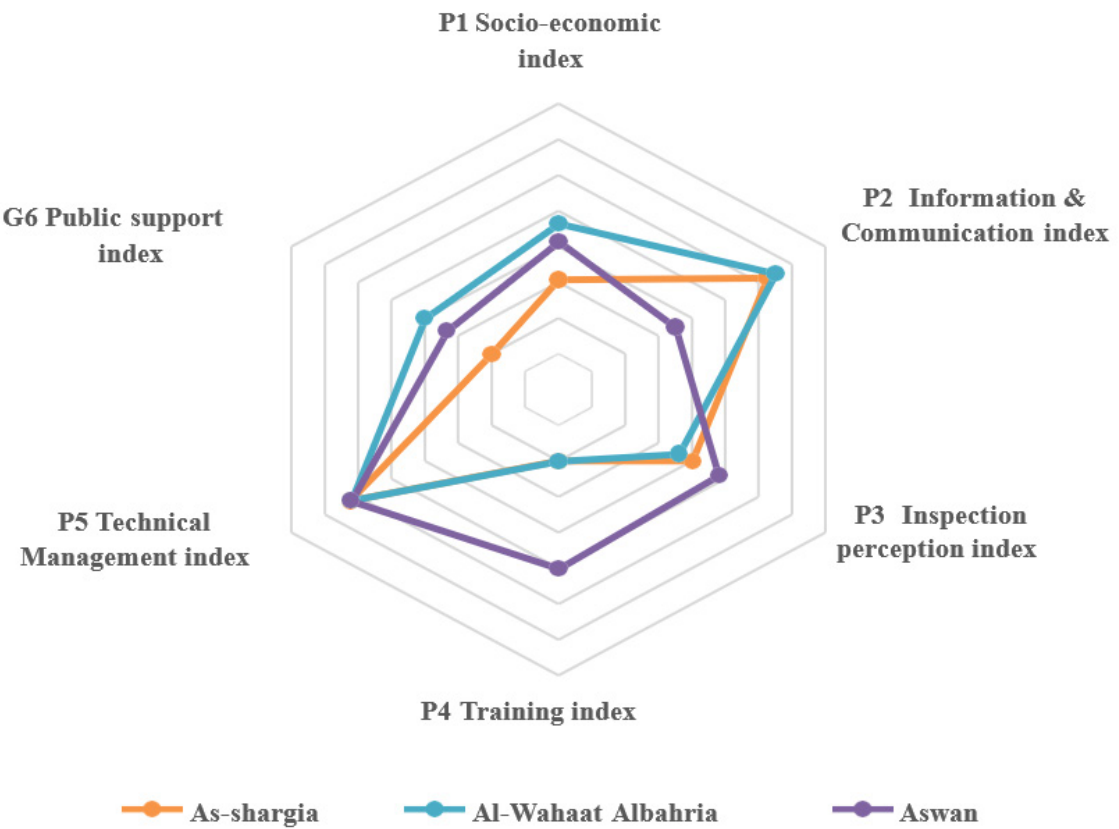
Most RPW infestations (68%) occur at the trunk, 20% at the bottom, and 12% at the head/crown of the date palm. Like Egypt, almost 43% of the respondents indicated that head infestation is the most serious due to difficulties in inspection, early detection, and effective treatment, followed by trunk infestation (35%), then bottom infestation (22.4%). Nevertheless, most farmers (68%) stated that the detection efficiency

Figure 5. Red Palm Weevil in Egypt: Assessment of the perception risk & governance effectiveness.



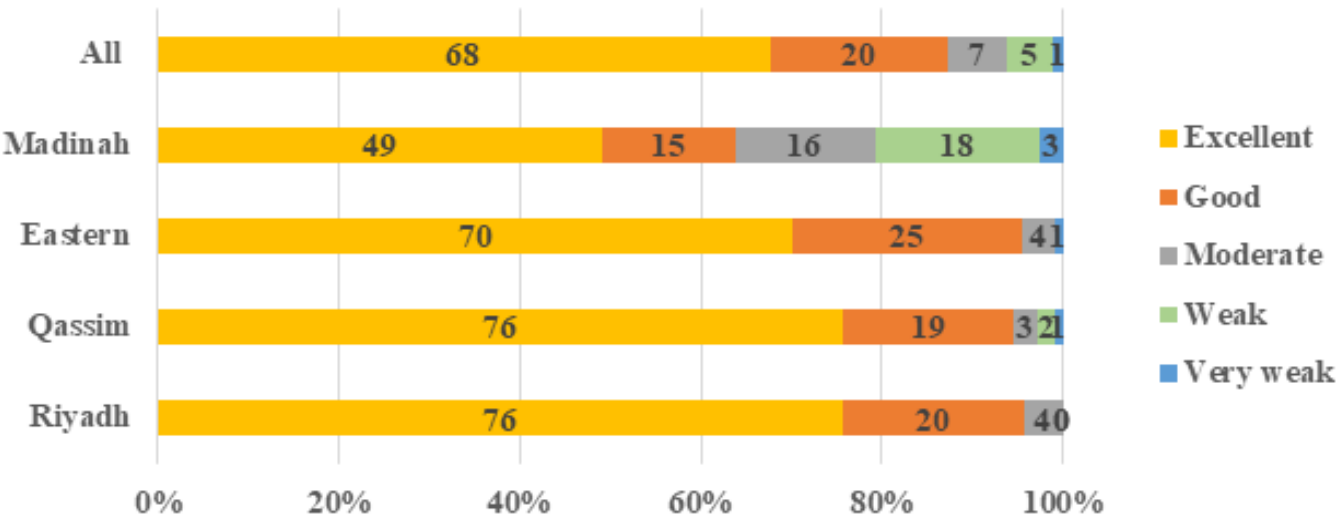
Source: Elaborated from CIHEAM-Bari Report, 2023

Figure 6. Rank categorization of Egypt's governorates according to six perception risk and governance effectiveness indicators of Red Palm Weevil.



Source: Elaborated from CIHEAM-Bari Report, 2023

Figure 7. The efficiency percentage of detection infested palms with red palm weevil in Saudi Arabia.



Source: Elaborated from AOAD Report, 2022

in identifying palms infected with red palm weevil was excellent (Figure 6). By location, only 18% and 3% of farmers in Medinah declared that the detection efficiency was weak and very weak, respectively (Figure 7).

Like Egypt, neighboring farms are the main source of the infestation, accounting for nearly two-thirds of the infestations. Similarly, the risk of the RPW spreading within the vicinity is aggravated by the extensive infestations of neglected and abandoned farms, requiring urgent corrective administrative and legal actions.

About 91% of the respondents were farmers, and 7% were farm operators, while sharecropping in date farming is rare and practised by 2% of the farmers. Date farming is not preferable for the young, with 90% of the respondents exceeding 40 years of age. The majority (80% of the respondents) have experience of more than ten years of date palm cultivation. Date farming is the main

agricultural activity contributing 80% of the income from farming.

The adult literacy rate in Saudi Arabia progressively increased to 98% by 2020, growing at an annual rate of 5.43% during recent years. For the sampled farmers, the majority (80%) have intermediate to university education. Such an impressive literacy rating reflects the high quality of social capital in Saudi Arabia. It indicates a wider margin of farmers' willingness to accept and adopt proven technologies/practices for inspection, early detection, and control of the RPW.

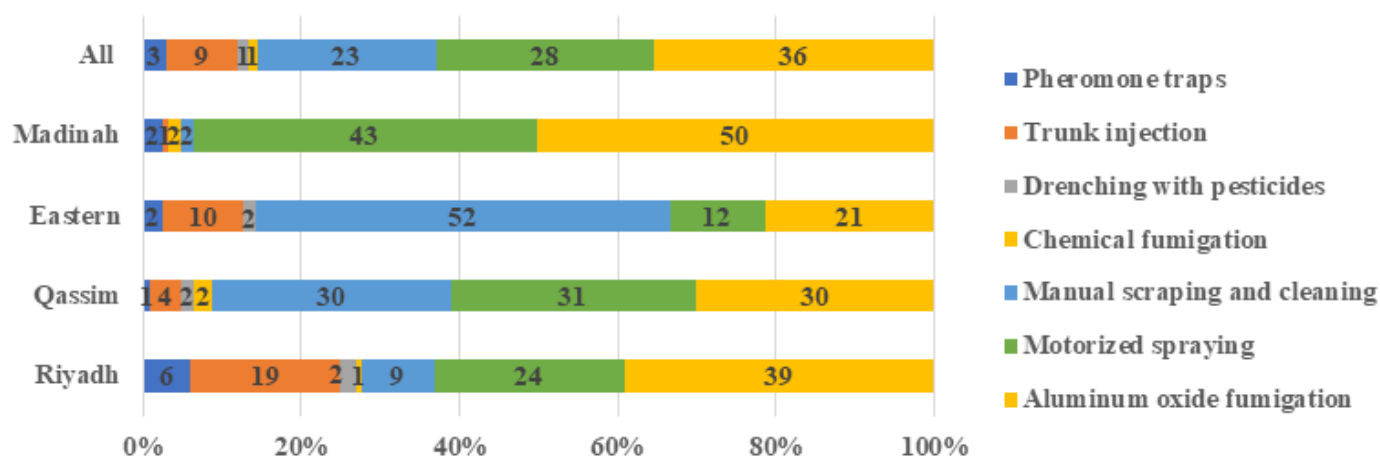
3.2.2. Socioeconomic impacts and farmer's perception towards RPW management

Adopting good agricultural practices (GAP) in Saudi Arabia is like the Egyptian farmers, reflecting the region's high proficiency in date palm farming. Most respondents (93%) understand the importance of adhering to the time and procedure specified for offshoots separation

and spraying detachment place using contact pesticides or covering injuries with appropriate material/ fluid to make it unsuitable for the RPW to lay its eggs. More than 88% of the respondents knew about applying moderate irrigation to reduce moisture and lower humidity surrounding the date palm, and 83% knew the importance of maintaining the recommended distance between trees. The shortage of seasonal labour and restrictions governing recruitments from abroad were reported as the main reasons most farmers failed to apply some of the recommended cultural practices.

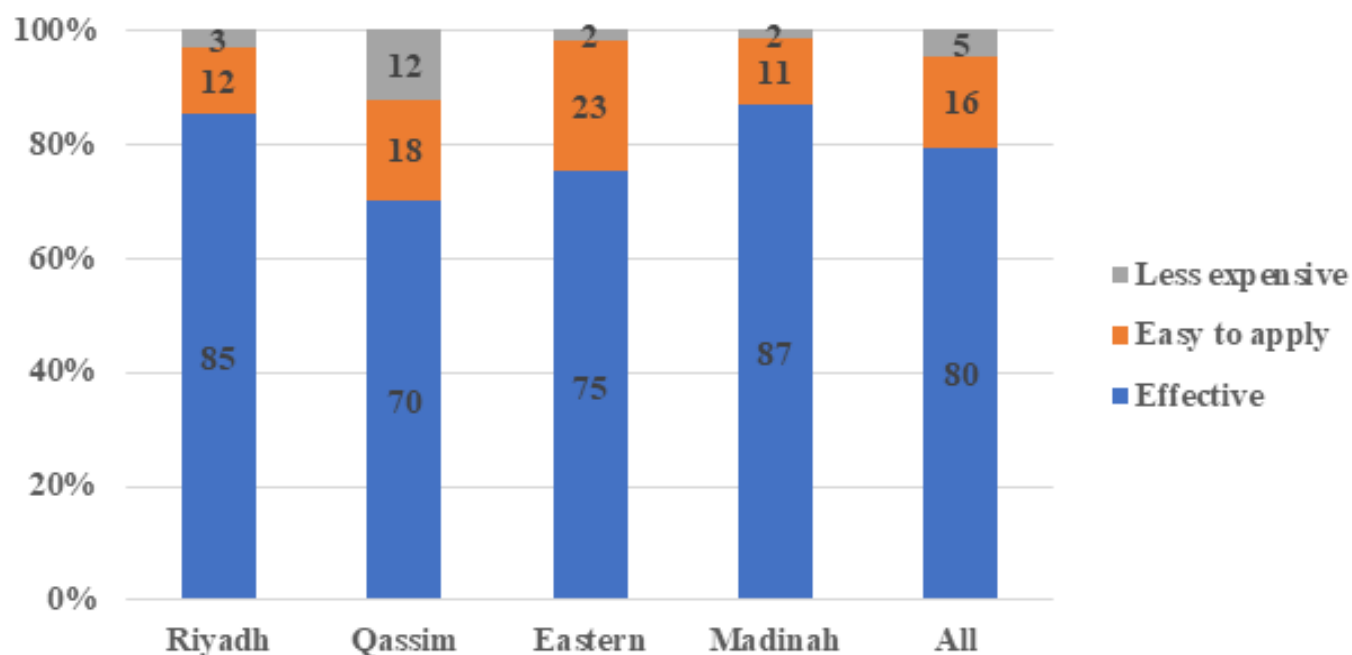
The methods of control used in Saudi Arabia include fumigation, manual scraping and cleaning, trunk injection, drenching with pesticides, and motorized spraying. However, fumigation is the most preferred method and is used by the government on all farms of up to 2000 date palms. About 36% of the respondents use fumigation, 27% use motorized spraying, and 19% manual scraping and cleaning (Figure 8). The

Figure 8. Farmer's Preference percentage of RPW control methods in Saudi Arabia.



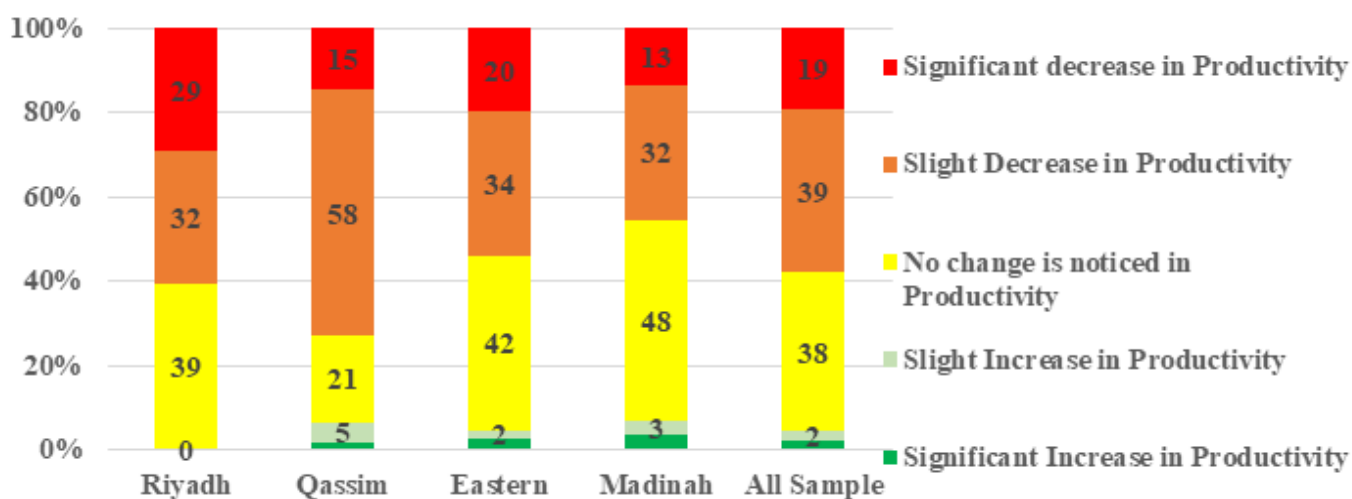
Source: Elaborated from AOAD Report, 2022

Figure 9. Assessment percentage of RPW control methods by farmers in Saudi Arabia.



Source: Elaborated from AOAD Report, 2022

Figure 10. Farmer's Perception Percentage of the Impact of RPW infestation on tree productivity in Saudi Arabia.



Source: Elaborated from CIHEAM-Bari Report, 2023

reasons indicated for the preference include effectiveness, reported by 80% of the respondents, and ease of application, by 16% (Figure 9). The total treatment cost per a single date palm (government and farmer borne) averaged USD 56. The lowest cost

of single Date palm treatment (USD 45) incurred by the modernized Date palm farming system in Saudi Arabia due to low infestation. This result indicates the positive correlation between the low rate of RPW infestation and Date palm farming

systems with localized irrigation systems.

In terms of the impact of RPW infestation, almost 39% and 19% of farmers perceived a slight and significant decrease in tree

productivity, respectively (Figure 10). By location, nearly 58% of farmers in Qassim recorded a slight reduction in tree productivity, while 29% in Riyadh registered a significant decline (Figure 10).

The loss in revenue from falling date palms is considerable, averaging USD 2200 per single date palm. The RPW control and treatment program for the infested 613,000 date palms annually costs the Saudi national economy about USD 34 million. The Net Present Worth of the annual loss in investment and related foregone revenue from falling Date palms in Saudi Arabia is estimated at more than USD 400 million.

3.2.3. Assessment of the perception risk & governance effectiveness indicators

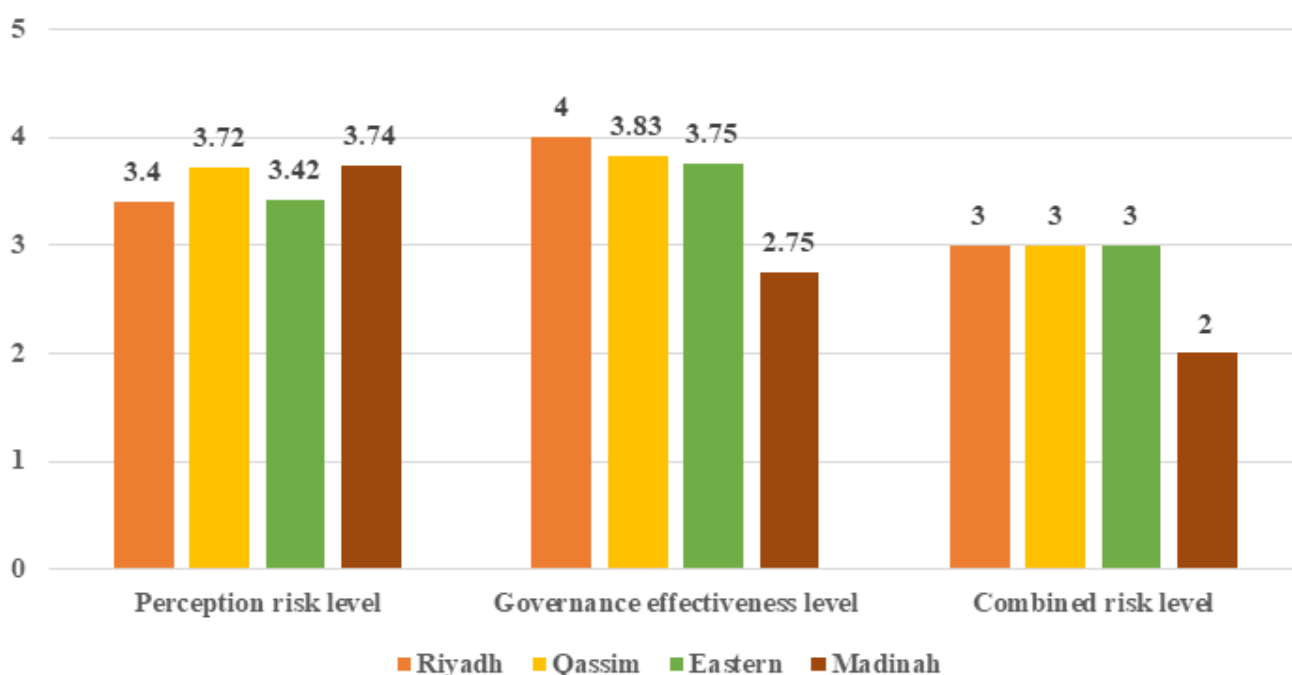
Regarding Saudi Arabia, Qassim (3.72/5) and Madinah (3.74/5) are

similarly ranked at the medium perception risk level, followed by Eastern (3.42/5) and Riyadh (3.40/5), as illustrated by Figure 11. In Riyadh, the low level of information and communication indicators may highlight the lowest level of this governorate in terms of the perception risk of RPW. On the contrary, the latter appears as the best level governorate of governance effectiveness due mainly to the high appreciation of its farmers perception of government support and the high performance of the inspection and control team. As such, Riyadh is followed by Qassim (3.83/5), Eastern (3.75/5) and Madinah (2.75/5) in terms of public support indicator, as shown in Figure 12. In this country, Madinah yields the lowest level of combined risk, while the latter is medium in Riyadh, Qassim and Eastern governorates.

4. Concluding Remarks and Policy Recommendations

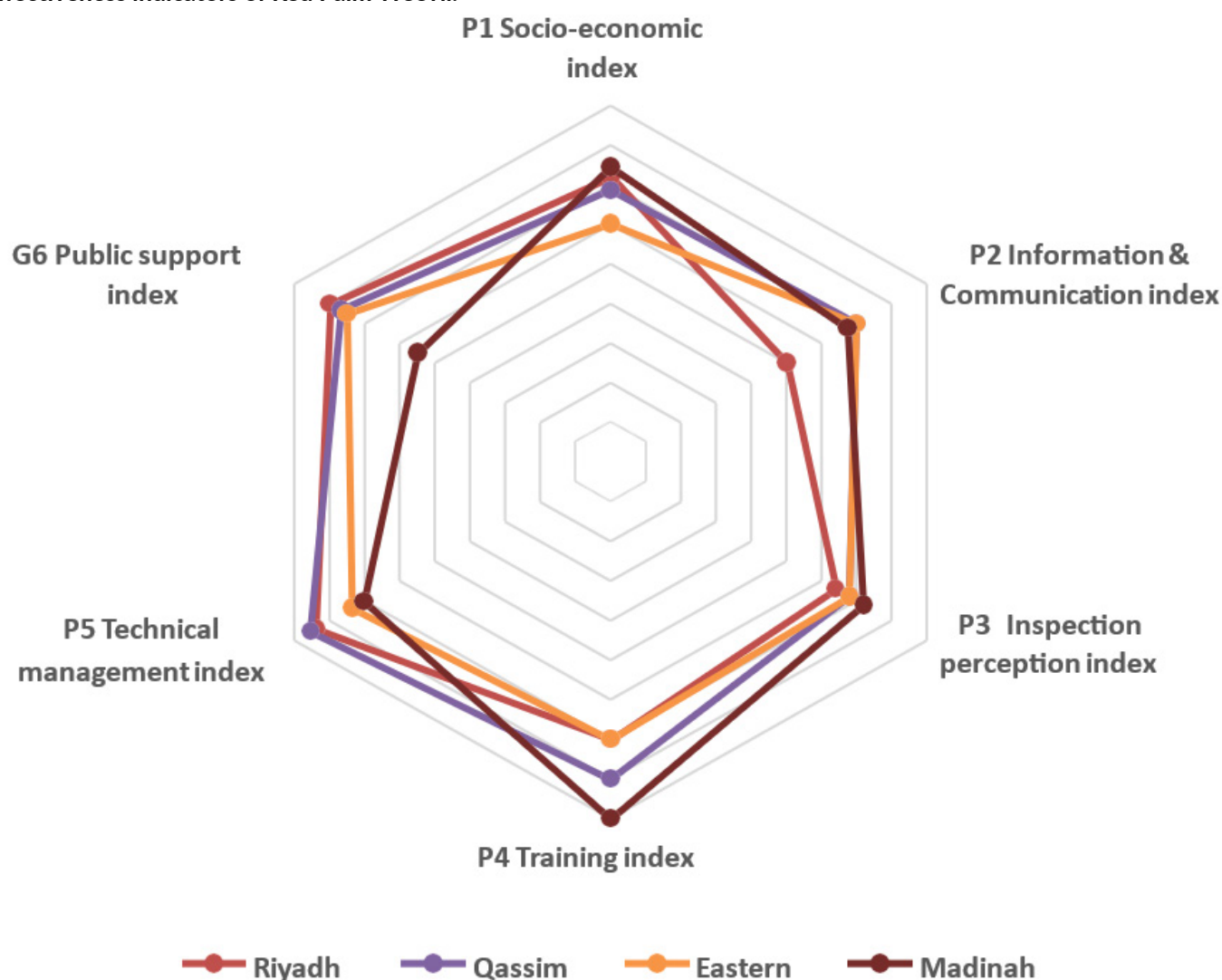
Despite enormous efforts to control the RPW, the empirical evidence shows persistent devastating effects and considerable negative socioeconomic impacts of RPW spread in almost all territories and date palm farming systems in Egypt and Saudi Arabia. The ongoing control and treatment programs annually cost Egypt and Saudi Arabia more than USD 5.7 million and USD 34.4 million, respectively. The ongoing control and treatment programs also achieved less than 75% success. These treatment programs were unable to recover an annual loss of more than USD 213 million and USD 401 million net present worth of investment in the form of falling date palms and associated forgone

Figure 11. Red Palm Weevil in Saudi Arabia: Assessment of the perception risk & governance effectiveness.



Source: Elaborated from CIHEAM-Bari Report, 2023

Figure 12. Rank categorization of Saudi Arabia's governorates according to six perception risk and governance effectiveness indicators of Red Palm Weevil.



Source: Elaborated from CIHEAM-Bari Report, 2023

revenues in Egypt and Saudi Arabia, respectively.

For both countries, improving farmers' risk perception and governance effectiveness indicators could decrease the damage induced by RPW. In Egypt, higher risk perception and governance effectiveness indicators of RPW implied more engagement of farmers in trainings and more implication in awareness campaigns and public support. In Saudi Arabia, improving

the risk perception and governance effectiveness indicators of RPW requires a contextual strategy to mainly enhance the perception of the government support (control and inspection actions) and the dissemination of information (public awareness, sharing information, collaboration with local authorities) related to RPW.

The risk of further spread of the Weevil in both countries is looming. Therefore, adequate measures are

urgently required in both countries to enhance the governance of the date palm farming system, ensure the resilience of the date palm ecosystem, and mitigate the risk of further insect spread. Policy-making bodies should reform the current date palm ecosystem governance in both countries. It is also crucial to devise a mitigation plan to deter the risk of further spread of the RPW. In this regard, sustaining the ongoing integrated RPM control strategies would be critical. For example,

enhancing the capacity of early detection of infestation, promoting farmers' awareness to adopt good farming practices, including the removal of highly infested dates, improving quarantine regulations to contain the pest, reducing the risk to the environment by minimizing overdependence on pesticides and engaging farmers and related stakeholders in the pest control efforts are key policy areas that need concerted action (FAO, 2020; El-Shafie and Faleiro, 2020; FAO, 2023). Understanding the biology of the RPW through genomics of basic research is also essential in the future for successfully controlling and eradicating the devastating insect (Manee et al., 2023).

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