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A Comparison of Iranian Farmers' Participation in Diffusion-Push Plans with Different Levels of Training Transfer

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Original Research

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Abstract:

Today, organizations spend billions of dollars on training, yet only a small fraction of that training is effectively transferred to the workplace. Due to a lack of evaluation regarding training transfer, organizations increasingly demand evidence of performance improvement. The main objective of this study was to classify farmers participating in the diffusion-push plans of Fars Province, Iran, based on their levels of training transfer. A retrospective design was adopted, as the data pertained to past events. In terms of purpose, this was an applied study, with findings intended for use by planners and officials involved in sustainable agricultural development. A stratified random sampling technique was used to select 120 participants from the diffusion-push plans in Fars Province. Data were collected via a questionnaire consisting of two sections: one covering the components of training transfer and the other capturing farmers' demographic characteristics. The classification results showed that 95% of the farmers were accurately grouped into categories of low, moderate, and high training transfer. Farmers in the high training transfer group were identified with slightly higher accuracy (97.4%) compared to those in the low (93.3%) and moderate (88.9%) transfer groups.

Keywords: Training Transfer, Diffusion-Push Plans, Discrimination of Farmers, Fars Province, Training Transfer in Agriculture.

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INTRODUCTION

Agriculture is a key economic sector globally, playing a vital role in ensuring food security, creating employment, and preserving the natural environment (Dinh et al., 2022). In Iran, the agricultural sector supports the livelihoods of approximately 30 percent of the rural population. It also accounts for 20 percent of total employment, 23 percent of non-oil exports, 80 percent of domestic food consumption, and 90 percent of the raw materials used in the food processing industry (Ataei et al., 2022). For rural communities in Iran, agriculture is more than an economic activity—it is a way of life. Although its contribution to the country's gross domestic product (GDP) has declined over time, agriculture remains a critical component of the national economy and rural sustainability (Stads et al., 2008). However, researchers have raised serious concerns about the negative impacts of farmers' improper practices

on the environment, natural resources, and the long-term viability of agricultural systems. These concerns include soil degradation and erosion (Emadodin & Bork, 2011; Emadodin et al., 2012), excessive use of chemical fertilizers leading to water pollution (Alighardashi & Mehrani, 2017), overexploitation and depletion of groundwater resources (Golian et al., 2021), destruction of natural wildlife habitats and threats to biodiversity (Jowkar et al., 2016), and the overuse of pesticides contributing to pest resistance (Abadi et al., 2021).

It is undeniable that some of Iran's agricultural problems stem from natural factors such as climate variability and drought. However, most challenges are man-made, resulting from decades of poor management at both farm and national levels. These issues are largely due to a lack of foresight, inadequate technical knowledge and skills, and misguided perceptions of agricultural development (Madani et al., 2016).

Agricultural training and extension services are considered effective tools for enhancing farmers' knowledge and skills, offering practical solutions to these challenges (Pimonratanakan, 2022; Panyasing et al., 2022). Nevertheless, the success of such training programs in addressing agricultural problems depends on whether farmers can apply the acquired knowledge and skills to their farming practices (Gondwe et al., 2017; Ali et al., 2018; Van Huong et al., 2022). In other words, many farmers lack the necessary competencies and engage in practices that harm the environment. These farmers need to receive proper training and adopt improved behaviors. Crucially, they must also be able to transfer their learning effectively to the farm, highlighting the essential role of training transfer in achieving the intended outcomes of agricultural education programs (Ataei & Zamani, 2015; Goli et al., 2022).

In this regard, the extension service departments of agricultural organizations and institutes spend billions of dollars on training, while as little as 10 percent of the training is actually transferred to the job (Paradise, 2007). Because of the lack of evaluation of training transfer, organizations demand evidence of performance improvement (Bahrami Nejad Joneghani et al., 2023; Ghasemi Kooktapeh et al., 2023). The money spent on learning interventions is growing, and when this is coupled with the failure of transfer, the importance of increasing and improving transfer is highlighted.

Training and the transfer of that training to new settings are key issues in the design and assessment of training programs. Training transfer is an important and relevant topic for all training professionals including those involved in agriculture because it cannot be assumed that if a learner learns something, she will automatically use it on the job (Hannum, 2009). Schwartz et al. (2005) acknowledged that the literature on transfer can provide conflicting perspectives, from the position that transfer is rare to the argument that transfer is everywhere. They argued that a broader theoretical foundation can shed light on the transfer problem. Research that focuses on factors that facilitate or inhibit transfer can help build a framework to address the transfer problem. Identifying the categories of farmers according to training transfer and factors that influence their training transfer is an important step in helping instructional designers design programs for the agricultural sector and develop effective training. Huczynski and Lewis (1980) proposed that for transfer to occur, the links of the chain must include the learner, the supervisor, the facilitator, and the organization, or as they put it, "for transfer to occur, all the links must hold when the chain is pulled". In the agricultural sector, there should be interaction among farmers, extension agents, and researchers as this interaction can influence training transfer positively.

According to the literature, researchers have used various terms such as "learning transfer" (Weiss et al., 2016; Day & Khoshgoftaar, 2017; Duong & Ngo, 2022; Zhuang et al., 2020) or "the transfer of learning" (Royer, 1979) and "training transfer" or "transfer of training" (Baldwin & Ford, 1988; Baldwin et al., 2009; Baldwin et al., 2017; Ataei et al., 2022) to conceptualize the same meaning. Zhuang et al. (2020) reviewed various transfer learning approaches, especially homogeneous and heterogeneous transfer learning approaches. They demonstrated the importance of selecting appropriate transfer learning models for different applications in practice. Royer (1979) introduced the concept of "transfer of learning" based on psychological cognitive and environmental theories to describe the use of previously acquired knowledge and skills in new learning or problem-solving situations. Baldwin and Ford (1988) summarized the existing literature and outlined an agenda for going forward. They defined transfer of training as the use of knowledge and skills learned during on-the-job training programs. Then, Baldwin et al. (2017) focused on conceptualizing training transfer (not just learning) and measuring transfer outcomes.

The concept of training transfer was originally introduced by Baldwin and Ford (1988) and later expanded by Baldwin et al. (2009). According to Baldwin and Ford (1988), training transfer refers to the generalization and continued use of knowledge and skills acquired during training in the actual work environment. They emphasized that transfer is not a one-time event but an ongoing process of applying learned competencies over time.

Building on this foundation, other scholars have contributed to the development of the concept. Tannenbaum and Yukl (1992) defined training transfer as the extent to which trainees successfully apply the Knowledge, Skills, and Attitudes (KSAs) gained during training to their job roles. Khasawneh (2004) further explained that training transfer involves how individuals generalize, apply, and sustain work-related behavior changes resulting from training. Training transfer occurs when the acquired KSAs positively impact job performance. In line with Baldwin and Ford's view, this process involves the sustained use of new knowledge and behaviors, highlighting that transfer requires maintenance over time rather than a one-time implementation.

The importance of training transfer lies in the fact that,

despite the vast financial investments organizations make in training programs to enhance employee performance, only about 10 percent of that investment results in actual job performance improvement through training transfer (Garavaglia, 1993; Dustmohammadloo et al., 2023; Ebrahimi et al., 2023). This low return on investment has led human resource development (HRD) professionals and researchers to examine the underlying causes of this gap. In HRD terms, the disconnect between what employees learn and what they apply in the workplace is considered a major transfer problem (Goli & Golmohammadi, 2022; Baldwin & Ford, 1988; Broad & Newstrom, 1992; Ford, 1994). Royer (1979) identified two primary theoretical approaches to explaining the transfer of learning: cognitive and environmental theories. Environmental theories, rooted in behaviorist traditions, focus on external conditions and pay little attention to internal cognitive processes. They are mainly applicable to near transfer, where tasks in the training and application environments are closely aligned. Cognitive theories, in contrast, assume that human memory operates as a structured storage and retrieval system. They argue that successful transfer depends on how information is encoded and retrieved. These theories can explain both near and far transfer, making them more comprehensive in addressing various transfer scenarios. Royer (1979) concluded that while each approach has its strengths and limitations, cognitive theories offer broader explanatory power across diverse learning contexts.

The importance of training transfer stems from the fact that, despite the substantial financial investments organizations allocate to training programs aimed at improving employee performance, only about 10 percent of this investment results in actual improvements in job performance through the application of learned skills (Garavaglia, 1993; Dustmohammadloo et al., 2023; Ebrahimi et al., 2023). This low rate of transfer has prompted human resource development (HRD) professionals and researchers to explore the root causes of this discrepancy. In HRD, the gap between learning and on-the-job application is regarded as a significant transfer problem (Goli & Golmohammadi, 2022; Baldwin &Ford, 1988; Broad & Newstrom, 1992; Ford, 1994).

Royer (1979) identified two major theoretical perspectives to explain learning transfer: cognitive theories and environmental theories. Environmental theories, grounded in behaviorist principles, emphasize external conditions and largely overlook internal cognitive processes. They are best suited to explaining near transfer, where the tasks in the training and work environments are highly similar. Cognitive theories, on the other hand, are based on the premise that human memory is a structured system for storing and retrieving information. These theories suggest that the effectiveness of training transfer depends on how information is encoded and recalled. Unlike environmental theories, cognitive theories account for both near and far transfer, offering a more comprehensive understanding of transfer across different learning contexts. Royer (1979) concluded that although both theories have strengths and weaknesses, cognitive theories provide a more robust framework for explaining transfer across a broader range of situations.

Holton et al. (2000) proposed that solving the training transfer issue involves a two-step process. First, it is essential to understand what training transfer is and what factors influence it. Second, these influencing factors must be measured. To capture this complexity, they introduced the concept of a "transfer system," which they defined as encompassing all factors related to the individual, the training, and the organization that affect the transfer of training to job performance. Within this system, several key factors influencing training transfer have been identified by researchers. These include learner readiness, perceived content validity, motivation, and opportunity to use. Among these, learner readiness is one of the most frequently cited individual characteristics. For effective learning to occur, scholars argue that the learner must be both willing and active. Willingness refers to approaching the training with an open mind and readiness to learn, while activeness implies mental and physical engagement in the training process (Scott, 2010). Research on trainee readiness for training transfer has been documented in several studies, including those by Baldwin et al. (1991), Hicks and Klimoski (1987), Ryman and Biersner (1975), and Tannenbaum et al. (1991), all of which emphasize its critical role in ensuring successful application of training on the job.

According to the literature, management support has consistently been identified as a crucial factor in the effective application of training on the job (Brinkerhoff & Montesino, 1995; Kirkpatrick, 1998; Clarke, 2002; Lim & Johnson, 2002; Hyde, 2010; Arasanmi, 2019). In particular, the role of immediate supervisors or managers—both before and after training—can significantly influence transfer outcomes (Brinkerhoff & Montesino, 1995). While many studies have demonstrated a positive link between self-efficacy and performance, this connection is understood to be motivational in nature. Vancouver et al. (2001) found that self-efficacy positively affects training transfer. When trainees believe in their ability to meet job performance goals, they experience higher satisfaction and are more motivated to apply what they have learned (Scott, 2010). Baldwin and Ford (1988) also included self-efficacy as one of the key trainee characteristics influencing transfer. Trainers have emphasized the importance of perceived content validity in facilitating training transfer (Wang et al., 2022). When training content is seen as relevant and aligned with actual job requirements, it enhances trainee motivation and supports transfer (Clark et al., 1993; Miner, 2005). Perceived content validity reflects how well the training matches real workplace needs and expectations and is typically assessed using Holton et al.'s (2007) scale. Another critical factor is motivation to transfer—the trainee's internal drive to apply the acquired knowledge and skills in their job (Baldwin & Ford, 1988; Noe, 1986; Noe & Schmitt, 1986; Wexley & Latham, 1991; Baharim, 2008; Arasanmi, 2019; Santana-Domínguez et al., 2022). Motivation is strengthened when trainees believe in their ability to succeed and perceive value in the application

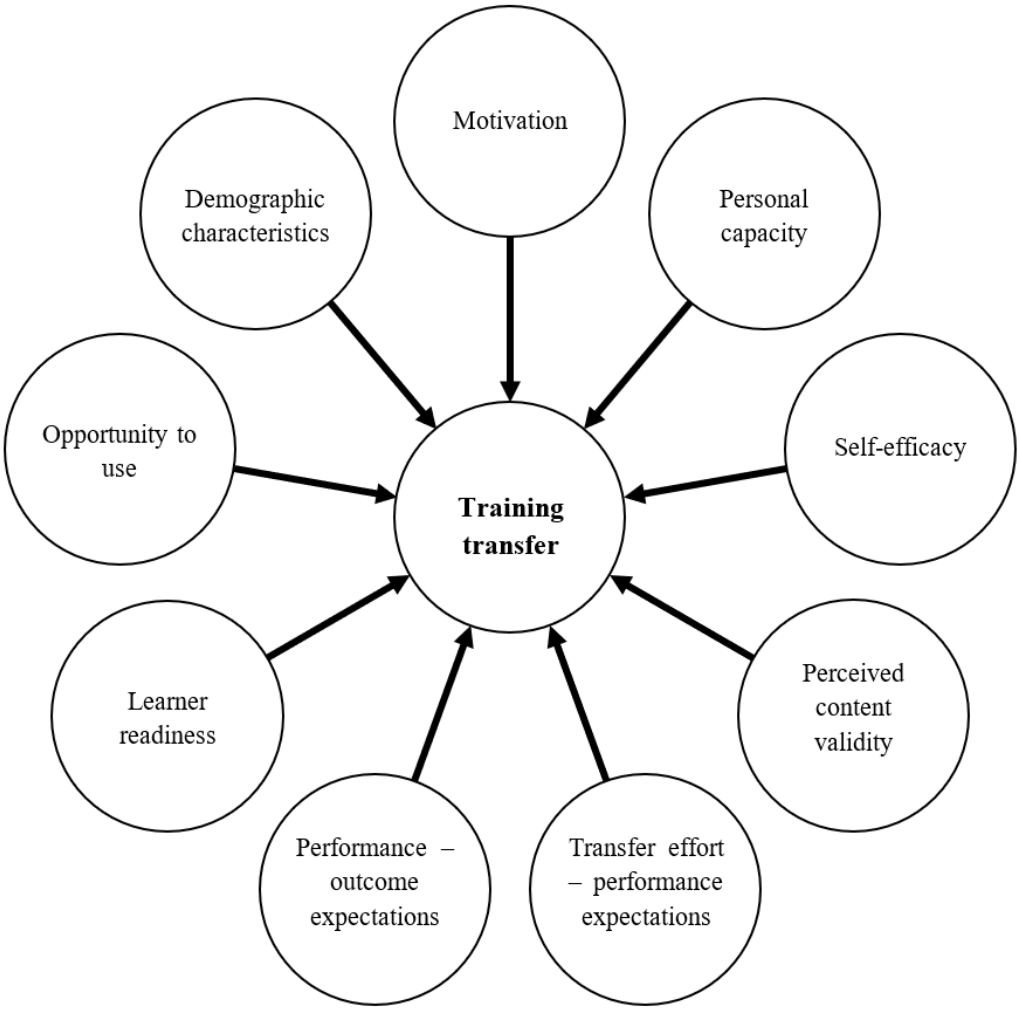

Figure 1. The Factors Influencing Training Transfer.

of their training (Yammill & McLean, 2001). Research by Lakshman (2007) and Kirwan & Birchall (2006) confirmed that motivation and awareness of training's relevance significantly influenced transfer effectiveness in healthcare organizations in Ireland.

In a study on 967 public sector managers and supervisors, Facteau et al. (1995) found that "transfer effort – performance expectations" and "performance – outcome expectations" were predictive factors of training transfer. The positive relationship between trainees' expectancy and training performance (Froman, 1977) can raise employee expectations about outcome performance (Eden and Ravid, 1982). Noe (1986) discusses that trainees will be more motivated to perform if they believe that their effort will lead to better performance and that their performance will lead to rewards.

One of the important factors for the transfer of training into the workplace is the opportunity to use (Almoussawi et al., 2022) or the opportunity to apply (Santana-Domínguez et al., 2022). "Opportunity to use" is defined as the extent to which trainees are provided with or obtain resources and tasks on the job enabling them to use training on the job (Holton, 1996). To find the opportunity and to use new learning on the job, trainees must have some 'space' in their career to make this happen. In other words, trainees may return to work after training only to be faced with a number of jobs demands or responsibilities that limit their ability to transfer training (Khasawneh, 2004).

Another factor influencing training transfer is personal capacity (Santana-Domínguez et al., 2022). Holton et al. (2000) define personal capacity for transfer as "the extent to which individuals have the time, energy, and mental space in their work life to make changes required to transfer training to the job" (p. 334). In other words, even if a person is motivated and well-trained, without sufficient physical, emotional, or cognitive resources, applying new learning becomes difficult. Additionally, demographic characteristics—such as age, education level, years of experience, and gender—have been shown to impact training transfer (Warr & Bunce, 1995; Curry et al., 2005; Coetsee & Eiselen, 2006; Lacy, 2007; Velada et al., 2009). These variables can affect an individual's readiness, confidence, and opportunity to implement new knowledge and skills. While much of the existing HRD literature has examined training transfer in public and private organizations with a focus on improving job performance and organizational outcomes, the present study introduces a novel perspective by examining training transfer

among farmers participating in agricultural development programs. This research not only measures the extent to which farmers apply learned skills on their farms but also employs a comprehensive, systems-thinking approach to identify and utilize key factors influencing training transfer. Despite these contributions, the study underscores the need for further research on training transfer specifically within the agricultural sector, where contextual and occupational conditions may uniquely shape how learning is applied.

In summary, psychological factors such as motivation (Baharim, 2008; Arasanmi, 2019; Santana-Domínguez et al., 2022) and personal capacity (Santana-Domínguez et al., 2022) would determine the amount of training transfer during training programs. Additionally, self-efficacy (Van Hoa et al., 2022; Scott, 2010), perceived self-efficacy (Paman et al., 2022; Scott, 2010), and perceived content validity (Miner, 2005) could affect participants' training transfer. "Transfer effort-performance expectations", "performance-outcome expectations" (Facteau et al., 1995), and learner readiness (Baldwin et al., 1991; Zamani et al., 2016; Ataei et al., 2021) are important internal factors to enhance training transfer. Also, management support (Hyde, 2010; Arasanmi, 2019) and demographic characteristics (Curry et al., 2005; Lacy, 2007; Velada et al., 2009) might influence the transfer of learning.

Based on the literature review and the theoretical bases of the constructs, it can be asserted that many components can influence farmers' training transfer through a systematic process. This process is based on variables of learner readiness, motivation to transfer, personal capacity for transfer, perceived content validity, opportunity to use, transfer effort-performance expectations, performance-outcome expectations, performance self-efficacy, and demographic characteristics. Due to the importance of diffusion-push plans and the important role of farmers in applying their principles, this study was conducted with the main purpose of discriminant analysis of participant farmers' characteristics in these plans based on training transfer (Figure 1).

METHODOLOGY

The research aimed to assess the adequacy of a classification of participants in diffusion-push plans of Fars province, Iran. More clearly, it aimed to investigate differences between groups on the basis of the attributes of the cases, indicating which attributes contribute most to group separation. Fars province is one of the 31 provinces of Iran located in the south. It is a major agricultural hub in Iran. Many diffusion-push plans have been conducted in this province. Also, it has a special place in Iran for its natural resources and diverse climates enabling it to be one of the main producers of major crops such as corn. The geographical and climatic diversity of the province allows for the cultivation of many crop varieties. Consequently, wildlife has diversified in the province. Agriculture is of great importance and the dominant sector in Fars province. Data were collected using a questionnaire. The face validity of the instrument was confirmed by an expert panel, and reliability was assessed through a pilot study conducted with 30 farmers outside the research population. The reliability coefficients ranged from 0.73 to 0.85, indicating acceptable internal consistency. The study population consisted of all participants involved in diffusion-push plans in Fars Province (N = 143). A stratified random sampling method was used to select participants. Although the sample size was estimated at 103 based on Krejcie and Morgan's (1970) table, it was increased to 120 to enhance data validity. Over the past two decades, diffusion-push plans have been implemented across Iran. These plans aim to support the production, adaptation, and transfer of new technologies to farmers (Ataei & Zamani Miandashti, 2014a). Additional objectives include increasing quantitative, qualitative, and sustainable agricultural output, accelerating the application of research findings, improving resource-use efficiency, and preserving natural resources to ensure clean and safe production (Ataei & Zamani Miandashti, 2014b). These plans are based on collaborative teams composed of researchers, advisors, and farmers. Researchers are expected to maintain direct communication with farmers throughout the process to understand planning, challenges, and obstacles. In some cases, recommended practices must be implemented by the farmers as part of the program.

This research was a quantitative study employing a survey design to describe data collected from the target population. The data were analyzed using SPSSwin26 and subjected to discriminant analysis. Data were gathered through a structured questionnaire consisting of three sections: Farmers' demographic characteristics, training transfer, independent variables, including: Learner readiness, motivation to transfer, personal capacity for transfer, perceived content validity, opportunity to use, transfer effort–performance expectations, performance–outcome expectations, performance self-efficacy. Learner readiness refers to the degree to which farmers are prepared to enter and actively engage in diffusion-push plans. Performance self-efficacy is defined as a farmer's general belief in their ability to improve farm performance whenever they choose to. Perceived content validity reflects the extent to which farmers believe the training content accurately aligns with real farm responsibilities. Personal capacity for transfer is the degree to which farmers possess the energy, time, and mental capacity in their work life to implement changes required for training transfer. Opportunity to use refers to the availability of resources and relevant tasks that allow farmers to apply training from diffusion-push plans on their farms. Motivation to transfer is defined as the direction, intensity, and persistence of a farmer's effort to apply newly learned knowledge, skills, and attitudes in real farming conditions. Transfer effort–performance expectations represent farmers' belief that their efforts in applying training will result in improved farm performance. Performance–outcome expectations are defined as the belief that improvements in farm performance will lead to valuable and desirable outcomes.

Questionnaires were completed through face-to-face interviews. A 5-point Likert-type scale, ranging from strongly agree to strongly disagree, was used for measurement. The training transfer score was calculated

using predefined formulas. All items were positively scored, meaning that a higher score indicated a higher level of training transfer. Therefore, the greater the score obtained by a farmer, the higher the degree to which they were considered to have transferred training to their farm practices.

$$TR = \frac{AT}{TT} \times \frac{PA}{PT} \times \frac{YT}{YP} \quad (1)$$

$$LT = \frac{TR1 + \ldots + TRn}{NR} \quad (2)$$

where *TR* is the transfer of recommendation X, *AT* is the average number of times the trainee has implemented the recommendation per year, *TT* is the total number of times that the recommendation should be implemented per year, *PA* is the percentage of the total farm acreage on which the recommendation has been implemented, *PT* is the percentage of the total farm acreage on which the recommendation should be implemented, *YT* is the number of years that the trainee has been implementing the recommendation, and *YP* is the number of years that have passed from training. In the second formula, TR_1 is the transfer of recommendation X_1, TR_n is the transfer of recommendation X_n, *NR* is the number of recommendations, and *LT* is the extent of training transfer per farmer per plan.

RESULTS AND DISCUSSION

All 220 participants in the Diffusion-Push Plans (DPPs) ranged in age from 23 to 77 years, with the majority (60.8%) falling within the 31–50-year age group. Most respondents (90.8%) were married. Among the 120 respondents who completed the questionnaire regarding education level, 36.7 percent had a secondary education, and 8.3 percent held an associate diploma or higher. The largest portion of participants (39.2%) reported an annual income of less than USD 2,543. As anticipated, the DPP recommendations were not fully implemented. The mean training transfer score among participants was 0.67 (on a scale from 0 to 1), while the average years of farming experience was 28.91. A transfer score above 0.5 indicates an above-average level of training transfer. A comparison of the plans revealed that Plan 4 had the highest mean training transfer score (0.74), while Plan 5 had the lowest (0.54). The mean scores for all plans are detailed in Table 1.

Based on the training transfer scores (mean = 0.67; standard deviation = 0.17), farmers were categorized into three groups: low, moderate, and high levels of training transfer. In this study, and in accordance with the literature review, the following variables were included in the model as key determinants of training transfer levels: learner readiness (LR), motivation to transfer (MT), personal capacity for transfer (PCT), perceived content validity (PCV), opportunity to use (OU), transfer effort–performance expectations (TEPE), performance–outcome expectations (POE), performance self-efficacy (PSE), age, years of experience in farming (YEF), and education level (EL). Discriminant standardized functions were as follows:

F_1= 0.009 LR + 0.44 PSE + 0.43 MT + 0.04 TEPE + 0.46 POE + 0.38 OU - 0.07 PCT + 0.39 PCV - 0.65 age - 0.08 EL + 0.28 YEF
Wilks' Lambda= 0.151 $p< 0.01$

F_2= 0.27 LR - 0.57 PSE + 0.09 MT - 0.09 TEPE + 0.56 POE - 0.59 OU + 0.17 PCT + 0.05 PCV + 0.006 age + 0.26 EL + 0.08 YEF
Wilks' Lambda= 0.810 $p< 0.01$

Wilks' lambda, which indicates the significance of the discriminant function and is the inverse of the squared canonical correlation, was statistically significant (p <0.01) for both functions. This result suggests that the

Table 1. The Measurement of Training Transfer in DPPs.

Subject of plan	Mean	SD
Winning the battle against narrow-leaf and broadleaf weeds	0.66	0.17
Influence of seed disinfection and spraying with new systemic pesticides on reducing the damage from beet curly top	0.57	0.26
Impact of rice-fish farming on rice production	0.70	0.16
Efficient use of phosphorus in sustainable wheat farming	0.74	0.08
The effect of sanitary practices on the microbial quality of raw milk	0.54	0.22
California Mastitis Test (CMT) to improve the quality and quantity of raw milk production	0.67	0.17
Total	**0.67**	**0.17**

Table 2. Eigenvalues and Canonical Correlation.

Function	Eigenvalue	% of variance	Cumulative %	Canonical correlation
1	4.371	94.9	94.9	0.902
2	0.235	5.1	100	0.436

Table 3. The Correlation of the Variables and Mean Group Differences.

Variables	Variables correlation with function1	Variables correlation with function 2	Mean			*p*-Value
			Group 1	Group 2	Group 3	
LR	0.009	0.274	9.06	11.22	16.30	0.000
PSE	0.446	-0.573	6.80	14.29	17.20	0.000
MT	0.436	0.098	11	15.29	21.53	0.000
TEPE	0.047	-0.095	23.86	24.81	27.15	0.008
POE	0.461	0.565	10.66	11.51	18.35	0.000
OU	0.389	-0.598	7	14.51	16.10	0.000
PCT	-0.073	0.170	18	17.48	17.41	0.787
PCV	0.399	0.057	9.73	14.11	18.62	0.000
Age	-0.651	0.006	62.60	51.37	38.71	0.000
EL	-0.087	0.268	5.40	5.40	8.48	0.001
YEF	0.289	0.084	32.86	31.37	27.30	0.193

Table 4. Classification Results of the Discriminant Analysis Model.

Groups	Count	Predicted group membership		
		G 1	G 2	G 3
G 1	15	14	1	0
		93.3%	6.7%	0%
G 2	27	1	24	2
		3.7%	88.9%	7.4%
G 3	78	0	2	76
		0%	2.6%	97.4%

95% of originally grouped cases were correctly classified.
G1= Participants with low training transfer
G2= Participants with moderate training transfer
G3= Participants with high training transfer

discriminant functions reliably differentiate between groups. Function 1 accounts for 84.9 percent of the variance (i.e., 15.1% unexplained), while Function 2 accounts for 19 percent of the variance (81% unexplained). Since the analysis involves three groups—participants with low, moderate, and high training transfer—two discriminant functions are produced. Eigenvalues are directly related to canonical correlations and reflect each function's ability to discriminate between groups. The larger the eigenvalue, the greater the discriminating power of the function. As presented in Table 2, Function 1 has a considerably higher eigenvalue (4.37) compared to Function 2 (0.23), indicating that Function 1 has a stronger discriminant ability.

Table 3 presents an index of the importance of each predictor, similar to standardized regression coefficients (beta) in multiple regression. The standardized coefficient for age in the first discriminant function is larger in magnitude than that of any other variable, indicating that age has the greatest influence on the first discriminant score among the 11 predictors. In the second function, the standardized coefficients for opportunity to use, performance self-efficacy, and performance–outcome expectations are the largest, suggesting that these three variables have the strongest impact on the second discriminant score. In Group 1 (low training transfer), farmers scored lower on learner readiness, motivation to transfer, transfer effort–performance expectations, performance–outcome expectations, performance self-efficacy, perceived content validity, and opportunity to use compared to the other two groups. Additionally, the average age of farmers in Group 1 was higher than that of farmers in the moderate and high transfer groups. The results indicate that all variables—except personal capacity for transfer and years of experience in farming—were statistically significant ($p > 0.01$). All other results and values are detailed in Table 3. The classification results presented in Table 4 show that 95 percent of the farmers were correctly classified into the low, moderate, and high training transfer groups.

Classification accuracy was highest for the high training transfer group at 97.4 percent, followed by the low group at 93.3 percent, and the moderate group at 88.9 percent. Specifically: Out of 78 cases predicted to be in the high training transfer group, 76 were correctly classified, and 2 were misclassified into the moderate group. Out of 15 cases predicted to be in the low training transfer group, 14 were correctly classified, with 1 misclassified. Out of 27 cases predicted to be in the moderate training transfer group, 24 were correctly classified, and 3 were misclassified. These results confirm that the discriminant model performed very accurately in classifying participants based on their level of training transfer.

CONCLUSION AND RECOMMENDATIONS

Unfortunately, as performance expectations continue to rise, many organizations are struggling to meet even their current goals. In the agricultural sector, trainers from the Ministry of Agriculture, who are the most commonly utilized resource to improve farmers' performance, have fallen short of delivering high-impact results. For example, while experts from the Ministry have placed emphasis on ensuring that farmers acquire new knowledge and skills, the focus has remained on learning outcomes at the end of training activities, rather than on the actual application of that learning on farms. In practice, farmers often fail to apply the knowledge and skills they have gained during training to their real farming conditions. Researchers such as Baldwin et al. (2009, 2017) and Santana-Domínguez et al. (2022) argue that training transfer is a crucial mediating factor between individual learning and real-world outcomes. As such, the assessment and enhancement of training transfer—which serves as the vital link between farmer learning and agricultural advancement—has become a growing priority for many human resource managers and policymakers in the sector.

This paper examined the classification of farmers participating in diffusion-push plans based on their level of training transfer. To determine whether differences among groups could be attributed to specific characteristics that most strongly contribute to group separation, the analysis revealed that farmers with low training transfer scored lower on several key variables, including learner readiness, motivation to transfer, transfer effort–performance expectations, performance–outcome expectations, performance self-efficacy, perceived content validity, and opportunity to use, compared to farmers in the other two groups.

Farmers with low training transfer lacked a clear understanding—prior to training—of how the program could benefit and improve their farming practices. They did not believe in their ability to apply newly acquired skills and were not enthusiastic about trying to implement what they had learned. In contrast, farmers with high training transfer reported that the training content closely aligned with their actual job requirements. They believed that applying the new skills would enhance both the quality of their lives and the productivity of their farms. These findings align with existing literature, which highlights the influence of factors such as learner readiness (Baldwin et al., 1991), self-efficacy (Ataei & Zamani Miandashti, 2014a; Scott, 2010), perceived content validity (Miner, 2005), motivation (Baharim, 2008; Arasanmi, 2019; Santana-Domínguez et al., 2022), opportunity to use (Ataei et al., 2021; Santana-Domínguez et al., 2022), personal capacity (Santana-Domínguez et al., 2022), transfer effort–performance expectations, and performance–outcome expectations (Facteau et al., 1995) on training transfer effectiveness.

The results also showed that farmers with low and moderate training transfer were generally older than those with high training transfer, and the latter group had a higher level of education. These findings are consistent with previous studies, including those by Curry et al. (2005), Coetsee and Eiselen (2006), Lacy (2007), and Velada et al. (2009). Farmers in the low training transfer group demonstrated lower readiness, particularly in understanding how to apply recommendations, interpret training outcomes, and implement the plan effectively before it began. This lack of subjective readiness weakened their motivation to transfer, reduced their transfer effort–performance expectations and performance–outcome expectations, and ultimately limited their training transfer. To address this, agricultural extension agents should organize targeted extension classes and programs aimed at increasing farmers' readiness for training transfer.

Furthermore, perceived content validity was found to significantly influence training transfer across the three groups. To enhance this perception, extension agents are encouraged to use tools such as educational films, CDs, and demonstration farms to bridge the gap between training content and actual job tasks. Based on the findings, it is recommended that participants selected for future programs should ideally possess the following characteristics: Higher education level, greater readiness for training, younger age, stronger self-efficacy, higher motivation, greater transfer effort–performance and performance–outcome expectations, adequate opportunity to apply new knowledge and higher perceived content validity. These factors collectively support more effective training transfer and better implementation of diffusion-push plans.

Governments and organizations recognize the importance of training but have largely failed to address the challenges related to training transfer. This study makes a timely and practical contribution to human resource development (HRD) practices within the Ministry of Agriculture by examining training transfer in the agricultural sector. Its goal is to identify the strengths and weaknesses in current transfer practices. A precise diagnosis of transfer-related issues creates opportunities for performance improvement. To achieve better outcomes, the Ministry should shift its training evaluation focus to higher levels, particularly the application and results of training, rather than merely assessing learning completion. This study offers measurable indicators of training transfer that can help the Ministry evaluate the effectiveness of training programs and improve performance outcomes. The findings also provide a tested framework that can support theoretical development in

the field of training transfer. Researchers can build on this model to establish broader theoretical principles, and trainers can use the insights to improve training design and delivery by concentrating on factors proven to influence transfer. By focusing on Iran's agricultural context, the study can encourage greater interest among both practitioners and researchers to allocate resources toward investigating training transfer, especially given that organizations often invest millions of dollars in training without evaluating its impact on farm-level performance. Like all research, this study includes assumptions and limitations that may affect its results and their generalizability. Awareness of these factors helps mitigate their effects and allows for transparent communication of the study's scope and boundaries. These limitations are outlined in the following section.

One of the key limitations of this study is the reliance on self-reported data from farmers. Their responses were based on recall of training experiences that occurred two to three years prior, which may have introduced memory bias. Additionally, the use of a single data source poses the risk of method variance (Podsakoff & Organ, 1986). For instance, the measure of motivation to transfer was based solely on the trainees' perceptions and was not corroborated by input from supervisors. Collecting supervisor feedback on factors that influence training transfer could enhance the reliability and validity of the findings. While this approach was beyond the scope of the current study, it represents a valuable direction for future research. In conclusion, for the sustainable development of agriculture, it is not enough to merely implement agricultural education programs. Equal emphasis must be placed on ensuring training transfer. To support this, pre-training empowerment and capacity-building efforts that enhance farmers' subjective readiness for transfer should be prioritized by extension agents.

Moreover, the Ministry of Agriculture Jihad should design training programs with relevant and practical content aligned with farmers' job requirements, including the essential skills and knowledge they need. Extension agents, as the primary agricultural trainers, should also receive training and recognition to strengthen their understanding of training transfer and to apply effective methods and strategies that facilitate it.

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CONFLICTS OF INTEREST
The authors have not declared any conflict of interest.

AUTHOR(S) CONTRIBUTION
Pouria Ataei: Writing – original draft, Software, Methodology, Conceptualization. Hamid Karimi: Writing – review & editing, Supervision, Formal analysis, Data curation. Meysam Menatizadeh: Writing – review & editing, Validation, Methodology.

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