

Determinants of the Transfer of Sustainability Learning in Agricultural Sector of Iran

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ABSTRACT

Literature review indicates that systemic agricultural human resource development interventions are rarely carried out in developing countries, and limited knowledge exists about how successful they are. Learning transfer is the generalization of material learned, such as skills acquired or knowledge gained in training, back to the job. The main aim of this study was to analyze factors influencing sustainability learning transfer among farmers participating in Diffusion-Push Plans in Fars Province, Iran. A total number of 120 subjects were selected through stratified random sampling method. Results revealed that performance-outcomes expectations, perceived content validity, transfer design, opportunity to use, supervisor support, years of experience in farming, and age had a significant effect on participants' learning transfer. The formula developed in this study contributes to quantify learning transfer and provides new opportunities for a deeper investigation of causal relationships among learning transfer factors using advanced statistical methods. Farmer training decision makers and other actors in the extension system should pay particular attention to the factors reported here as critical to learning transfer.

Keywords: Diffusion-Push Plans, Farmer training, Learning transfer system inventory, Transfer of sustainability learning.

INTRODUCTION

Development interventions require substantial allocation of resources, but there is little evidence in research that the skills, knowledge, and behavior learned in training programs are transferred to the job or result in changed behavior in the workplace (Baldwin and Ford, 1988). Transfer of learning is generally defined as the degree to which trainees apply the knowledge, skills, and attitudes gained in training to their job (Holton *et al.*, 2003). Review of training outcomes suggests that participants often fail to transfer what is learned in training to the workplace. According to the practitioners, less than 20 percent of the skills and knowledge acquired in training are used in the job (Devos *et al.*, 2007).

With rapid changes in agricultural knowledge and information systems, farmers need to learn and transfer their learning continuously for a better role playing in agricultural development. Fars Provincial Organization of Agriculture spends a considerable amount of money on providing learning opportunities for farmers. But, most agricultural human resource development (HRD) professionals realize that this organization needs to enhance transfer of learning (Zibaei, 2006; Jalali and Karami, 2006) among target farmers. To our knowledge, most of the previous studies investigating learning transfer determinants employed factor analysis to identify underlying constructs, but, studies that measure learning transfer (e.g. Xiao, 1996) and determine predictive power of

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independent variables are still limited. The current research measured the transfer of learning among farmers and investigated the predictive power of learning transfer model.

MATERIALS AND METHODS

Learning Transfer System Inventory and the Research Hypotheses

Holton *et al.* (2000) designed a questionnaire, known as Learning Transfer System Inventory (LTSI), whose purpose was to investigate the system of variables that influence learning transfer. The LTSI has four sets of factors: motivation, work environment, ability, and trainee characteristics. The motivation, work environment and ability factors directly influence individual performance, whereas the trainee characteristics are perceived to affect motivation and then further to affect individual performance. They suggest that improvement in job performance results from learning transfer than learning by itself. In early development of the LTSI, Holton *et al.* (1997) factor-analyzed nine constructs for transfer climate. The factors assessed in the study were essentially related to environmental factors. Holton *et al.* (2000) expanded the instrument by fitting the factors to an evaluation model (Holton, 1996) and included motivational-related (for example, expectancy and motivation to transfer), ability-related (for example, personal capacity for transfer), and trainee-characteristics-related factors (for example, learner readiness and performance self-efficacy). The results suggested that sixteen LTSI factors were validated. Measuring sixteen factors represents two construct domains: specific scales and general scales in the LTSI. The training in specific domain contains eleven constructs. The training in general domain consists of five constructs. Several previous studies (Yamnil, 2001; Bookter, 1999) have validated LTSI factors, suggesting that it contains unique constructs. In the year 2012, Bates *et al.* (2012)

introduced a new version of the LTSI whose items were reduced to 48.

This study addresses answering to the question "What are the factors influencing learning transfer among participants in Diffusion-Push Plans (DPPs)?" The research framework for this study is an adaptation of the LTSI model (Holton *et al.*, 2000) and literature review. Our extended LTSI model included LTSI factors as well as personal characteristics (age, level of education and years of experience in farming). Twenty three hypotheses were formulated to test the research model. The influences of subjective trainee characteristics on motivation factors were explored through hypotheses H1 to H6. Hypotheses H7 to H9 were formulated to investigate the effects of motivation factors on learning transfer. The influences of environmental elements on learning transfer were addressed using hypotheses H10 to H16. Hypotheses H17 to H20 were formulated to investigate the effects of ability factors on learning transfer. The influences of personal characteristics on learning transfer were addressed through hypotheses H21 to H23. The framework for and the hypotheses tested by this study are presented in Figure 1. To avoid complexity in the figure, the parts which the reader can easily conceive are not presented in the figure.

Sampling

The study population was all participants in DPPs of Fars Province (N= 143). The sample was selected by a stratified random sampling from participants. Sample size was estimated at 103 participants based on Krejcie and Morgan's (1970) table. To enhance the generalizability of the findings, the sample size was increased to 120. Participants' age ranged from 23 to 77. The majority of respondents (60.8%) indicated being between 31 and 50 years old. The mean score of years of experience in farming was 28.91. Of the 120 respondents

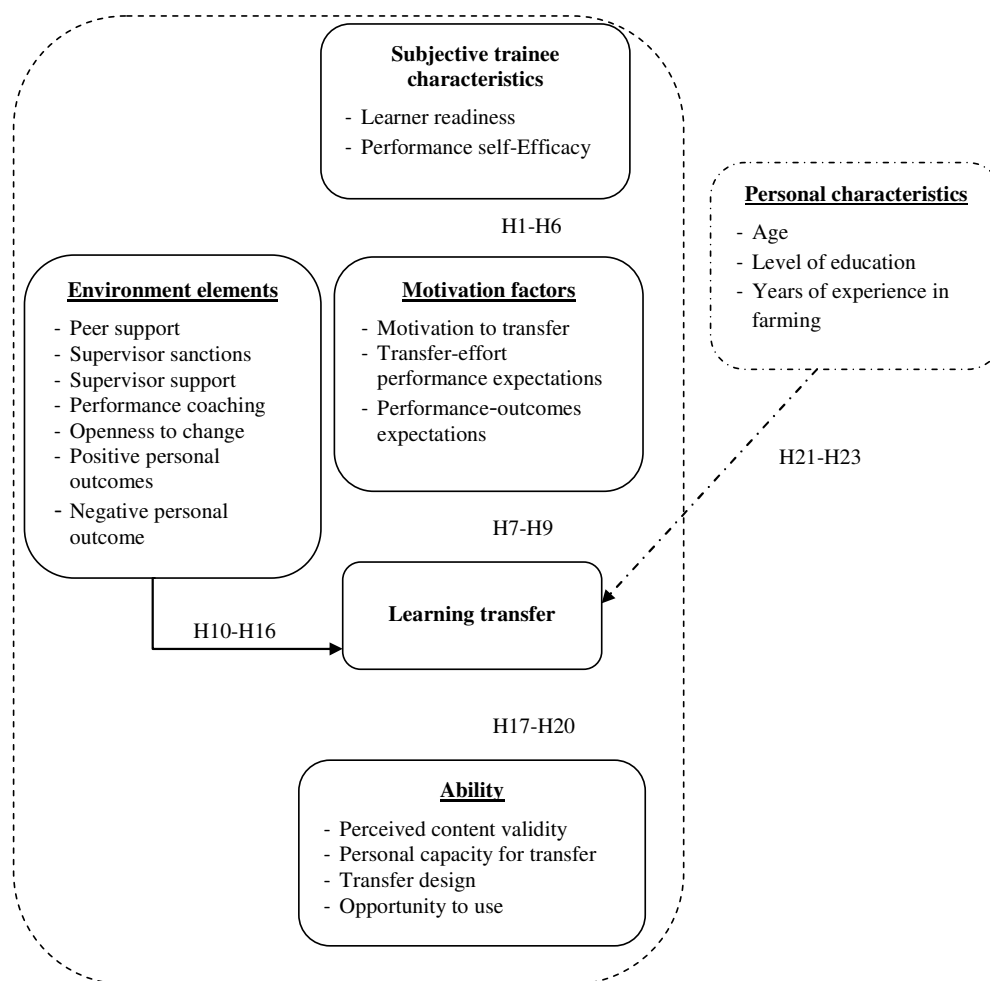


Figure 1. Research framework.

answering the question related to their education level, 19.2% were illiterate, 36.7% indicated having secondary education, and 8.3% indicated having an associate diploma or higher. The majority of participants (39.2%) had an annual income lower than 2,500 Dollars.

The Case under Study

Iran's Ministry of Agriculture formulated Diffusion-Push Plans to increase adoption of improved and more sustainable agricultural technologies and practices. These plans were first implemented in 2000. This participatory extension approach involves a range of

stakeholders and professionals including farmers, extension agents, and researchers in a cooperative and flexible learning process. This study focused on DPPs implemented in Fars Province. By the time of the current study, six DPPs had been carried out in the following subjects: winning the battle against narrow leaf and broadleaf weeds; influence of seed disinfection and spraying with new systemic pesticides on reducing the damage from Beef Curly Top; impact of rice-fish farming on rice production; efficient use of phosphorus in sustainable wheat farming; the effect of sanitary practices on the microbial quality of raw milk; and California Mastitis Test (CMT) to



improve the quality and quantity of raw milk production.

Data Collection and Analysis

The current study was a quantitative research in nature, and a survey design was used to achieve research objectives. The data were obtained through a questionnaire whose items were developed using prior research (e.g., Holton *et al.*, 2000; Zamani-Miandashti and Malek-Mohammadi, 2012), and interview with local informants. Face validity of the questionnaire was obtained through an experts' panel and reliability was obtained through pilot testing 30 farmers out of the research populations. The reliability estimates ranged from 0.73 to 0.92. Questionnaires were completed through face to face interviews. Five-point Likert-type response scale (from Strongly disagree= 1 to Strongly agree= 5) was used to measure LTSI constructs. The number of items ranged from four to seven.

In order to obtain transfer score, we applied the following formulas. All the items were positively scored, so the higher the score obtained by one farmer, the greater his transfer.

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

$$LT = \frac{TR_1 + \dots + TR_n}{NR} \quad (2)$$

Where, TR is transfer of recommendation X , AT refers to 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 refers to the percentage of the total farm acreage on which the recommendation should be implemented, YT is the number of years that trainee has been implementing the recommendation, YP is the number of years that have passed from training. In the second formula, TR_1 refers to

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 learning transfer per farmer per plan.

Data were analyzed using the Analysis of Moment Structures (AMOS_{win 20}). Path analysis was used to examine the relationships among variables.

RESULTS

The Extent of Learning Transfer

As expected, the DPP recommendations were not fully implemented. The mean score of participants' learning transfer was 0.67 (range of learning transfer was 0 to 1). The mean score of leaning transfer was more than 0.5, suggesting above-average transfer. Review of the plans indicates that the plan "efficient use of phosphorus in sustainable wheat farming" (Mean= 0.74) had the maximum (0.74) and the plan "the effect of sanitary practices on the microbial quality of raw milk" had the minimum (0.54) learning transfer (mean score).

Measurement Model Estimation

We analyzed the structural equation model using Analysis of Moment Structures (AMOS), which simultaneously estimates the model, including latent and observed variables, exogenous and endogenous variables, and the paths to these variables. Goodness of fit measures indicate how well the model fits the data and the paths in the analysis. Non-significant chi-square statistics indicate a good fit; however, chi-square statistics are sensitive to sample size, thus other goodness of fit are also often used. These goodness of fit indices i.e. Normed Fit Index (NFI), Relative Fit Index (RFI), and Comparative Fit Index (CFI) presented in Table 1 indicated a good fit with values greater than 0.90 (Medsker *et al.*, 1994).

Table 2. Total and direct effects between subjective trainee characteristics and motivational factors.

Exogenous variable	Endogenous variable	Direct effect	Indirect effect	Total effect
Performance	Motivation to transfer	0.09	0	0.09
self-efficacy	transfer effort–performance expectations	0.06	0	0.06
	Performance–outcomes expectations	0.32	0	0.32
learner readiness	Motivation to transfer	0.48	0	0.48
	Transfer effort–performance expectations	0.20	0	0.20
	Performance–outcomes expectations	0.23	0	0.23

Analysis of Structure Model

A path analysis was used to estimate simultaneously the processes of influence of some variables on others, and the direct and indirect effects of all variables on learning transfer.

According to the model, subjective trainee characteristics had direct effect on motivational factors and indirect effect on learning transfer.

From the overall model (Figure 2), it can be seen that “learner readiness” had its strongest significant effect on ‘motivation to transfer’ (0.48, $P < 0.000$), providing support for H1. Other path stemming was from learner readiness to “transfer effort–performance expectations” and “performance–outcomes expectations” and it had medium significant effect on them (0.20, $P < 0.05$), (0.23, $P < 0.01$), providing support for H2 and H3.

The model suggests that “performance self-efficacy” had strong significant effect on “performance–outcomes expectations” (0.32, $P < .01$) and did not have significant

effect on “motivation to transfer” and “transfer effort–performance expectations”. This result provided support for H6, but H4 and H5 were rejected. According to Holton (2005), performance self-efficacy has direct effect on performance–outcomes expectations. Other direct, indirect, and total effects are presented in Table 2.

According to the model, motivational factors, environmental elements, ability and personal characteristics had direct effect on learning transfer. Among ability factors, perceived content validity (0.11, $P < 0.05$), transfer design (0.12, $P < 0.05$) and opportunity to use (0.19, $P < 0.000$) had direct, significant and positive effects on learning transfer, providing support for H17, H19 and H20. This finding suggests that when farmers are provided with resources and tasks on the job, training instructions match the job requirements, and perceived training content reflects job requirements, learning transfer increases. Personal capacity for transfer did not have a significant effect on learning transfer, and therefore, H18 was rejected.

Performance–outcomes expectations, with

Table 1. Goodness of fit measures.

Assumptions	Recommended values	Proposed model
Chi-square	$P > 0.05$	Chi-square = 44.76 Degrees of freedom= 38 Probability level= 0.2
Normed Fit Index (NFI)	> 0.90	0.962
Relative Fit Index (RFI)	> 0.90	0.921
Comparative Fit Index (CFI)	> 0.90	0.993
Root Mean Square Residual (RMSEA)	< 0.10	0.039

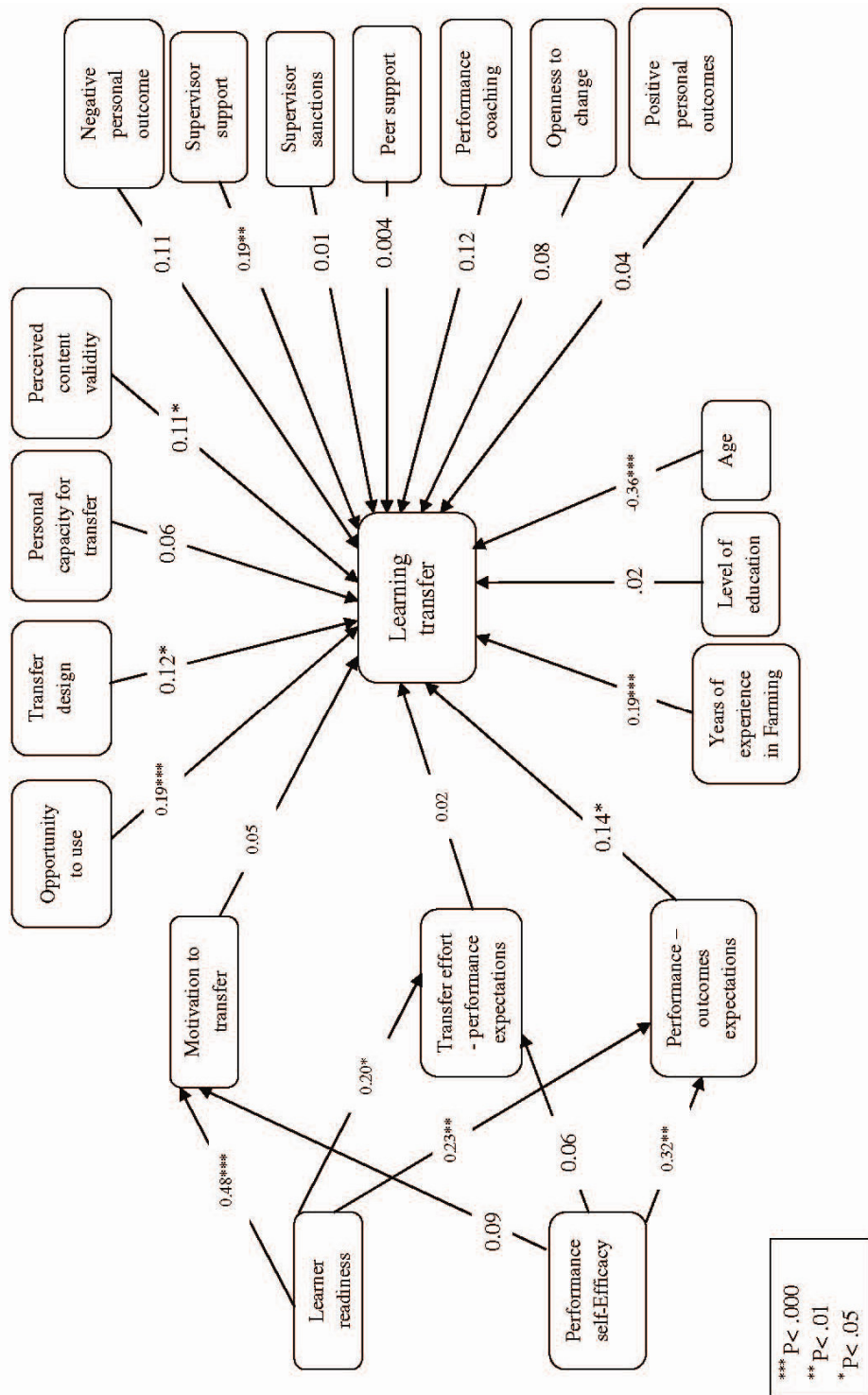


Figure 2. The model of learning transfer.

a path coefficient of .14 ($P < 0.05$), had a direct, significant, and positive effect on learning transfer, providing support for H9. This means that farmers with higher performance-outcome expectations have larger extent of learning transfer. Two variables of motivation to transfer and transfer effort-performance expectations did not have significant effect on learning transfer, and therefore, H7 and H8 were rejected.

As shown in Figure 2, supervisor support (0.19, $P < 0.01$) had a direct, significant, and positive effect on learning transfer. Therefore, the full support of supervisors increases learning transfer. Other environmental elements did not have significant effects on learning transfer. These results provided support for H12, but all other hypotheses derived from environmental elements (H10, H11, H13, H14, H15, and H16) were rejected.

Of personal characteristics, years of experience in farming (0.19, $P < 0.000$) and age (-0.36, $P < 0.000$) had a direct and

significant effect on learning transfer, providing support for H21 and H23. Years of experience in farming had a positive influence, while age had a negative effect on learning transfer. But, level of education did not have a significant effect on learning transfer, therefore, H22 was rejected. Other direct, indirect and total effects are provided in Table 3.

DISCUSSION

Recommendations for Practice

Results of this study have some practical value regarding farmer sustainability training. The factors determined here as critical to the success of sustainability learning transfer should be addressed by those who organize learning opportunities for farmers. We found that widespread support of supervisors maximizes learning

Table 3. Total, direct and indirect effects between variables of model.

Categories	Variable	Direct effect	Indirect effect	Total effect
Subjective trainee characteristics	Performance self-efficacy	0	0.05	0.05
	Learner readiness	0	0.06	0.06
Motivational factors	Motivation to transfer	0.05	0	0.05
	Transfer effort-performance expectations	0.02	0	0.02
Environment elements	Performance-outcomes expectations	0.14	0	0.14
	Peer support	0.004	0	0.004
	Supervisor sanctions	0.01	0	0.01
	Supervisor support	0.19	0	0.19
	Performance coaching	0.12	0	0.12
	Openness to change	0.08	0	0.08
	Positive personal outcomes	0.04	0	0.04
Ability	Negative personal outcome	0.11	0	0.11
	Perceived content validity	0.11	0	0.11
	Personal capacity for transfer	0.06	0	0.06
	Transfer design	0.12	0	0.12
Personal characteristics	Opportunity to use	0.19	0	0.19
	Age	-0.36	0	-0.36
	Level of education	0.02	0	0.02
	years of experience in farming	0.19	0	0.19



transfer. This finding is consistent with the results of Cromwell and Kolb (2002); Brinkerhoff and Montesino (1995); Quinones *et al.* (1995); Cohen (1990); and Holton *et al.* (2007, 2000). Extension agent's support for farmers so that farmer together with extension agent can discuss individuals' problems and try to find solutions leads to enhanced transfer of learning. Extension workers and researchers should provide catalytic, facilitating, and supportive role, and their supportive role should be fulfilled not only during training but also even before and after the training program. They should guarantee that farmers receive a sufficient amount of self-determination and freedom in how to perform their job. Based on the studies that found positive relations between supervisory support and transfer, Weisweiler *et al.* (2012) summarize five behaviors that might enhance transfer: prompting trainee after training to set proximal goals to implement the training content at the workplace; providing recognition and encouraging trainees to put the newly learned knowledge and skills into practice; being a role model in everyday life or by attending the training as well; supporting constructive dialogue and discussion about the newly learned; and, sharing information and giving direct feedback.

The results of this study suggested that training content should be valid and appropriate. The findings agree with the result of Bates *et al.* (1997) and Khasawneh (2004). Without strong match between the training content and the trainee's work roles, transfer of learning is hindered. Appropriateness of content is situation driven, and what is appropriate for one farmer may not be appropriate for another, even though both families are within the same agro-ecological zone. Content appropriateness should be defined within the scope of what is technically feasible, economically feasible, socially acceptable, and environmentally safe and sustainable (Campbell and Barker, 1998). This research also verified the presence of positive relationship between opportunity to use and

learning transfer. Access to resources is considered as the key component of opportunity to use. For Swanson *et al.* (1984), the main resources which should be given special attention in technology development and training content are land size and type of tenure, water, family and hired labor, inputs, markets, capital, information and advisory services, influence and claim-making capacity.

We found that transfer design positively relates to learning transfer. According to Bhatti and Kaur (2010), it may not be sufficient for the learner to learn the skills and knowledge; there is a need to learn how to transfer the learned skills and knowledge to the workplace. Training program should be designed to clearly link learning with on-the-job performance through the use of clear examples, methods similar to the work environment, and activities and exercises that clearly demonstrate how to apply new knowledge and skills. Interactive training design (i.e. feedback during training, practical cases, team work) could enhance learning transfer. Nikandrou *et al.* (2009) suggest that trainee-centered training methods play an important role in learning transfer. Our results revealed that performance-outcomes expectations can positively influence learning transfer. Our finding is consistent with the results of Tannenbaum and Yuki (1992), Scott (2010), and Holton *et al.* (2007, 2000). Performance-outcome expectations refer to the extent to which farmers believe that applying new knowledge learned in training will lead to some kind of recognition and meaningful to them. In other words, farmers will use their new skills and knowledge if they expect that transfer will lead to valued outcomes (e.g. the rewarding of a high performance, or improvement in their lives).

The age of an individual can negatively influence learning transfer. This finding is in line with the results of Zamani-Miandashti and Malek-Mohammadi (2012), Coetsee and Eiselen (2006) and Islam *et al.* (2007). A possible explanation is the reality that young farmers are more likely than older farmers to

take risks and transfer their newly learned skills and knowledge. Of socio-demographic factors, respondents' total years of experience in farming can positively influence learning transfer. One possible explanation is that farmers who are more experienced in their job may be more familiar with the training content than the less experienced farmers.

Future Research Directions

This study gives insights into the measurement of learning transfer. To our knowledge, most of the prior studies on learning transfer did not measure the transfer of learning, or used the perceived transfer (Perez, 2006) rather than the actual transfer. The majority of researchers employed factor analysis as a data-reduction technique and to discover simple patterns in the pattern of relationships among the variables. We developed a formula in our study to measure the actual transfer of learning. Quantifying learning transfer opens up new opportunities for statistical methods to identify causal mechanisms. Future research could use 4th version of the LTSI whose items have been reduced to 48 (Bates *et al.*, 2012).

The study further opens up the agricultural sector as an important area of LTSI and learning transfer research. The LTSI and learning transfer research in agricultural sector, specifically among farmers, is scarce. The agricultural industry creates a distinct environment for learning transfer which can be expected to challenge and improve established theories. Furthermore, today's urgency related to food security and environmental concerns create an opportunity for LTSI and learning transfer research to make a contribution to sustainability science. The replication of this study in the same environment but with a different type of training may also provide additional insights. A qualitative interview processes may uncover factors of sustainability learning transfer that were not identified in this study.

Learning transfer has a dynamic, complex, and systemic character that changes over time. Longitudinal studies of learning transfer and the role of its determinants would be beneficial in understanding the success of training.

Study Limitations

One of the limitations to the study is self-reporting by the farmers. The answers given on the survey were subject to recall bias. Recall of information depends greatly on memory, which can be imperfect. People usually find it difficult to remember incidents that happened in the past (Hassan, 2006). Also, it is acknowledged that results of a single source of data may be affected by method variance (Podsakoff and Organ, 1986). For example, motivation to transfer training was based solely on trainees' perceptions but not assessed by their supervisors. Obtaining data from supervisors on what can motivate trainees to transfer their learning could increase confidence in the results. It is an area for future research, but was outside of the practical limits of the present work.

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تعیین کننده‌های بکارگیری یادگیری پایداری در بخش کشاورزی ایران

پ. عطایی، ن. زمانی

چکیده

پیشینه موضوع بیانگر آن است که در کشورهای در حال توسعه، برنامه‌های نظام‌مند توسعه منابع انسانی کشاورزی به ندرت اجرا می‌شوند، و دانش کمی درباره میزان موفقیت آن‌ها موجود است. بکارگیری یادگیری عبارت است از عملی نمودن آموخته‌ها، از جمله مهارت‌های کسب شده یا دانش به دست آمده در دوره‌های کارآموزی، در شغل. هدف اصلی این تحقیق تحلیل عوامل تأثیرگذار بر بکارگیری یادگیری پایداری توسط کشاورزان مشارکت کننده در طرح‌های تسریع انتقال یافته‌های تحقیقاتی بود. تعداد ۱۲۰ نفر از کشاورزان از طریق روش نمونه‌گیری طبقه‌ای تصادفی انتخاب شدند. نتایج نشان داد که انتظار از نتایج عملکرد، برداشت از اعتبار محتوا، طرح بکارگیری، فرصت استفاده، حمایت ناظر، تعداد سال تجربه در کار کشاورزی و سن تأثیر معنی‌داری بر بکارگیری یادگیری توسط کشاورزان داشتند. فرمول توسعه داده شده در این مطالعه نقش مهمی در کمی‌سازی بکارگیری یادگیری دارد، و فرصت‌های جدیدی را برای بررسی عمیق‌تر روابط علی میان عوامل بکارگیری یادگیری از طریق روش‌های پیشرفته آماری فراهم می‌نماید. تصمیم‌گیران آموزش کشاورزان و دیگر عملگران نظام ترویج باید به عامل‌های شناسایی شده در این تحقیق که نقش کلیدی در بکارگیری یادگیری دارند، توجه ویژه‌ای نمایند.