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Towards the institutionalization of ethics: agricultural experts' knowledge of planning effective management of passive defense in Iran

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Abstract
Globally, agriculture is regarded as the pivot of independence and economic development. Threats to Iranian agriculture are serious and their management calls for the application of passive defense principles. The lack of structural mechanisms, poor knowledge, and poor skills in human resources are the main obstacles to the deployment of passive defense in the agricultural sector. Therefore, the main aim of this study was to investigate the knowledge of agricultural experts about effective passive defense management planning and moving towards its ethical institutionalization in Iran. The research methodology was based on a quantitative approach using a questionnaire-based survey. The final participants were selected using a proportional random sampling method, and finally, 97 males and 44 females were surveyed. The results indicated that the knowledge of the participants regarding the passive defense in agriculture was less than moderate (3.64 out of 10), showing its non-optimal condition. In addition, educational level and field of study brought about significant ($p < 0.05$) differences in knowledge of passive defense in the agricultural sector. However, the type of employment did not make a significant difference in the knowledge of passive defense in the agricultural sector. As a result, passive defense should be understood as a dynamic concept that needs moral institutionalization to face new agricultural challenges. This research has the potential to develop a passive defense framework by stimulating ethical concerns in the context of food security. It can also bring new insights to policymakers, planners, and agricultural experts in Iran and worldwide on the successful planning and institutionalization of passive defense management based on ethical principles.

Keywords Food security · Agricultural experts · Knowledge · Awareness · Passive defense · Ethics

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1 Introduction

Sometimes blamed for its impact on the environment, other times praised for its contribution to human well-being, agriculture continues to be valued as an economic sector with huge duties in solving social conflicts, respecting climate change engagements, or contributing to animal welfare. These are all sources of the ferment for ethical debate that gravitates around notions of justice, human rights, or freedom of choice. "Eating is an agricultural act", Berry (2010) nicely said. That is why food security remains, probably, the central concern of agricultural ethics (Alnafissa et al., 2021), no matter if it is about the moral evaluation of practices, actions, laws, or policies that impact the distribution, allocation, and use of resources (Lipton & Saghai, 2017). The concept "food security" refers to the condition in which all people of a community have constant access to "culturally acceptable, nutritionally appropriate food from local, non-emergency sources" (Opitz et al., 2016). Despite the increasing concern for food security, ethical discourse in this field remains a fairly unreported topic. The state in which all members of a community have continual access to "culturally acceptable, nutritionally suitable food from local, non-emergency sources" is referred to as "food security" (Kogo et al., 2021).

Politics has debated sustainable food security (e.g. Ara & Ostendorf, 2017; Boratyńska & Huseynov, 2017; Monirul Alam et al., 2018; Mottaleb et al., 2020; Toma et al., 2021), but there hasn't been much pertinent ethical debate. Thompson (1995) covered a wide range of topics related to food ethics and sustainability in his seminal work The Spirit of the Soil. Schanbacher (2010) addressed food security and sovereignty, while publications by Sandler (2014), Lang and Barling (2012) and EuroSafe (2013) highlighted the difficulties between food security and sustainability (Casabona et al., 2010). However, the First World's food security is seldom ever referenced in any of these writings. Silvasti and Riches (2014) book, which provides the most thorough analysis of first-world hunger, mostly ignores the ethical dimensions of the argument in favor of a discussion of national-level policy. Therefore, within the ethical perspective of food security, the social value of food and its connection to production, distribution, and use-value chain must be acknowledged. Considering the food security concept, it becomes evident that food must be accessible, affordable, and available in the quantities and form of choice, and consequently, any discussion about food security should be integrated into a complex web of sociopolitical, trade, health, and environmental issues (Chakraborty & Newton, 2011).

Globally, agriculture is regarded as the pivot of independence and economic development. Iran shares this vision, too (Pakrooh et al., 2020), which is supported by figures that illustrate the force of its agricultural sector. Thus, Iranian agriculture makes foreign exchange through non-oil exportation, creates job opportunities for over 25% of the population, and accounts for 1.4% of the gross domestic production (GDP) (Nematpour & Khodadadi, 2020). Thus, it is important to safeguard the stability, sustainability, and development of the agricultural sector (Ehtesham Majd et al., 2019). However, food sovereignty framework justice asks for claims that direct food security programmes rather than viewing food security and food sovereignty as being in conflict (Noll & Murdock, 2019). As it is often linked to national food sovereignty (Kortetmäki, 2015), it is imperative to shelter agriculture from domestic and foreign threats.

In the agricultural sector and in the context of soft warfare, foreign corporations seek to disrupt the planning and implementation of the development programmes through low-quality and invalid pesticides and organic or inorganic fertilizers; the introduction of quarantined pests and diseases to animals, poultry, and plants; the promotion of producing

crops with high water consumption; and the introduction of low-quality and invalid seeds (White, 2010). Given that viruses, animals, and weeds are directly responsible for yield losses that range from 20 to 40% of worldwide agricultural production, these facts cannot be disregarded (Oerke, 2006; Savary et al., 2012). It is in this context that passive defense can make a difference, as it implies a wide spectrum of economic, social, and political actions that are not related to military interventions. It encompasses measures to reduce the probability of damage and minimize the effects caused by a foreign attack. In fact, passive defense is about awareness, proactive thinking, and rationality, and it requires that the whole public administration staff is trained to identify threats in a timely and correct manner. Thus, the success of development programmes depends on the effective management of these threats, and it is evident that it relies on the quality of the involved human resources, especially the planning staff. Skillful people are those who use innovative methods, reduce costs, and enhance the outputs and implications of development programmes (Pate & Cameron, 2003). Thus, a priority in the agenda of human resources training departments of the executive entities is to empower their staff experts and improve their scientific and practical capabilities (Vito, 2019). A review of the documents of passive defense training courses in the Ministry of Agriculture (MOA) shows that these courses commenced in 2007 and have been offered mostly to selected managers and experts of the headquarters and the province. Some of the most important delivered courses were "The principles of passive defense", "Maneuvering in passive defense", "Crisis management", "Non-military defense and crisis management", "Passive defense in MOA and the principles of crisis chamber", "Organizational vigilance against threats and crises", "An introduction to veterinary MPLS network", "An introduction to the integrated veterinary GIS system", "An introduction into incident commanding system and crisis management chamber and their interaction with one another", "Technical training courses to educate teachers of applied epidemiology and critical statistic", "Technical training courses on surveillance and counteracting threats to poultry industry", and "Passive defense in the agricultural sector" (Safari et al., 2019).

The most important challenges facing bio-defense are the lack of proper vision, lack of common understanding of bio-threats among organizations, lack of sufficient experience in the field of bio-defense, lack of bio-threat monitoring and detection system, and lack of specialized collections. In addition, the weakness in the specialized and laboratory infrastructure of the country's bio-defense, and the lack of specialized forces in this field, are the other major factors. Therefore, the vital task in a challenging world full of conflicts and disputes is to protect and reduce the vulnerability of infrastructure and facilitate crisis management against various threats around the territorial space of Iran. This is because passive defense measures in this regard play a vital role in maintaining the country's infrastructure, national security, and food security (Papipour et al., 2018). In fact, the "lack of the required data and information on staff experts' knowledge for planning effective in-service training courses and empowering them" led to the initiation of those courses. This was identified as the research problem for this study. Equally important was to find out the level of MOA staff experts' knowledge in the context of agricultural passive defense. It is in this context—where the role of human resources within agricultural sustainable development and passive defense is of utmost importance—that this paper takes the challenge to reveal the agricultural planning experts' knowledge of passive defense. Furthermore, in this study, the authors tried to articulate the main objective within the framework of ethics. Therefore, we integrated the experts' knowledge of planning effective management of passive defense in the field of agriculture into the institutional ethics debate. Therefore, experts in charge of managing agricultural problems should weigh their obligations towards the economic performance of agriculture against ethical obligations. In this context, where

ethics may raise dilemmas (e.g. the question of the use of some technologies), it is important to see what agricultural experts know and believe about passive defense in agriculture. Most of the time, decision-makers' judgements lead to trade-offs and they should find a balance between profit and moral norms. This is why the institutionalization of ethics seen as codes or norms for human conduct can play a significant role. Therefore, the purpose of this study was to investigate the knowledge of agricultural experts about effective passive defense management planning and moving towards its ethical institutionalization in Iran, by answering the following questions:

1. What is the role of knowledge and awareness of agricultural experts in planning effective management of passive defense?
2. How to move towards ethical institutionalization in passive defense management?

So, according to the main goal of this study, the findings can create a passive defense framework that means changing laws and behaviours by stimulating ethical concerns in the context of food security. It can also provide policymakers, planners, and agricultural experts with new insights into the effective planning and institutionalization of passive defense management based on ethical principles, both in Iran and elsewhere.

2 Passive defense in agriculture: the theoretical framework

Generally, defense refers to dodging, neutralizing, and/or mitigating the impacts of the actions of infringing and delinquent companies. Defense can take two forms—active defense and passive defense. Active defense refers to direct military actions against the actions and assaults of foreign enemies (Garrido et al., 2019). In contrast, passive defense, the focus of the present study, is a set of non-martial actions to reduce vulnerability, improve deterrence, keep on necessary activities, enhance national stability, and facilitate crisis management against threats or military actions of infringing and delinquent companies (Najafnezhad Asl et al., 2019).

Presently, all industries are becoming increasingly vulnerable. Thus, the goal of passive defense planning and implementation is to support human resources and assets and alleviate their vulnerabilities against threats (NikooManesh et al., 2014). Passive defense in crisis management is an essential component of strategic management (Shafiq et al., 2015). Prior to pursuing any long-term goal, crisis management is key to assure the stability and continued viability of an organization. Basically, organizations that are in the first line of the crisis track are more prepared to contrast and cope with it. Effective crisis management needs a systematic approach that is based on knowledge, management sensitivity, and a good understanding of the importance of accurate planning and organization readiness. The following are the main concepts of passive defense: (1) determining a country's safe geographic areas, (2) determining the optimal scale of population and space activities, (3) distribution of functions with threats and geography, (4) small and inexpensive construction and initiative in passive defense, (5) projects' economic feasibility, (6) parallelism-related support systems, and (6) production of dual-purpose structures (Alhawasli & Daneshjoo, 2018).

Accounting for about 7% of GDP and having a positive economic growth rate in the years of economic recession in Iran (World Bank, 2017), the agricultural sector has had a significant role in creating employment (18%) and exporting non-oil commodities

Table 1 The distribution of damages to the agricultural sector in 2017–2018 (*Source*: Deputy of Planning & Economics, 2018)

Cause	Number of affected provinces	Cost (billion IRR)	Share in total hazard costs of the sector
Forest and pasture fire	30	25,446	21.5
Farm, orchard, and animal farm fire	17	954	0.8
Livestock diseases	22	14,649	12.4
Plant pests	16	1695	1.4
Dust	4	162	0.1
Total loss by fires, pests, diseases, and dust	–	42,906	36.33
Total loss by different hazards	–	118,115	100.0

(Cheraghi et al., 2019). Nonetheless, the persistence of droughts and inadequate investment in agricultural constructions and machinery (37,000 billion IRR in reference year price in 2015–2016 and the allocation of about 3% of total gross fixed capital formation in this year) can be blamed for the failure to realize its potentials in recent years (World Bank, 2017).

The agricultural sector of Iran has a share of over 15% in the national economy, so the sustainability of its activities can contribute to the development and sustainability of businesses across the country. As such, the relevant businesses should design and implement smart and scientific management to cope with the (intentional and unintentional) risks posed to the agricultural sector if they want to keep working and surviving (Najafnezhad Asl et al., 2019; World Bank, 2017).

Table 1 shows the distribution of damages to the agricultural sector in 2017–2018. It is indicated that 30 out of 31 provinces of Iran were struggling with these hazards with the highest frequency belonging to fires, diseases, and pests. Since almost all provinces are struggling with these hazards, their management and control have become both time-consuming and costly. Thus, the prevention of hazards by intelligent management is more rational and efficient than compensation for their damages (Cheraghi et al., 2019; Najafnezhad Asl et al., 2019; Safari et al., 2019).

It has been revealed that the main obstacles hindering the operational deployment of passive defense in the agricultural sector are the lack of comprehensive structural and organizational mechanisms at the national level and the poor knowledge and skill of human resources in this sector (Eckert et al., 2008; Hosseini et al., 2018). This shows the significance of empowering different parts of society in the field of passive defense to make effective management of foreign threats in different possible sectors. According to Najafnezhad Asl et al. (2019) in a study on the role of passive defense in urban crisis management, passive defense is effective in reducing damages to cities and application risk, as well as developing a proper pattern for urban sustainability from the perspectives of experts and managers.

Bioterrorism, defined as the "intentional transmission of infections of animals or crops to cause economic loss", is a prominent target in the agriculture industry (Casagrande & Wills, 2005). Erenler et al. (2018) found a negative relationship between government and society readiness and the impacts of bioterrorism. Bioterrorism encompasses not just catastrophic mass-victim terrorism, but also low-tech micro-events that cause public unrest,

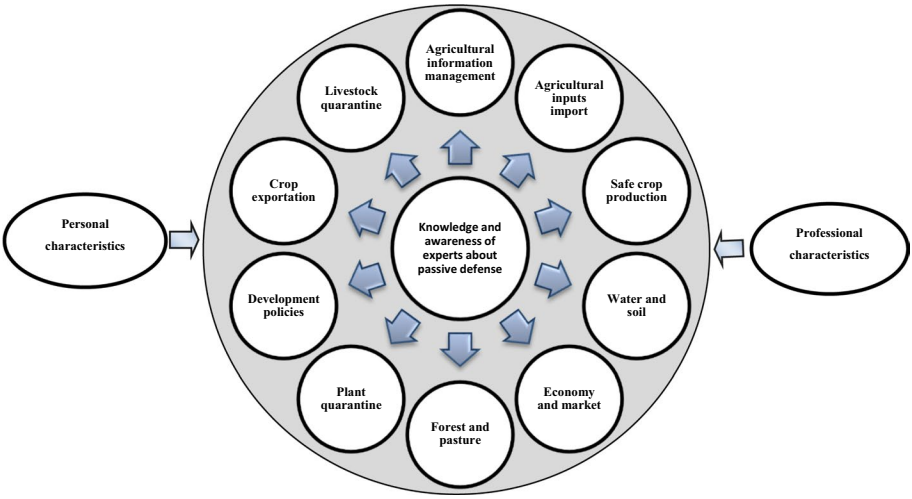

Fig. 1 Theoretical framework

disruption, sickness, disability, and death. According to Turvey et al. (2008), people who had good knowledge of food industries were 13% surer than those who had moderate knowledge of these industries and knew that the problems and challenges of this sector and agroterrorism may have roots in foreign countries.

Martensson et al. (2013) state that it is necessary to create a warning culture and an understanding of biological threats. An effective warming system, according to them, has three components: early detection for immediate action, ongoing monitoring of recognized hazard situations, and horizon scanning for future and emerging risks and possibilities. Having this scientific literature evidence related to the need for relevant knowledge development in agriculture public administration, the theoretical framework of the study was constructed as depicted in Fig. 1. As it is shown, the passive defense capabilities of agricultural experts consist of 11 categories of water and soil, economy and market, safe crop production, forest and pasture, passive defense knowledge, development policies, crop exportation, livestock quarantine, plant quarantine, agricultural information management, and agricultural inputs import. Furthermore, the scope of these capabilities is influenced by the personal and professional characteristics of the expert.

2.1 Ethical principles in passive defense

One of the most critical concerns that humans have dealt with is security. As a result, they sought to attain this security using a variety of defensive mechanisms (Adat & Gupta, 2018). To guarantee independence, integrity protection, territory preservation, and people's safety against enemy assaults, a combination of activities known as defense must be taken into account (Veebel et al., 2020). There are two types of defense: non-military and military. These are now referred to as practical defense and impractical defense (Steinsbekk et al., 2013). When defense is impractical, armour is not immediately required, but certain anticipated activities are required to engage the adversary, increasing both the opponent's costs and the defensive strength of the local troops. Because of this, ethics in passive defense allude to a fundamental fact (Martensson et al., 2013).

While the modern world of industry and the train of progress move on the rails of time, it frees itself from moral-extraterrestrial constraints to achieve the ideas of humanism and the absolute rule of human beings over the world (Dierksmeier, 2019). Ethics are trying to recognize good and bad behaviour, and it has been based on unity brings perfectionism and excellence seeking for humans (Djigo, 2010). Therefore, he does not allow countless attacks on a man who considered himself an absolute activist after the Renaissance. Then ethics were gradually marginalized; as a result, moral, social, and psychological crises appeared (Dhont et al., 2019). The agricultural and environmental crisis is one of them, caused by modern man's invasion of nature body (including the Earth, the sky, the seas, etc.) (Chu & Karr, 2017). Now, after several centuries have passed since the modern era, humanity does not have any choice except to use ethical issues to resolve crises surrounding the crisis of agriculture and the environment (Doramajian & Bukowski, 2015).

Today's enterprises must institutionalize ethics if they are to successfully combat the rising frequency of clearly unethical and frequently unlawful activities within large and frequently well-respected organizations (Tseng, 2019). Agriculture is often recognized as the fulcrum of independence and economic progress across the world (Balafoutis et al., 2017). Threats to Iranian agriculture are also serious and their management calls for the application of passive defense principles. The term "institutionalizing ethics" may sound weighty, but its meaning is simple. It entails officially and explicitly incorporating ethics into daily life (Tseng, 2019) through correct, suitable, and timely training, emphasizing the role of passive defense.

According to Omran et al. (2014), the value judgements that form the foundation of environmental ethics have a direct influence on human relations with the environment, and providing scientific information without considering environmental ethics and attitude has a limited influence on environmental behaviour. As a result, education must be prioritized in order to transform beliefs, attitudes, and environmental behaviour. Environmental education techniques should be severely reviewed, and the notion of social learning may provide a solution.

2.2 Study design

Assuming that moral understandings are affected by social practices (Walker, 1998) and that people interpret and apply ethical norms differently according to their values and life experiences (Resnik, 2015; Petrescu-Mag et al., 2019), the investigation of experts' knowledge of passive defense was considered relevant, having the potential to avoid gaps that are inherent in institutional ethical frameworks. Therefore, the research methodology was based on a quantitative approach using a questionnaire-based survey. Therefore, in the conventional view, the research is quantitative with the overall function of "describing" (by data analysis and description) and "explaining" (by recommendations). The knowledge of experts about passive defense in the agricultural sector was subjected to assessment. The instrument for collecting data in this study was a researcher-made questionnaire. The research questionnaire comprised two categories of primary questions. Part A focused on gathering descriptive information, encompassing details like the participant's field of study, degree level, age, gender, work experience, employment status, organizational position, and the number of in-service training courses completed in the field of passive defense (before 2012 and after 2012). This part also included familiarity with goals questions, the need for learning, and the importance and necessity of passive defense knowledge. Part B consisted of questions related to passive defense knowledge, with 38 variables measuring

current knowledge and the importance of passive defense. Research variables were categorized into three categories. The dependent variable was "the knowledge of experts which is composed of 38 priorities (Table 9), and the independent variables included the field of study, educational level, age, career years, gender, organizational position, main job, management background, membership in passive defense scientific association, and workplace organization.

During training, before answering the questionnaire, respondents received information about values that they should assume as guidelines for raising the ecological, societal, and economic sustainability thinking of the experts in relation to their training priorities. These values were chosen in accordance with FAO's (2013) recommendations. (i) "The natural environment's resilience, inventiveness, and strength beyond human abilities and control", according to FAO rules. It takes longer to restore or repair functioning ecosystems than it does to destroy them. It is our obligation and in our best interests to protect these resources. (ii) "People's health and safety are of vital significance to individuals, families, and communities". (iii) "The health and safety of people, families, and communities are critical". (iv) "Cropping plans, crops, and variety selection, and crop rotations that are tailored to local agro-environmental and socioeconomic circumstances, meet the long-term agronomic demands of farming companies while also providing ecosystem services". (v) "Our reasons for producing animals should be balanced by our respect for their own innate behaviours and motivations. Proper animal care, then, necessitates human attention and connection with those creatures. (vi) "Good biodiversity management entails improving the quantity and degree of positive interactions among the varied system's components, such as food webs, symbioses, biological pest control, and so on, known as functional biodiversity". Before completing the questionnaire, the experts were given a set of values and asked to assess their grasp of passive defensive principles in light of these ideals for an ethical atmosphere.

The knowledge of passive defense was assessed in two main distinct sections, including "current knowledge" and "item importance". Borich Needs Assessment is a comprehensive model that assesses the competency of experts and recognizes their training needs (Choi et al., 2021; Goli et al., 2013). The purpose of a needs assessment is to identify the gap between current extension programme practices and what is ideally required or anticipated for the learning outcomes (Borich, 1980; Dlamini & Huang, 2020). Borich refers to these "gaps" as discrepancies (Borich, 1980). A needs assessment is accomplished by allowing experts to indirectly express their training needs through "self-assessment and professional judgement to point out the areas of discrepancy that need to be filled" (Goli et al., 2013; Olorunfemi et al., 2020). In 1980, Borich published the first equation for determining training needs by linking importance and knowledge in the form of the empirical equation shown below:

$$\text{Training need} = (\text{Importance} - \text{Knowledge}) \times \text{Mean importance}.$$

Therefore, the items were averaged to rank them in the order of importance using the following equation (Borich, 1980):

$$\text{Item priority} = \text{Item importance} \times (\text{Current knowledge} - \text{Item importance}).$$

The face validity of the questionnaire was assessed by a panel of experts. This panel consisted of 10 researchers of passive defense and experts in educational planning who were directly responsible for passive defense affairs and staff training at the agricultural ministry.

In addition, the reliability of the questionnaire was confirmed by Cronbach's alpha, with threshold values above 0.7. This method is usually applied when the items of the questionnaire are not dichotomous; rather, they are in the form of degrees of agreement/disagreement (i.e. items with multiple choices or levels) (Markechová et al., 2010). Cronbach's alpha is used to calculate the internal consistency of the research. In this type of instrument, the response to a question may take various numerical values. In the present study, the reliability of the questionnaire sections was calculated by Cronbach's alpha using the following equation (Taber, 2017) (Eq. 1):

$$ya = \frac{J}{J-1}\left(1 - \frac{\sum Si^2}{S^2}\right) \tag{1}$$

where J is the number of questionnaire item sets, Si^2 is the variance of the ith sub-test, and S^2 is the variance of the sub-test.

Cronbach's alpha varies in the range of 0–1, in which $\alpha = 1$ means that the research instrument is fully reliable, and $\alpha = 0$ means that it is fully unreliable. The reliability range of attitude scales is defined as follows (Markechová et al., 2010):

$$0.45 = \text{low},\ 0.75 = \text{moderate},\ 0.95 = \text{high}.$$

The statistical population was composed of the staff experts of the Ministry of Agriculture (MOA) who had participated in at least one passive defense training course. These people worked in the departments of crop production, investment, livestock production, planning, and economic affairs. In addition to reviewing the offices of Legal Affairs and Parliament, checks were conducted on departments such as Water and Soil, Human Resources Management and Development, and various units within Headquarters (including the Ministry, Security, Coordination of Administrative Violations Councils, General Administration of Provinces, Public Relations, Environment, and Administration of Food Safety, Inspection, etc.). Finally, 132 people were selected and examined through stratified sampling. The sample size was determined by Cochran's formula (as shown below), and the participants were chosen by the systematic random sampling technique, given that the sample size was half of the statistical population (N = 261) (Eq. 2).

$$n = \frac{Nt^2pq}{Nd^2 + t^2pq} \tag{2}$$

where n denotes the research sample size, N is the research population size, d shows the desired level of precision, and p and q represent the probability of opinion type. Since the opinion of sample members about passive defense training courses of MOA was unknown, the p-value was set at 0.5. Therefore, the variance was maximized to its highest level, i.e. 0.25 (Taber, 2017) (Eq. 3).

$$t^2 = 1.962;\ p = 0.5;\ q = 0.5;\ d^2 = 0.6 \tag{3}$$

According to the following calculations, the sample size was estimated to be 132 (Eq. 4).

$$n = \frac{261 \times 1.96^2(0.5)(0.5)}{261(0.06)^2 + 1.96^2(0.05)(0.5)} = \frac{250.6644}{0.9396 + 0.9604} = 132 \tag{4}$$

The number of returned questionnaires was 132, out of which 130 questionnaires were subjected to statistical analysis considering their quality. The final participants for the sample were selected by the proportional random technique for which the research sample was taken in proportion to the size of different groups of the statistical population (Eq. 5).

$$n_h = n\frac{N_h}{N} \tag{5}$$

where n shows the sample size taken from the studied population, n_h is the sample size taken from the hth group, N_h is the population size of the hth group, and N is the total size of the research population.

The convergent and divergent correlation reflects the relationship of different indicators (items) measuring a single construct with one another. In fact, if the scores of tests measuring a single trait are closely correlated, the indicators measuring that construct will have convergent validity. If the average variance extract (AVE) is higher than 0.5 for all constructs, i.e. the items can account for over 50% of the variance of their related constructs, this will imply the convergent validity of the employed tests. AVE is calculated as below (Eq. 6):

$$AVE = \frac{\sum \lambda_i^2}{n} \tag{6}$$

where λ_i expresses the factor loads of an indicator, and $\text{var}(\varepsilon_i) = 1 - \lambda_{i2}$.

The study design might be blamed for being too technical for an ethical discussion framework. However, we considered that all this scientific evidence is the foundation of ethical argumentation. As pointed out by Dundon (2003), no agricultural ethics are possible without solid technical information.

This research has a notable limitation, as certain experts may lack adequate belief or knowledge regarding biological threats and agro-terrorism. Additionally, the geographical dispersion of the participating institutions may have posed a challenge, potentially extending the time required for completing the questionnaire. Another aspect to consider is the scarcity of research addressing ethical issues related to passive defense knowledge, including familiarity with relevant programmes.

3 Results and discussion

3.1 Professional-individual characteristics

The field of study of most experts (44.5%) was “agriculture”. “Social science and management” were in the next ranks. A little less than half of the participants (44.6%, 62 individuals) had a bachelor’s degree, and the second rank was for those with a master’s degree. Most respondents (68.3%) were male. The respondents had an average age of 44.11 years with most being in the age range of 46.1–54 years. The range of career years was 1–36 years with an average of 21.33 years and a standard deviation of 7.45 years. The age range was divided into five strata among which the stratum of 22.1–29 years had the highest frequency (36.3%). The employment type of most studied experts (74.3%) was “permanent and temp-to-perm”. The organizational position of most studied participants (89.1%) was “expert in charge” followed by “office head” in the second rank for 28.2% of the respondents. According to the results, only 3.45% of the studied people attended two

passive defense training courses in 2013–2014. However, after 2013–2014, the attendance rate increased to 20.9%.

3.2 Priority of educational issues

38 items were used to measure the passive defense knowledge of staff experts in the agricultural sector. The answer interval for the questions was 0–10 and was quasi-intermittent; therefore, mean and standard deviation were used. Each item had two parts marked for the answer. Then, the amount of current knowledge and the importance of the item from the perspective of staff experts were examined. To prioritize the importance of the items, the average of each item was obtained; then through the following relationship, the importance of each item was determined among the other items. Importance of each item = importance level (IM) − current knowledge (KN) * importance level (IM). The standard deviation (SD) of reported items indicates that the standard deviation is not very large or small and is normal. The total current knowledge of the study sample in relation to passive defense knowledge was measured using 38 items. Analysis of variance was used to examine the differences (ANOVA). This test was performed using SPSS software. Furthermore, regression was used to evaluate the effect of independent variables on the dependent variable. Each item had two parts marked for the answer. The amount of current knowledge and the importance of the item in the opinion of staff experts were two parts of the answer. To prioritize the importance of the items, the average of each item was obtained; then through the following relationship, the importance of each item was obtained among the other items.

The results indicated that the knowledge of the studied people regarding the passive defense in agriculture was less than moderate (3.64 out of 10), showing its non-optimal condition. However, the experts were most aware of the need for the management of biological data and their protection against threats, the recognition of the principles and goals of passive defense in safe crop production, agricultural data management approaches in Iran, threats pertaining to crop importation, agencies in charge of passive defense, and the need for the application of passive defense principles in livestock quarantine management (Table 2). Given the importance level of the items (8.34 out of 10) (as the *t*-test corroborated the significant difference between "importance level" and "current knowledge level" of experts in all topics), the top priorities in the training agenda of the studied experts are shown in Table 9 ("Appendix").

The components of passive defense knowledge were categorized and ranked by the analytic hierarchy process using the Smart PLS software package. In the structural equations model, it is first necessary to examine construct validity to ensure that the correct indicators have been selected for the measurement of the construct precision. This was done by confirmatory factor analysis. In this case, the load factor of the indicator with its design should be greater than 0.6. Since all indicators had a load factor of > 0.6, their validity is supported (Fig. 2).

In order to have a significant indicator, its factor load with its design should have a significant *t*-value at an error level of 0.05. In other words, its value should be out of the (− 1.96, 1.96) range. Then, it can be claimed that the indicator is precise enough to measure the construct or latent trait (Nunnally & Bernstein, 1994). The results depicted in Fig. 2 illustrate that all indicators and factors were significant.

To show the divergent validity, the correlation between all constructs should be smaller than the square of AVE for each construct. This means that no two variables are perfectly correlated, and the items are in such a way that the constructs are well distinguished from

Table 2 The root of AVE and correlation coefficients

	Water and soil	Economy and market	Safe crop production	Forest and pasture	Passive defense knowledge	Development policies	Crop exportation	Livestock quarantine	Plant quarantine	Agricultural information management	Agricultural inputs import
Water and soil	0.97[a]										
Economy and market	0.88	0.97[a]									
Safe crop production	0.84	0.82	0.95[a]								
Forest and pasture	0.85	0.91	0.78	0.98[a]							
Passive defense knowledge	0.94	0.92	0.93	0.93	0.95[a]						
Development policies	0.90	0.87	0.92	0.83	0.913	0.94[a]					
Crop exportation	0.94	0.91	0.85	0.86	0.935	0.91	0.98[a]				
Livestock quarantine	0.85	0.92	0.79	0.91	0.93	0.84	0.86	0.98[a]			
Plant quarantine	0.83	0.91	0.75	0.97	0.919	0.81	0.84	0.96	0.98[a]		
Agricultural information management	0.82	0.79	0.89	0.74	0.89	0.87	0.81	0.75	0.70	0.95[a]	
Agricultural inputs import	0.89	0.92	0.80	0.93	0.93	0.85	0.90	0.93	0.92	0.78	0.97[a]

[a]The square roots of AVE estimate

Fig. 2 The model of experts' knowledge and their factor loads

one another. This is also referred to as the Fornell–Larcker criterion. In this case, the correlation between the items of one variable and that variable should be higher than the correlation between the items of that variable and other variables (Fornell & Larcker, 1981). According to Table 2, divergent validity is also confirmed (Fig. 3).

To be considered a relevant indicator, its factor load with its design must have a significant *t*-value at an error level of 0.05. In other words, its value should not fall within the range of (− 1.96, 1.96). Therefore, it may be claimed that the indicator is precise enough to measure the construct or latent characteristic (Nunnally & Bernstein, 1994). The results displayed in Fig. 2 demonstrate that each indicator and factor had a significant influence.

The results of R^2 values[1] derived from the structural equations model of experts' knowledge showed that the factors in priority included economy and market, input and crop importations, development policies, crop exportations, forest and pasture, livestock

[1] These values are regressive since they are derived from the results of the structural model. In these equations, several regressions were addressed simultaneously.

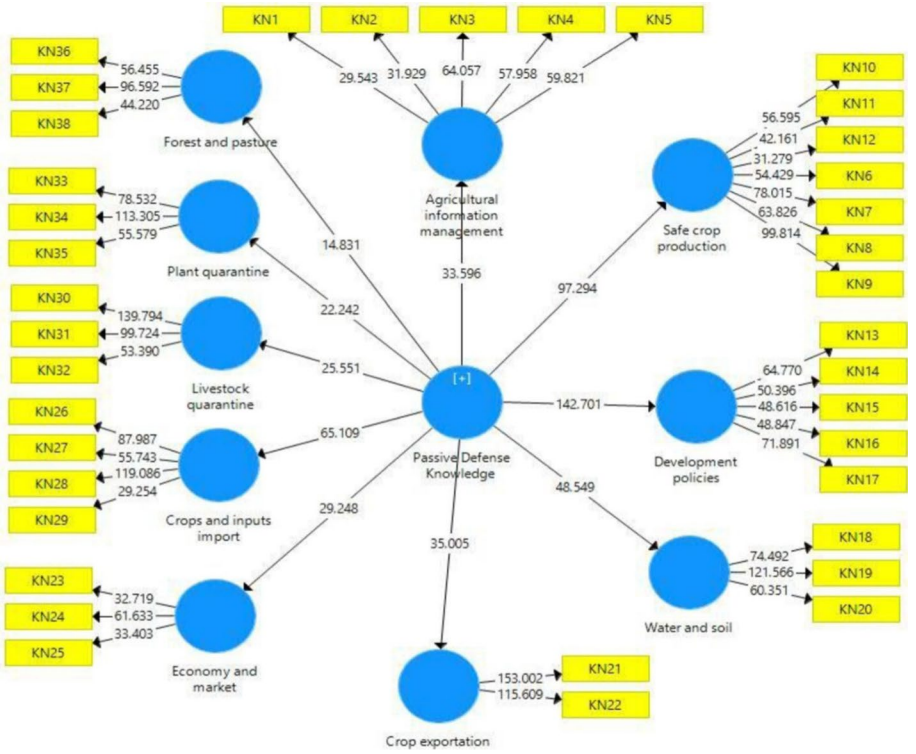

Fig. 3 The significance distribution of the variables included in the model of experts' knowledge

Table 3 Statistical distribution of the priority of experts' knowledge factors according to R^2 values

Variable	R^2	R^2 adjusted	Impact size rank
Development policies	0.914	0.913	1
Safe crop production	0.892	0.891	2
Crops and inputs import	0.862	0.861	3
Water and soil	0.821	0.819	4
Agricultural information management	0.773	0.772	5
Crop exportation	0.771	0.770	6
Economy and market	0.763	0.762	7
Livestock quarantine	0.723	0.721	8
Plant quarantine	0.691	0.688	9
Forest and pasture	0.637	0.634	10

quarantine, water and soil, safe crop production, plant quarantine, and agricultural information management (Table 3).

These findings are consistent with the studies by Erenler et al. (2018), Najafnezhad Asl et al. (2019), Foxell (2001), and McKinney et al. (2005). They also stressed the significance

of passive defense knowledge and terroristic attacks in the agricultural sector. Nonetheless, McKinney et al. (2005) reported that the experts had a moderate level of knowledge about passive defense and bioterrorism. However, its practical use has not been reported. This reflects the fact that there is no question about the need for developing and running diverse short-term, mid-term, and long-term programmes in the field of passive defense in the agricultural sector. For an effective input to sustainable agricultural policies, it is imperative to develop, offer, and evaluate specifically-designed training courses in the following fields: "knowledge with the contexts and agents of biological warfare and strategies to cope with their threats", "knowledge with the strategies of agricultural input importation with respect to the principles of passive defense", "understanding the need for adhering to the principles of passive defense in the management of livestock quarantine", "understanding the principles and goals of passive defense in safe crop production by the agricultural sector", "knowledge with methods to protect natural resources and important biological species", "observing the principles of passive defense in research centers and susceptible laboratories of the agricultural sector", "knowledge with threats in the field of agricultural input importations", "knowledge with the strategies of crop importation with respect to the principles of passive defense", "knowledge with the threats to natural resources", and "the role of passive defense in protecting water resources and their revival".

The training topics were categorized by structural equations test whose results prioritized the factors in this order: economy and market, input and crop importation, development policies, crop exportation, forest and pasture, livestock quarantine, water and soil, safe crop production, plant quarantine, and agricultural information management.

3.3 Relations of variables

The results revealed that educational level and field of study brought about significant ($p < 0.05$) differences in knowledge of passive defense in the agricultural sector. At the same time, the type of employment did not make a significant difference in the knowledge of passive defense in the agricultural sector (Table 4). As is evident, those whose fields of study were political science and social science were more knowledgeable. However, since their number was much less than the agricultural experts in the research sample, the highest average knowledge was related to agricultural experts. Employment type had no effect on the experts' knowledge of passive defense in the agricultural sector. In other words, no matter what kind of employment the person had, his/her knowledge of passive defense was not optimal. On the other hand, organizational position and career year's gender did not cause significant differences in knowledge.

Based on the results obtained from the *t*-test (Table 5), gender did not cause significant differences in knowledge.

A key assumption in most tests, especially in the tests of causal hypotheses, is that there should be no collinearity. In other words, none of the independent variables should be linearly related to one another. When two independent variables are functions of one another, this is known as collinearity. When the collinearity of a regression equation is high, the independent variables are strongly correlated, and the model will always be incorrect even if R^2 is high (Markechová et al., 2010). The collinearity can be supported or refuted according to the correlation matrix of the independent variables and their pairwise correlation coefficients. A high pairwise correlation shows collinearity, but multiple collinearities may happen even when pairwise correlations are not high enough. Given that regression models include one X as a dependent variable as the independent variables, it can be said

Table 4 Statistical distribution of the results of variance analysis for the relationship between personal and professional characteristics of respondents and their knowledge of passive defense

Variable	Statistic	$\overline{X}$	SD	f	Sig	Results of LSD pairwise comparison
Field of study	Law	95.50	38.23	2.46	0.02*	Difference between 1 and 2, 2 and 7, 3 and 6, and 3 and 7
	Agriculture	153.93	78.85			
	Political science	186.60	75.52			
	Social science	165.35	69.77			
	Management	115.16	69.58			
	Civil or computer engineering	85.50	57.72			
	Water,	91.0	59.65			
	accounting, economics, or mathematics	104.1429	77.49			
Educational level	Associate degree	202.6000	46.22553	3.45	0.019*	Difference between 1 and 2, and 2 and 3
	Bachelor's degree	116.5510	64.36843			
	Master's degree	153.2041	83.85130			
	Ph.D	119.5000	57.92236			
Employment type	Permanent and temp-to-perm	141.6	77.34	0.157	0.85	–
	Contractual	131.1	7594			
	Contracted	134.4	79.247			
Organization position	Monitoring expert	192.2	92.012	2.26	0.085	–
	Public relations	141.52	82.47			
	Information dissemination	165.07	70.4			

Table 4 (continued)

Variable	Statistic	$\overline{X}$	SD	f	Sig	Results of LSD pairwise comparison
Career years	1–8	139.39	70.09	1.11	0.35	–
	8.1–15	122.76	69.3			
	15.1–22	125.15	70.2			
	22.1–29	150.29	74.8			
	29.1–36	129.19	71.9			
	30–38	127.84	73.6			
	38.1–46	115.45	70.6			
	46.1–54	133.07	68.1			
	54.1–62	0.95	80.3			

**Significant at the < 0.01 level

*Significant at the < 0.05 level

Table 5 *T*-test to compare the level of knowledge in two genders

Variable	Statistic				*t*	Sig
	N		SD	$\overline{X}$		
Gender	Male	97	2.83	143	1.32	0.187
	Female	44	3.05	125.69		

Table 6 The distribution of the collinearity coefficient of the independent variables underpinning experts' knowledge

Variables included in the model	VIF	Tolerance
Familiarity with programmes	1.94	0.53
Age	1.98	0.50
Employment type (permanent)	1.34	0.74
Employment type (contractual)	1.51	0.66
Organizational position (office head)	1.38	0.72
Organizational position (expert in charge)	1.48	0.86
Organizational position (monitoring expert)	1.57	0.68
Gender	1.43	0.70
The feeling of the need for learning	2.07	0.48
Interest in learning passive defense	1.99	0.51
Familiarity with the goals of passive defense	2.07	0.49
Career years	1.57	0.66
Educational level	23.12	0.04
Job	9.9	0.12
Field of study	11.43	0.08

that $R^2 \geq$ b confirms the presence of collinearity. For assessing collinearity, there are plenty of approaches, and measuring variance inflation factor (VIF) and Tolerance index is one of the best and simplest ways. On the other hand, if the VIF is greater than 2, the collinearity is stronger. Moreover, the coefficient of tolerance varies in the range of 0–1, and if it is closer to zero, the collinearity will be higher (Toghraei, 2007). According to what was described and the results in Table 6, the studied independent variables did not have collinearity, so the regression model was found to be valid. It should be noted that tolerance and VIF were calculated by the Stata software package. The variables such as field of study, occupation, education level, and career years exhibited high collinearity, so they were excluded from the analysis.

The results in Table 7 show that the knowledge of passive defense was significantly influenced by the variable of familiarity with goals at the $p < 0.01$ level and by the variables of organizational position (expert in charge) and employment type (permanent) at the $p < 0.05$ level, showing the coefficients of 27.27, 65.02, and 68.11, respectively. It can be said that as one becomes more familiar with passive defense programmes, his/her knowledge is improved, too. In addition, the organizational position of the experts in charge may lead to more knowledge about passive defense because they need this knowledge more than others. With respect to the significant effect of contractual employment type, it can be said that these people learn more about passive defense because they are not certain about their careers. The analysis of variance showed that the F-value was 5.37, which was significant ($p < 0.01$). This shows the significance of the regression model. Other findings indicated

Table 7 The results of regression analysis for the variables influencing experts' knowledge

Variable	*B*	Standard error	*t* value	Sig
Constant factor	46.85	48.33	0.98	0.33
Familiarity with programmes	27.27	7.37	3.58	0.001**
Familiarity with goals	4.77	7.90	0.6	0.54
Employment type (permanent)	13.19	9.88	−0.46	0.648
Employment type (contractual)	68.11	30.72	2.24	0.028*
Organizational position (office head)	−17.48	14.52	−1.23	0.22
Organizational position (expert in charge)	65.02	32.65	1.99	0.05*
Organizational position (monitoring expert)	−37.28	30.15	−1.24	0.22
Need for learning	−11.89	9.30	−1.28	0.2
Interest in learning	4.45	7.68	0.58	0.56
Career years	0.75	1.01	0.75	0.45
Gender	9.65	6.63	1.19	0.23

$Y = 4685 + 27.27\ X_1 + 68.11\ X_2 + 65.02\ X_3$, Y = knowledge of passive defense, X_1 = familiarity with programmes, X_2 = employment type (contractual), X_3 = organizational position (expert in charge)

**Significant at the < 0.01 level

*Significant at the < 0.05 level

that the adjusted R^2 was 0.315, meaning that 31.5% of the variance of experts' knowledge accounted for the variables of familiarity with programmes, organizational position, and employment type.

According to Fig. 4, the most influential variables on experts' knowledge of agricultural passive defense were awareness and interest with an impact factor of 0.42; need and necessity with an impact factor of 0.042; age, training, and career years with an impact factor of −0.008; and gender, educational level, field of study, employment type, and organizational position with an impact factor of −0.166, respectively. It should be noted that these variables captured 24.2% of the variance of the dependent variable.

The *t*-values revealed that all indicators included in the model were significant. According to Table 8, the indicators of age, career years, training before 2013–2014, training after 2013–2014, employment type, organizational position, gender, educational level, the need for learning passive defense knowledge in the agricultural sector, and the necessity of knowledge of passive defense for experts were not significant.

Figure 5 depicts that only "awareness and interest" had a significant effect ($p < 0.05$) on the knowledge of passive defense in agriculture, and the effects of the two other variables were insignificant. These results support the significance of the path model of the impact of variables on the knowledge of agricultural passive defense based on the *t*-test. If the relationship between an independent variable and a dependent variable is significant, the *t*-value should be greater than 1.96 for the significance to be at the 0.05 level. Accordingly, "awareness and interest" had a significant effect ($p < 0.05$) on the knowledge of passive defense, but the effects of "need and necessity"; "age, training, and career years"; and "gender, educational level, employment type, and organizational position" on this knowledge of experts were insignificant.

These findings are consistent with the results of Safari et al. (2019) and Erenler et al. (2018) on the importance of training experts and farmers to deal with threats and apply the principles of passive defense.

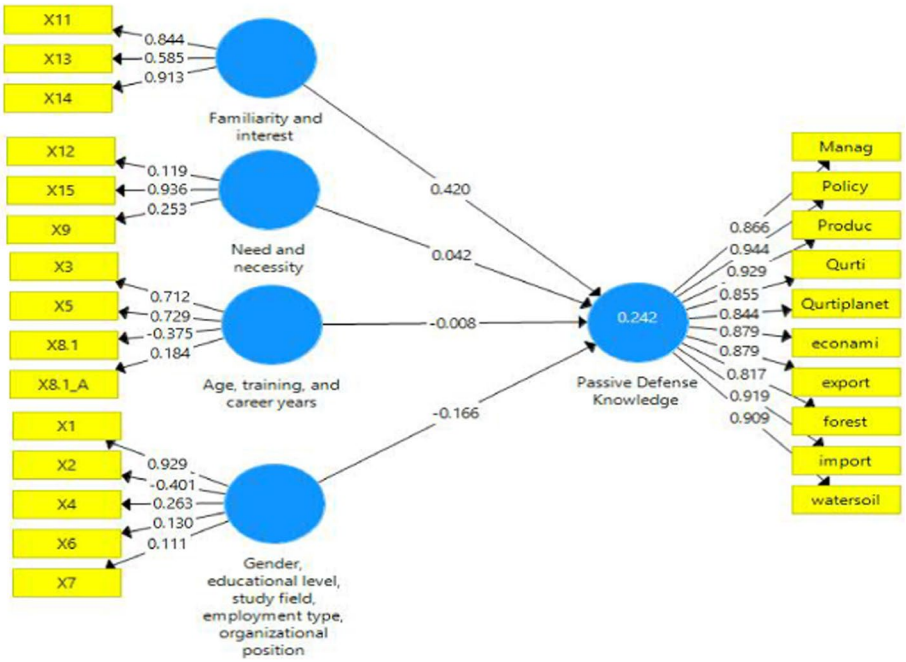

Fig. 4 The structural model of the effect of variables on experts' knowledge and their factor loads

According to the results of regression analysis, familiarity with the programmes and goals of passive defense, organizational position (expert in charge), and type of employment influenced the knowledge of passive defense significantly, and they are important variables in predicting the level of knowledge of experts in this field. This is in agreement with the results of Foxell (2001) and McKinney et al. (2005). Furthermore, employment type (contractual) had a significant effect on passive defense learning. Thus, we need to first familiarize experts with passive defense programmes and goals, and then we can proceed to enhance their knowledge. It seems that job insecurity makes experts learn passive defense. This supports the finding of Martensson et al. (2013) on the role of timely informing and creating awareness in coping with bioterrorism threats.

4 Conclusions and recommendations

Productivity is undoubtedly a desirable economic goal, but making the transition from industrial agriculture to agricultural sustainability successfully needs major institutional innovation. One step is to call public institutions to investigate the knowledge of agricultural experts. This research was considered necessary for passive defense in the agricultural sector.

According to this study, education is one of the components that may influence moral views that can be transferred to future decisions. The demographic and professional characteristics of the studied experts show that most of them had an academic degree, mostly a bachelor's or a master's degree, in "agriculture". This was anticipated because the majority

Table 8 Statistical distribution of factor loads and significance level for each item of respondents' knowledge

Construct	Variable	Symbol	*t*-value	Factor load
Knowledge of passive defense in agriculture	Agricultural information management	Manage	33.5	0.866
	Development policies	Policy	24.94	0.944
	Safe crop production	Product	78.1	0.929
	Livestock quarantine	Qurti	28.67	0.855
	Plant quarantine	Qurtiplanet	25.55	0.844
	Economy and market	Economy	30.43	0.879
	Crop exportation	Export	34.12	0.879
	Forest and pasture	Forest	15.77	0.817
	Agricultural inputs importations	Import	59.15	0.919
	Water and soil	Water soil	44.85	0.909
Familiarity and interest	Interest in learning about passive defense	X13	4.54	0.585
	Familiarity with passive defense training programmes	X14	43.11	0.913
Age, training, and career years	Age	X3	1.69	0.712
	Career years	X5	1.74	0.729
	Training before 2013–2014	X8,1	0.718	−0.375
	Training after 2013–2014	X8,1_A	0.47	0.184
	Employment type	X6	0.46	0.130
	Organizational position	X7	0.37	0.111
Gender, educational level, study field, employment type, and organizational position	Gender	X4	1.72	0.263
	Study field	X1	2.68	0.929
	Educational level	X2	1.29	−0.401
	Gender	X11	14.92	0.844
Need and necessity	Need for learning passive defense	X12	0.31	0.119
	Necessity of passive defense knowledge in food security	X15	2.23	0.936
	Necessity of knowledge for experts	X9	0.72	0.253

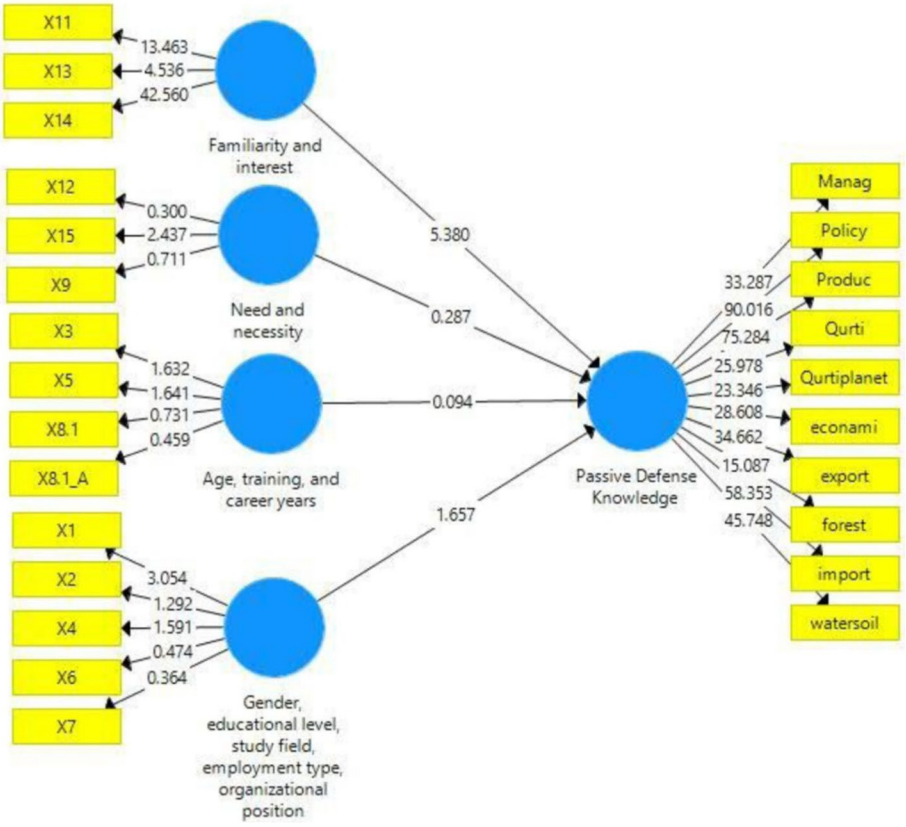

Fig. 5 Structural model of the effect of variables on experts' knowledge and factor loads in a significant state

of them participated in MOA planning, which meant they should have an in-depth technical understanding of passive defense. Thus, educational planners should pay attention to the quality of educational content in this context.

Moreover, their high average age shows their valuable experiences and deeper understanding of external threats to agriculture. Therefore, scientific and practical attention should be given to their training plans. In addition, the average career years of statistical samples show that they had a long career and job experience and might have a deeper understanding of passive defense in agriculture. Thus, increasing the studied staff experts' knowledge of issues of passive defense is necessary.

Moreover, the results showed that two variables of educational type and level of the studied people were significantly related to their knowledge of passive defense in agriculture. However, employment type and knowledge of passive defense had no significant relationship. In other words, no matter what type of employment the people had, they did not have an optimal knowledge of passive defense. This implies that distinctive training programmes should be developed for all experts of MOA, irrespective of their study field or employment type, and there is a need to enhance their knowledge of passive defense in agriculture.

According to the results of regression analysis, familiarity with the programmes and goals of passive defense, organizational position (expert in charge), and type of employment influenced the knowledge of passive defense significantly, and they are important variables in predicting the level of knowledge of experts in this field. Thus, first, the experts should be familiarized with the plans and objectives of passive defense and then proceed to improve their knowledge. It seems that job insecurity makes experts learn passive defense.

According to these findings, it is recommended to prioritize the following points in planning training courses and workshops on passive defense in the agricultural sector:

a. knowledge of the contexts and agents of biological warfare and strategies to cope with their threats; b. knowledge of the strategies of agricultural input importation with respect to the principles of passive defense; c. understanding the need for adhering to the principles of passive defense in the management of livestock quarantine; d. understanding the principles and goals of passive defense in safe crop production by the agricultural sector; e. knowledge of methods to protect natural resources and important biological species; f. observing the principles of passive defense in research centers and susceptible laboratories of the agricultural sector; g. knowledge with threats in the field of agricultural input importations; h. knowledge of the strategies of crop importation with respect to the principles of passive defense; i. knowledge of the threats to natural resources; and j. the role of passive defense in protecting water resources and their revival.

Based on the analysed issues in the field of empowering experts within the Ministry of Defense of Iran, the following observations or findings have been made. Therefore, more research is needed to identify training needs and develop a passive defense training programme for experts of specialized units in the fields of livestock and poultry, horticulture, forestry, pasture, beekeeping, and fisheries. Moreover, the socio-economic implications and effectiveness of these courses should be continually evaluated. Furthermore, the same can be done for agricultural experts and extension workers in provincial agricultural organizations.

The primary objective of the present study was to raise ethical considerations within the realm of food security through a passive defense framework, suggesting alterations in both laws and behaviours. These transformations show that the potential of organizations and individuals to act unethically is infinite. Why not consider unexpected events as a source to illuminate the challenges with integrity in public administration? The results of the investigation of agricultural experts' knowledge of passive defense in agriculture show that Iranian professionals from public administration are concerned with the sustainability of the agricultural sector. This is one step towards increasing responsibility in the promotion of ethics at the organizational level. Last but not least, passive defense should be considered a dynamic concept that both public administration and the scientific community should prioritize. It is an area that asks for an update of our ethical framework to adapt to the new agricultural challenges. Experts in public administration have a significant impact on the institutionalization of ethics because they may affect or influence the organization's decisions, practices, or actions just as the organization can affect or influence these stakeholders' decisions, practices, or activities. In reality, institutionalizing ethics entails integrating activities that bring ethics into daily professional life. Prior to this integration, however, it is important to look into how well-versed specialists are in the concepts of passive defense in agriculture.

Appendix

See Table 9.

Table 9 The statistical distribution of training priorities of the studied experts

Topics to be trained	Importance level (IM)	SD	Current knowledge(KN)	SD	Final score	Priority
Knowledge with the fields and agents of biological warfare and strategies to cope with its threats	9.32	3.1	3.51	1.16	54.25	1
Knowledge with strategies of importing agricultural inputs with respect to the principles of passive defense	9.15	3.2	3.51	1.22	51.54	2
Understanding the need for the application of passive defense principles in livestock quarantine management	9.27	3.16	4	1.5	48.85	3
The recognition of the principles and goals of passive defense in safe crop production	9.26	3.63	4.07	1.49	48.06	4
Knowledge with the methods to protect natural resources and important biological species	8.48	2.1	3.36	1.3	43.42	5
Observance of the principles of passive defense in research centers and critical laboratories of the agricultural sector	8.53	1.92	3.54	1.29	42.58	6
Knowledge with the threats posed to importing agricultural inputs	8.47	3.03	3.55	1.29	41.67	7
Knowledge with the strategies to import crops with respect to the principles of passive defense	8.44	3.07	3.55	1.6	41.27	8
Knowledge with the threats to natural resources	8.32	2.97	3.4	1.42	40.93	9
The role of passive defense in the protection of water resources and their revival	8.45	2.11	3.66	1.3	40.48	10
Knowledge with the strategies of exporting crops of natural resources with respect to the principles of passive defense	8.21	2.13	3.29	1.42	40.39	11
Knowledge with the characteristics of biological threats and the history of terroristic actions to disrupt safe crop production in the agricultural sector	8.37	2.03	3.58	1.31	40.09	12
Knowledge with the cycle of biological defense in the process of safe crop production	8.49	1.77	3.78	1.43	39.99	13
Understanding the need for the application of passive defense principles in the management of livestock quarantine	8.31	2.24	3.54	1.29	39.64	14
Knowledge with the strategies of managing the quarantine of livestock, poultry, and fish with respect to the principles of passive defense	8.31	2.06	3.57	1.5	39.39	15
Knowledge with the threats posed to agricultural and horticultural crops	8.25	1.94	3.48	1.5	39.35	16
Knowledge with the threats posed to agribusinesses and how to manage them	8.03	2.05	3.14	1.26	39.28	17
Knowledge with the strategies of agricultural data management	8.57	2.04	4.02	1.5	38.95	18
Knowledge with the strategies of crop importation with respect to the principles of passive defense	8.09	2.02	3.28	1.15	38.88	19
Knowledge with the threats in the field of agribusiness and how to manage them	8.05	1.95	3.26	1.28	38.59	20

Table 9 (continued)

Topics to be trained	Importance level (IM)	SD	Current knowledge(KN)	SD	Final score	Priority
Knowledge with the threats in the field of livestock, poultry, and fishery	8.28	2.23	3.63	1.47	38.5	21
Knowledge with the terroristic threats in the field of water and soil resources	8.15	2.07	3.51	1.16	37.8	22
Knowledge with governmental approaches to manage crop production threatening factors	8.20	1.98	3.61	1.4	37.64	23
Knowledge with the threats in the field of agricultural and horticultural crops	8.28	2.16	3.77	1.42	37.34	24
Knowledge with how to observe the principles of passive defense in plant quarantine	8.09	2.17	3.48	1.5	37.29	25
Understanding the need for the application of passive defense principles in plant quarantine management	8.15	2.17	3.7	1.42	36.27	26
Knowledge with the threats in the field of agribusinesses and how to manage them	8.20	1.98	3.79	1.5	36.16	27
Capability of analyzing the relationship between food security challenges and passive defense	8.22	1.97	3.83	1.4	36.09	28
Knowledge with agroterrorism and strategies to cope with its threats	8.07	2.17	3.6	1.23	36.07	29
Knowledge with agriculture development strategies of Iran from the perspective of passive defense	8.00	2.19	3.51	1.16	35.92	30
Understanding the need for the management of biological data and their protection against threats	8.50	1.64	4.28	1.23	35.87	31
Knowledge with the threats in the field of crop importation	8.32	2.11	4.02	2.5	35.78	32
Recognizing the policies and plans of the ministry in the field of passive defense	7.96	2.13	3.51	2.22	35.42	33
Understanding the need for the application of passive defense principles in managing the threats in agricultural markets	7.91	2.12	3.45	2.43	35.28	34
Knowledge with information management in terroristic attacks	7.98	2.26	3.61	2.4	34.87	35
Understanding the need for developing agricultural development policies with respect to the principles of passive defense	8.05	2.11	3.74	2.3	34.7	36
Knowledge with the agencies in charge of biological passive defense	8.17	1.83	4.1	2.51	33.25	37
Knowledge with cyber passive defense in the agricultural sector	7.93	2.17	3.95	2.25	31.56	38
Total	8.34	2.19	3.64	2.21	–	–

"Questionnaire of staff experts"

Dear colleague, hello!

This research was carried out with the cooperation of experts from the Ministry's headquarters, and its purpose is to "examine the level of knowledge and awareness of agricultural jihad experts in the field of passive defense of the agricultural sector". Thank you for your seriousness, patience and patience, please read the questionnaire and give your comments. Undoubtedly, your individual answers will remain confidential with the research group.

- ✓ Personal-professional characteristics of the respondent

- Field of study:

- Degree level:…..

- Age:

- Gender: Male Female

- work experience:……

-Type of employment: official and official-probationary under -a-contract Contractual Employment others

- Organizational position:…..

-The number of in-service training courses completed in the field of passive defense: before 2012, after 2012…..

- ➢ In your opinion, how necessary is the implementation of passive defense training courses in agriculture for the employees of the ministry?

It is not necessary very little little medium much very much

- ➢ In your opinion, how effective are these trainings in increasing your job productivity?

It hasn't had an effect very little little medium much very much

- ➢ How familiar are you with the goals and plans of the passive defense of the Ministry of Jihad and Agriculture?

I do not know very little little medium much very much

- In your opinion, to what extent do the experts of the ministry, especially in specialized fields, need to learn passive defense measures in the production of agricultural products and ensuring the safety and health of food for the people of the society?

They don't need very little little medium much very much

- How interested are you in acquiring information and knowledge about "passive defense in agriculture"?

It isn 't necessary very little little medium much very much

- How familiar are you with the programs and activities of the non-active defense organization of the country?
- In your opinion, how necessary is it to pay attention to passive defense in the agricultural sector to ensure the country's food security?

Idon't know very little little medium much very much

- In your opinion, what is the "importance" of the mentioned educational subjects in improving your work ability to play a more informed and accurate role in agricultural development planning? Also, what is your assessment of your "knowledge and awareness" in these fields?

It is' n necessary very little little medium much very much

In your opinion, what is the "importance" of the mentioned educational subjects in improving your work ability to play a more informed and accurate role in agricultural development planning? Also, what is your assessment of your "knowledge and awareness" in these fields?

Please answer in the form of numbers from 1 (very little) to 10 (very much).

Your level of knowledge and awareness	Variables	The importance of the subject
	Knowledge with the fields and agents of biological warfare and strategies to cope with its threats	
	Knowledge with strategies of importing agricultural inputs with respect to the principles of passive defense	
	Understanding the need for the application of passive defense principles in livestock quarantine management	
	The recognition of the principles and goals of passive defense in safe crop production	
	Knowledge with the methods to protect natural resources and important biological species	
	Observance of the principles of passive defense in research centers and critical laboratories of the agricultural sector	
	Knowledge with the threats posed to importing agricultural inputs	
	Knowledge with the strategies to import crops with respect to the principles of passive defense	
	Knowledge with the threats to natural resources	
	The role of passive defense in the protection of water resources and their revival	
	Knowledge with the strategies of exporting crops of natural resources with respect to the principles of passive defense	
	Knowledge with the characteristics of biological threats and the history of terroristic actions to disrupt safe crop production in the agricultural sector	
	Knowledge with the cycle of biological defense in the process of safe crop production	
	Understanding the need for the application of passive defense principles in the management of livestock quarantine	
	Knowledge with the strategies of managing the quarantine of livestock, poultry, and fish with respect to the principles of passive defense	
	Knowledge with the threats posed to agricultural and horticultural crops	
	Knowledge with the threats posed to agribusinesses and how to manage them	
	Knowledge with the strategies of agricultural data management	
	Knowledge with the strategies of crop importation with respect to the principles of passive defense	
	Knowledge with the threats in the field of agribusiness and how to manage them	
	Knowledge with the threats in the field of livestock, poultry, and fishery	
	Knowledge with the terroristic threats in the field of water and soil resources	
	Knowledge with governmental approaches to manage crop production threatening factors	
	Knowledge with the threats in the field of agricultural and horticultural crops	
	Knowledge with how to observe the principles of passive defense in plant quarantine	

Your level of knowledge and awareness	Variables	The importance of the subject
	Understanding the need for the application of passive defense principles in plant quarantine management	
	Knowledge with the threats in the field of agribusinesses and how to manage them	
	Capability of analyzing the relationship between food security challenges and passive defense	
	Knowledge with agroterrorism and strategies to cope with its threats	
	Knowledge with agriculture development strategies of Iran from the perspective of passive defense	
	Understanding the need for the management of biological data and their protection against threats	
	Knowledge with the threats in the field of crop importation	
	Recognizing the policies and plans of the ministry in the field of passive defense	
	Understanding the need for the application of passive defense principles in managing the threats in agricultural markets	
	Knowledge with information management in terroristic attacks	
	Understanding the need for developing agricultural development policies with respect to the principles of passive defense	
	Knowledge with the agencies in charge of biological passive defense	
	Knowledge with cyber passive defense in the agricultural sector	

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Data availability Once the manuscript is accepted, the data will be archived in the repository of the Agricultural Research, Education and Extension Organization and a link will be made available.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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