**The cross-sectional survey conducted for system requirements elicitation**

1. ***Questionnaire Design***

The questionnaire was designed using a Google Form platform and consisted of four main sections. It is important to note that we applied PDP-O to a case study of date palm disease and pests to illustrate its potential use. Therefore, our target sample comprised stakeholders directly or indirectly involved in date palm cultivation. The first section included questions to evaluate the demographic characteristics of participants (age, education level, experience, and role in the agricultural sector). The second section comprises questions that were designed to evaluate (1) the need for ICTs to support agriculture decisions, (2) major obstacles preventing the use of technology, (3) technology use and uptake in agriculture work, (4) the ease of handling technological tools in general and (4) attitudes towards the use of technology to support agriculture decisions. The third section comprises questions that were designed to (1) identify the most common types of pests and diseases affecting crops, (2) assess difficulty in identifying disease or damage and its causal agents, (3) assess the knowledge of safe use of pesticides and control methods without the use of pesticides, and (4) assess the need for instruction to apply control method. Overall, the questionnaire included both open-ended and closed-ended questions. The closed-ended questions included single choice and five-point Likert scale questions. Meanwhile open-ended questions included a free text answer. Before the questionnaire was distributed, experts from the agricultural domain reviewed each question for clarity. The questionnaire was allowed to be answered for two weeks, starting from November 30, 2022, to December 17, 2022, and 217 responses were obtained. Before subjecting the data to statistical analyses, each response was reviewed for eligibility, and illogical or irrelevant responses were disregarded. IBM SPPS Statistics was used to apply the descriptive analyses required by the study and is presented as count and frequency (%) for each variable.

1. ***Questionnaire Results***

This section presents the results of the questionnaire after data analysis as displayed in Tables 1, 2, and 3.

Table 1: Demographic characteristics of the respondents.

|  |  |  |
| --- | --- | --- |
| **Variable Category** | **No. of Responses** | **Frequency** |
| **Age** |  |  |
| From 20 to 30 years | 16 | 7.4% |
| From 31 to 40 years old | 55 | 25.3% |
| From 41 to 50 years old | 60 | 27.6% |
| Over 50 years old | 86 | 39.6% |
| **Region** |  |  |
| Makkah | 55 | 25.3% |
| Riyadh | 27 | 12.4% |
| Qassim | 24 | 11.1% |
| Medina | 39 | 18.0% |
| Eastern | 22 | 10.1% |
| Hail | 24 | 11.1% |
| Others | 26 | 12.0% |
| **Education** |  |  |
| Secondary education or low | 42 | 19.4% |
| University education (Bachelor) | 110 | 50.7% |
| Post-graduate | 65 | 30.0% |
| **Role** |  |  |
| Farmer | 97 | 44.7% |
| Researcher | 40 | 18.4% |
| Advisor | 32 | 14.7% |
| Guidance office | 5 | 2.3% |
| Government agency | 15 | 6.9% |
| Other (professionals and scientists) | 28 | 12.9% |
| **Experience** |  |  |
| Less than 5 years | 32 | 14.7% |
| From 5 to less than 10 years | 43 | 19.8% |
| From 10 to less than 20 years | 67 | 30.9% |
| More than 20 years | 75 | 34.6% |

Table 2: Responses of the participants regarding the major difficulties, technology handling skills, and their attitudes towards agricultural ICTs.

|  |  |  |
| --- | --- | --- |
| **Variable Category** | **N** | **%** |
| **Is date palm cultivation in SAUDI ARABIA facing difficulties in general** |  |  |
| No | 47 | 21.7% |
| Yes | 170 | 78.3% |
| **Major difficulties (if yes)** |  |  |
| Lack of support and services | 40 | 24.69% |
| Difficulty in controlling pests | 82 | 50.62% |
| Lack of knowledge and awareness | 33 | 20.37% |
| Lack of communication | 7 | 4.32% |
| **Most common method in managing date palm disease and pest** |  |  |
| Rely on previous experience | 73 | 33.6% |
| Seek experts help | 70 | 32.3% |
| Asking for help from others such as farmers | 40 | 18.4% |
| Using technology (e.g., mobile app and search engines) | 18 | 8.3% |
| Use government services | 16 | 7.4% |
| **Ease of handling technological tools in general (3.65±1.150)** |  |  |
| Very hard (1) | 13 | 6.0% |
| Hard (2) | 15 | 6.9% |
| Intermediate (3) | 72 | 33.2% |
| Easy (4) | 53 | 24.4% |
| Very easy (5) | 64 | 29.5% |
| **The technology uptake in agriculture work in general (3.47±1.139)** |  |  |
| Never (1) | 13 | 6.0% |
| Seldom (2) | 26 | 12.0% |
| Sometimes (3) | 72 | 33.2% |
| Often (4) | 58 | 26.7% |
| Always (5) | 48 | 22.1% |
| **Obstacle preventing the use of technology (if Never or Seldom)** |  |  |
| Difficult to use it | 1 | 2.56% |
| Do not know about it | 11 | 28.21% |
| High cost | 4 | 10.26% |
| No need for it | 8 | 20.51% |
| Unfeasible | 10 | 25.64% |
| Unwilling | 5 | 12.82% |
| **Attitudes toward relying on technology to make agriculture decisions (3.64±1.152)** |  |  |
| Strongly disagree (1) | 13 | 6.0% |
| Disagree (2) | 15 | 6.9% |
| Neutral (3) | 72 | 33.2% |
| Agree (4) | 52 | 24.0% |
| Strongly agree (5) | 64 | 29.5% |
| **Major obstacle (if strongly disagree or disagree)** |  |  |
| It does not satisfy the needs | 7 | 25.0% |
| It appears complex | 6 | 21.4% |
| Do not trust it | 8 | 28.6% |
| All the above | 7 | 25.0% |

Table 3: Responses of the participants regarding the major requirements and their information needs.

| **Variable Category** | **N** | **%** |
| --- | --- | --- |
| **The main types of pests that need support to control** |  |  |
| Insects | 97 | 44.7% |
| Nematodes | 4 | 1.8% |
| Weeds | 5 | 2.3% |
| All the above | 111 | 51.2% |
| **The main types of diseases that need support to control** |  |  |
| Fungal diseases | 138 | 63.6% |
| Viral diseases | 37 | 17.1% |
| Physiological diseases | 39 | 18.0% |
| Other | 3 | 1.4% |
| **Which problems regarding date palm diseases and pests need the “most” help to meet information needs** |  |  |
| Diagnosis of diseases and pests | 27 | 12.4% |
| Pests and diseases outbreak times | 8 | 3.7% |
| Protection from diseases and pests | 14 | 6.5% |
| Determine the control method | 12 | 5.5% |
| all the above | 156 | 71.9% |
| **Need for instructions on how to apply control methods** |  |  |
| No | 35 | 16.1% |
| Yes | 182 | 83.9% |
| **Seeing photos of plant parts with resulting symptoms from pests and diseases supports the correct diagnosis (3.51±1.375)** |  |  |
| Strongly disagree | 30 | 13.8% |
| Disagree | 16 | 7.4% |
| Neutral | 56 | 25.8% |
| Agree | 44 | 20.3% |
| Strongly agree | 71 | 32.7% |
| **Would you like to see recommendations only or recommendations with explanation?** |  |  |
| Recommendations only | 18 | 8.3% |
| Recommendations with explanation | 199 | 91.7% |
| **Which type of explanation do you prefer?** |  |  |
| Relevant parts from guideline document | 23 | 10.6% |
| References to agriculture literature | 30 | 13.8% |
| Experiences of others | 6 | 2.8% |
| All the above | 158 | 72.8% |
|  |  |  |