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The use of the Persian translation of the Learning Transfer System Inventory in the context of agricultural sustainability learning in Iran

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The Learning Transfer System Inventory considers 16 factors likely to influence the transfer of training to the workplace. This study uses the Persian translation of the inventory and applies it to agricultural sustainability learning in Iran. The aim is to examine the internal structure and predictive ability of the inventory as translated into Persian. The agricultural context was chosen because of its importance to Iran and because agricultural human resource interventions have failed to give serious attention to connecting training to practice. A valid and reliable tool for evaluating the transfer of learning among farmers can be helpful. A sample of 159 participating farmers was surveyed. Exploratory factor analysis revealed an 11-factor structure among specific scales and a five-factor structure among the general scales. The regression results indicated that about 82 per cent of the variability in the farmers' sustainability learning transfer is predicted by six inventory factors including motivation to transfer, performance self-efficacy, supervisor support, performance-outcomes expectations, opportunity to use and supervisor sanctions. The findings suggest that the Persian translation of the inventory has both internal and predictive validity and can be used either as a tool to diagnose training needs or as a means of evaluating existing learning programs.

Introduction

Currently, people worldwide are concerned about the negative consequences of unsustainable agricultural practices including soil degradation, water pollution and shortage and threats to biodiversity. Therefore, sustainability learning and its transfer are

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particularly important in the practice of agriculture. The only way to achieve sustainable agriculture is to facilitate the transfer of sustainability learning by farmers to their farms. A review of the literature on training program outcomes, however, reveals that participants often fail to transfer acquired knowledge and skills to their professional practice. Practitioners argue that more than 80 per cent of what is learned in training is not used in the workplace (Devos *et al*., 2007).

Agriculture plays a vital role in Iran, contributing to the country's socio-economic stability. Agriculture in Iran accounts for about 19 per cent of total employment (Statistical Center of Iran, 2013). Despite the decline in the contribution of agriculture to Iran's total gross domestic product, many Iranian people, particularly those who live in rural areas, still depend, directly or indirectly, on agriculture for their livelihoods. Eighty per cent of the country's food requirement is provided by Iranian agriculture and traditional farming practised by smallholder farmers is very dominant in the sector. Agricultural production is mainly self-sufficient and large-scale commercial agriculture is not much developed (Gerami, 2002). Enormous amounts of money, time and energy are spent on agricultural extension to train farmers. Around 7000 government employees are working as extension agents at national, provincial and local levels. A large number of Development Soldiers (the agricultural graduates who are trained in extension skills to do their compulsory military service in public agricultural organizations), local leaders and contact farmers are cooperating with public extension institutions. In addition, more than 20,000 private extension agents are working in 2300 agricultural engineering and consulting firms, providing fee-based extension services for their clients (Karamidehkordi, 2010). However, as argued by some extension scientists (e.g. Mirzaei *et al*., 2008; Zamani-Miandashti & Malek-Mohammadi, 2012), evaluation is often overlooked by Iranian extension agents and planners. Among Kirkpatrik's (1994) four levels of training evaluation, only the first level (reactions level) receives special attention by extension practitioners, and, in most cases, they only assess farmers' reactions to the training program. Quantitative reports from lower level employees to upper level employees are very common, and more qualitative in-depth evaluations are on an ad hoc basis, e.g. at a time when complaints are heard about training practices or extension projects. Namdar *et al.*'s (2010) study produces further evidence of a lack of evaluation capacity in the agricultural extension system, revealing that Iranian staff and managers involved in program evaluation are highly in need of evaluation competencies. Researchers in academia have been more careful and have adopted more holistic approaches in their evaluation practices. They not only have gone beyond the reactions level, but also have investigated some determinants of training outcomes (e.g. Bijani *et al*., 2009; Dinpanah *et al*., 2009). However, previous studies on Iran's agricultural HRD interventions have failed to use a comprehensive model of factors influencing training effectiveness.

The Learning Transfer System Inventory (LTSI) was developed by Holton *et al*. (2000) as a diagnostic tool using factors influencing learning transfer. As argued by Hutchins *et al*. (2013), studies that have examined whether the LTSI scales are correlated with learning transfer or they are correlated with intent to transfer are scarce.

Based on the above argument, there is a need for a practical, structured and flexible diagnostic instrument to analyze sustainability learning transfer factors in agriculture in Iran. The need is greater because scarce resources dictate that training becomes more effective and for that to happen extension evaluation systems require improvement. We suggest that the LTSI may be a tool that can advance agricultural training evaluation practice and training effectiveness in Iran. Therefore, this study attempts to explore both factorial validity and predictive validity of the LTSI and in doing so offers new understanding about the effectiveness of the instrument. To our knowledge, this is the first validation study of the Persian version of the LTSI and the first to validate the LTSI in agricultural sustainability learning. The closest studies to ours are Zamani-Miandashti and Malek-Mohammadi (2012) and Mirniam *et al.* (2013), in which they adopted/adapted the LTSI items to describe factors influencing learning transfer by Iranian farmers. However, these studies did not measure learning transfer, nor did they validate the Persian version of the LTSI.

The Learning Transfer System Inventory

Learning transfer is generally defined as the use in performance of the job of what has been learned in training (Burke & Hutchins, 2007). Several diagnostic instruments have been developed to examine factors inhibiting and enhancing the transfer of training. These efforts have lead to the development of LTSI. The LTSI was designed by Holton *et al*. (2000) to investigate the system of factors influencing learning transfer. The LTSI has four sets of factors: motivation factors, work environment factors, ability/enabling factors and trainee characteristics or secondary influences. The motivation, ability, and work environment factors directly influence individual performance, but the trainee characteristics affect motivation and then affect individual performance.

The instrument items are divided into two sections. The first section measures 11 constructs representing factors affecting the particular training program the trainee attended (training-specific scales). Constructs included in this section are motivation to transfer, learner readiness, positive personal outcomes, negative personal outcomes, personal capacity to transfer, peer support, perceived content validity, transfer design, supervisor support, supervisor sanctions and opportunity to use. The second section measures five constructs classified as general factors because they are expected to affect all training programs (training-general scales). Constructs in this section are transfer effort-performance, performance-outcomes, openness to change, performance self-efficacy and feedback-performance coaching. Factor definitions are shown in Table 1.

Methods

Pilot test

To understand if the constructs from the original LTSI hold up with our Persian translation of the instrument, we used validity and reliability tests. A panel of experts of three agricultural extension specialists, with an average of 23 years of experience in agricultural HRD, reviewed the questions for face validity and quality of translation. The questionnaire's reliability was obtained through a pilot test among 30 farmers in the research population. The reliability estimates for training specific scales ranged from 0.73 to 0.92 and for training-general domain ranged from 0.74 to 0.92. The definitions, reliabilities of the factors, and sample items for the LTSI in agriculture of Iran are provided in Table 1.

Sampling

In this study, we focused on sustainability-oriented training programs in two of Iran's provinces: Fars and Khorasan Shomali. The study population was all participating farmers in nine Research Finding Diffusion Push Plans (RFDPPs) in these provinces ($N = 270$). RFDPPs were first implemented in 2000 in Iran with the main aim of producing, adapting and transferring more sustainable technologies to farmers. In these plans, a team of researchers, extension agents/agricultural advisors and farmers work and learn together to solve farm-level problems. The sample was selected by a stratified random sampling from participants. The plans were used as strata. Sample size was 159 participants based on Krejcie and Morgan's table (1970): 84 from Fars, 75 from Khorasan Shomali. Face-to-face interviews were conducted to administer questionnaires. Interviews ranged from 25 to 35 min. All 159 participants in RFDPPs were men and their age ranged from 23 to 77 years, with a mean score of 44.55 (SD = 13.00). The majority of respondents – 60.8 per cent – were between 31 and 50 years old. As regards education level, 36.7 per cent reported having secondary education and 8.3 per cent indicated having tertiary study.

Method of analysis

Data collected were analyzed using the Statistical Package for the Social Sciences ($SPSS_{win18}$). Exploratory factor analysis (EFA) was used to examine the interrelationships among variables. Exploratory factor identifies the structure of a large number of variables. When there is no strong theory, any indicator is assumed to be associated

Table 1: LTSI scale definitions, number of items and Cronbach's alphas

Factor	Definition	Number of items	α
Training-specific scales			
1. Learner readiness	Extent to which individuals are prepared to enter and participate in training.	5	0.73
2. Motivation to transfer	Direction, intensity, and persistence of effort toward using skills and knowledge learned in a work setting.	6	0.74
3. Personal outcomes – positive	Degree to which applying training on the job leads to positive outcomes for the individual.	5	0.83
4. Personal outcomes – negative	Extent to which individuals believe that not applying skills and knowledge learned in training will lead to negative personal outcomes.	4	0.73
5. Personal capacity for transfer	Extent to which individuals have the time, energy, and mental space in their work lives to make changes required to transfer learning to the job.	6	0.85
6. Peer support	Extent to which peers reinforce and support use of learning on the job.	5	0.84
7. Supervisor support	Extent to which supervisors support and reinforce the use of training on the job.	5	0.82
8. Supervisor sanctions	Extent to which individuals perceive negative responses from supervisors when applying skills learned in training.	6	0.92
9. Perceived content validity	Extent to which trainees judge trainingcontent to accurately reflect job requirements.	5	0.85
10. Transfer design	Degree to which (1) training has been designed and delivered to give trainees the ability to transfer learning to the job and (2) training instructions match job requirements.	4	0.91
11. Opportunity to use	Extent to which trainees are provided with or obtain resources and tasks on the job enabling them to use training on the job.	5	0.78
General scales			
12. Transfer effort – performance expectations	Expectation that effort devoted to transferring learning will lead to changes in job performance.	7	0.81
13. Performance – outcomes expectations	Expectation that changes in job performance will lead to valued outcomes.	5	0.84
14. Resistance to change	Extent to which prevailing group norms are perceived by individuals to resist or discourage the use of skills and knowledge acquired in training.	6	0.92
15. Performance self-efficacy	An individual's general belief that he or she is able to change performance when he or she wants to.	5	0.74
16. Performance coaching	Formal and informal indicators from an organization or others about an individual's job performance.	6	0.88

Adapted from Holton *et al*. (2000).

with any factor. Principal component analysis was selected as an extraction method. EFA was previously used in validating other versions of the LTSI (e.g. Chen *et al*., 2005; Holton *et al*., 2000; Khasawneh, 2004; Khasawneh *et al*., 2006; Yaghi *et al*., 2008; Yamnill, 2001). A visual examination of the data was performed by subject-matter experts to ensure its suitability, and then, factor analyses were conducted on the specific and general domains covered by the LTSI. As suggested by Yamini and Rahimi (2007), Babbie (2004), Holton *et al*. (2000) and Walsh (1990), the number of extracted factors in this study was based on a combination of the screen plot examination and eigenvalues >1.00 with a cutoff for factor loading of 0.40.

Stepwise multiple regression analysis was conducted to determine the relative contribution of the LTSI factors to learning transfer. There are a number of recommendations to be adopted by farmers in every agricultural learning opportunity. In this study, learning transfer in the studied programs happened through implementation of the recommendations provided in the learning environment. To obtain transfer scores, we applied the following formulas. All the items were positively scored, so the higher the score obtained by one farmer, the greater his transfer.

$$TR = \frac{AT}{TT} \times \frac{PA}{PT} \times \frac{YT}{YP}$$

$$LT = \frac{TR1 + \ldots + TRn}{NR}$$

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. Self-report measures were used in the questionnaire to determine AT, PA, PT and YT. TT and YP were identified using the implementation program of RFDPPs. 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.

Results

Factor structure of the LTSI

The first question in this study was related to the number of the LTSI factors in agriculture sector of Iran that could be validated as compared with the original LTSI factors. We used EFA with an oblique rotation to identify the latent structures of the model. Because the items on the LTSI represent two separate program-specific and training-general domains, the two sections of items were factor analyzed separately.

Examination of both Bartlett's test of sphericity and the measure of sampling adequacy (MSA) indicated that the data were suitable for factor analysis. The results of the overall MSA (0.71) and the Bartlett's test of sphericity (7003.502, $p < 0.000$) for training-specific domain indicated that the data were suitable for factor analysis.

The results of the overall MSA (0.73) and the Bartlett Test of Sphericity (1764.826, $p<0.00$) for training-general domain indicated that the data were suitable for factor analysis. Twenty-three items in the LTSI were used to measure the general training domain. The initial EFA model resulted in extracting five factors with eigenvalues >1.00. These five factors explain 61.15 per cent of total variance. Largely, the resulting factors of LTSI match in the original LTSI.

Exploratory factor analyses revealed an 11 factor structure among specific scales. They represent the 16 factors originally revealed in the US. The first 45 items in the LTSI were used to measure the specific training domain. The initial EFA model resulted in

Table 2: Pattern matrix with factor loadings for the training-specific domain

	Factor										
	1	2	3	4	5	6	7	8	9	10	11
Items	Perceived content validity	Supervisor support	Supervisor sanctions	Personal capacity for transfer	Motivation to transfer	Transfer design	Personal outcomes – negative	Personal outcomes – positive	Opportunity to use	Peer support	Learner readiness
Q_{63}	0.71										
Q_{64}	0.63										
Q_{60}	0.58										
Q_{59}	0.51										
Q_{58}	0.47										
Q_{44}		0.80									
Q_{43}		0.75									
Q_{50}		0.75									
Q_{49}		0.73									
Q_{53}		0.73									
Q_{47}		0.71									
Q_{55}			0.62								
Q_{48}			0.61								
Q_{54}			0.45								
Q_{33}				0.79							
Q_{28}				0.75							
Q_{34}				0.58							
Q_{35}				0.49							
Q_{8}					0.79						
Q_{7}					0.67						
Q_{6}					0.67						
Q_{9}					0.43						
Q_{68}						0.80					

Table 2: Continued

	Factor										
	1	2	3	4	5	6	7	8	9	10	11
Items	Perceived content validity	Supervisor support	Supervisor sanctions	Personal capacity for transfer	Motivation to transfer	Transfer design	Personal outcomes – negative	Personal outcomes – positive	Opportunity to use	Peer support	Learner readiness
Q_{61}						0.75					
Q_{67}						0.59					
Q_{66}						0.51					
Q_{31}							0.71				
Q_{29}							0.71				
Q_{32}							0.43				
Q_{18}							0.40				
Q_{21}								0.53			
Q_{11}								0.43			
Q_{26}								0.42			
Q_{25}									−0.64		
Q_{38}									−0.64		
Q_{24}									0.45		
Q_{20}									0.41		
Q_{37}										−0.88	
Q_{36}										−0.78	
Q_{41}										−0.65	
Q_{42}										−0.50	
Q_{19}											−0.69
Q_{15}											−0.69
Q_5											−0.64
Q_{23}											−0.60
Eigenvalues:	15.65	5.5	3.9	3.1	2.3	2.1	1.9	1.6	1.4	1.3	1.1

Table 3: Pattern matrix with factor loadings for the training-general domain

	Factor				
	1	2	3	4	5
Items	Performance – outcomes expectations	Resistance to change	Performance coaching	Performance self-efficacy	Transfer effort – performance expectations
Q_{10}	0.85				
Q_{16}	0.84				
Q_{22}	0.81				
Q_{39}	0.82				
Q_{30}	0.60				
Q_{2}		0.77			
Q_{3}		0.75			
Q_{4}		0.75			
Q_{27}		0.58			
Q_{46}		0.56			
Q_{40}			0.72		
Q_{62}			0.79		
Q_{65}			0.74		
Q_{1}			0.71		
Q_{12}				0.75	
Q_{14}				0.78	
Q_{52}				0.52	
Q_{51}				0.58	
Q_{45}					0.66
Q_{56}					0.75
Q_{57}					0.72
Q_{17}					0.65
Eigenvalues:	3.43	2.91	2.88	2.43	2.39

Note: Only factor loadings ≥0.40 are shown in this table.

extracting 11 factors with eigenvalues >1.00. These 11 factors explain 54.2 per cent of total variance. Items that loaded on more than one factor (>0.40) were dropped from the model. Largely, the resulting factors of LTSI match in the original LTSI. But, item 13 deleted with loadings lower than 0.40. Factor loadings and eigenvalues for the training-specific scales are shown in Table 2. Factor loadings, eigenvalues and percentage of variance for the training-general scales are shown in Table 3.

Evidence for the appropriateness of this factor structure came from an examination of the correlation matrix which showed no meaningful residuals, suggesting that the 16 factor structure was appropriate and that the extraction of more or fewer factors would not improve the structure's representation of the data. Only a few correlations exceeded 0.30, further emphasizing the conceptual distinction between the factors.

Result of EFA confirmed that the study validated 16 factors in the LTSI compared with 16 factors in the original LTSI. These results mean that the LTSI is a valid instrument to assess learning transfer in the agriculture sector of Iran. Several studies from other cultures support the validation of the LTSI. Khasawneh (2004) used original LTSI in Jordan and reported extracting 15 factors explaining 62.86 per cent of the variance, and factor analyzed 26 items resulting in extracting seven factors explaining 60.78 per cent of the total variance. The validation of the LTSI is also evident in the German (Bates *et al*., 2007), Taiwan (Chen *et al*., 2005), French (Devos *et al*., 2007) and Ireland (Kirwan & Birchall, 2006), cultures. Yamnill (2001) used a cutoff at 0.35 and validated 11 factors of the specific

domain explaining 55.19 per cent of the variance, and five factors explaining 53.1 per cent of the total variance and validated 11 and five factors in the specific and general training domains, respectively. Similarly, Yaghi *et al*. (2008) validated 11 factors of the specific domain explaining 65.05 per cent of the variance, and five factors explaining 55.93 per cent of the total variance. These findings are consistent with this study.

Validity of the LTSI factors in predicting sustainability learning transfer

Hierarchical multiple regression was performed to investigate the ability of the LTSI factors to predict sustainability learning transfer. We entered those variables closest to the respondents first (i.e. trainee characteristics and motivation factors), then ability factors and training program factors (e.g. content validity and transfer design) and finally the work environment factors. The first model was statistically significant, $F = 43.87$; $p < 0.001$, and explained 66 per cent of variance in sustainability learning transfer (see Table 4). After entry of training program factors, at step 2, the total variance explained by the model as a whole was 77 per cent; $F = 40.33$; $p < 0.001$. The introduction of training program factors explained additional 11 per cent variance in sustainability learning transfer, after controlling for trainee characteristics, $\Delta R^2 = 0.11$; $\Delta F = 12.94$; $p < 0.001$. Work environment factors were entered at step 3, and accounted for additional 5 per cent of variance in sustainability learning transfer, after controlling for trainee characteristics and training program factors, $\Delta R^2 = 0.50$; $\Delta F = 4.47$; $p < 0.001$. The final model was statistically significant, $F = 29.66$; $p < 0.001$, and explained 82 per cent of variance in sustainability learning transfer. In the final model, six out of sixteen predictor variables were statistically significant, with performance-outcomes expectations recording the highest Beta value ($\beta = 0.32$, $p < 0.001$), and supervisor sanctions having the lowest Beta value ($\beta = 0.10$, $p < 0.001$). Variables contributing significantly to the regression model were motivation to transfer, performance self-efficacy, supervisor support, performance-outcomes expectations, opportunity to use and supervisor sanctions. This finding demonstrates the usefulness of the LTSI for predicting learning transfer. Nevertheless, ten LTSI factors did not significantly contribute to predicting sustainability learning transfer by farmers.

Discussion

Implications for theory and practice

Extensionists are seen as the world's largest providers of non-formal adult education (Boone, 1985). As government budgets are tightening and donor agencies and stakeholders are asking for performance improvement of agricultural extension programs, measurement of factors affecting transfer are becoming more important. Our study was a validation study and such studies take us one step closer to developing standard instruments to measure learning transfer system in different types of interventions. Lack of strong instrumentation limits researcher's ability to reach more general conclusions and prescriptions for the improvement of learning transfer because of measurement error (Holton *et al*., 2000). The LTSI was originally developed in English, and was administered to English-speaking respondents in the USA. The instrument is in its developmental phase, and its translation in other languages such as Thai, Chinese and Arabic has shown some slight differences (Devos *et al*., 2007). Our study extends previous research with LTSI, and is an initial attempt to validate LTSI in agricultural sustainability learning transfer and contributes to the improvement of the LTSI. We developed a formula in our study to measure the transfer of learning. Quantifying learning transfer opens up new opportunities for statistical methods to identify causal mechanisms and examine the LTSI predictive validity.

This instrument is also useful for practice. Findings of this study suggest that the LTSI can be used by agricultural training professionals as either a diagnostic tool of training needs or evaluation of existing training programs. Training practitioners in Iran's Ministry of Agriculture can use the Persian LTSI to evaluate sustainability learning transfer and assess problem areas before education planning. After pinpointing potential barriers in the transfer system, follow-up individual and group interviews with appropriate

Table 4: Summary results of hierarchical multiple regression analysis for LTSI factors predicting learning transfer

Predictor	R	R^2	ΔR^2	B	SE	β	T
Step 1	0.81	0.66***					
Performance self-efficacy				0.04	0.007	0.31***	5.13
Motivation to transfer				0.05	0.008	0.44***	6.41
Transfer effort-performance expectations				−0.01	0.009	−0.04	−0.64
Performance-outcomes expectations				0.04	0.009	0.34***	5.36
Learner readiness				0.01	0.007	0.04	0.68
Step 2	0.87	0.77***	0.11***				
Performance self-efficacy				0.03	0.006	0.24***	4.67
Motivation to transfer				0.03	0.007	0.29***	4.28
Transfer effort-performance expectations				−0.01	0.008	−0.05	−.89
Performance-outcomes expectations				0.05	0.007	0.34***	6.19
Learner readiness				−0.01	0.006	−0.02	−0.41
Perceived content validity				0.03	0.008	0.25***	4.41
Transfer design				0.02	0.014	0.08	1.51
Personal capacity for transfer				−0.02	0.011	−0.07	−1.47
Opportunity to use				0.03	0.007	0.21***	3.99

Table 4: Continued

Predictor	R	R^2	ΔR^2	B	SE	β	T
Step 3	0.91	0.82***	0.05***				
Performance self-efficacy				0.03	0.006	0.20***	4.15
Motivation to transfer				0.02	0.007	0.19**	2.98
Transfer effort-performance expectations				−0.01	0.007	−0.02	−0.42
Performance-outcomes expectations				0.04	0.008	0.32***	5.70
Learner readiness				0.01	0.006	0.06	1.01
Perceived content validity				0.01	0.009	0.07	1.14
Transfer design				0.02	0.014	0.07	1.40
Personal capacity for transfer				−0.02	0.011	−0.07	−1.51
Opportunity to use				0.02	0.007	0.15**	2.76
Resistance to change				0.01	0.010	0.05	0.51
Performance coaching				0.01	0.011	0.02	0.28
Personal outcomes-negative				0.01	0.01	0.06	0.85
Personal outcomes-positive				0.02	0.009	0.08	1.75
Supervisor support				0.03	0.009	0.21**	3.38
Supervisor sanctions				0.02	0.008	0.09*	2.09
Peer support				0.01	0.009	0.03	0.69

Note: Statistical significance: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

informants, as well as observations are used to help to fully understand the findings. Several different types of institutional arrangements have recently been used to provide training programs in the agriculture sector. Developing learning transfer system profiles for high and low performing institutional arrangements would provide insight into how these arrangements influence learning transfer. A Persian version of LTSI is likely to be of interest for Persian speaking community, including Iran, Tajikistan and Afghanistan.

Relative to practitioners, supervisor sanction was found to be a significant predictor of transfer. Many agricultural technologies are produced in agricultural research institutes, and sometimes these technologies are not believed by public agriculture extension supervisors to benefit farmers. In these cases, although extension supervisors are part of the organizing team, they do not provide support for farmers to transfer their learning. Trainee motivation to transfer accounted for a large amount of variance in learning transfer. This result is consistent with the findings of Hutchins *et al*. (2013) who found that motivation to transfer had the strongest relationship with intent to transfer. According the Theory of Planned Behavior, intent predicts behaviour. As argued by Gegenfurtner (2011), pre-training attitudes (attitudes towards training, self-efficacy and personality traits), training-related cognitions (learning and framing) and post-training environment (supports and consequences) influence motivation to transfer. Therefore, public extension and researchers play a key role in influencing trainee motivational aspects and conditions. Because farmers differ in their experiences and expectations, Grohmann *et al*. (2014) suggested that motivational interventions should be individually tailored for trainees. Furthermore, selection of appropriate farmers who have more opportunities to use sustainability lessons and are interested in transferring learning is critical to the success of any training program. It is also important to provide supports to extend opportunities for farmers to use sustainable technologies and provide farmers with an adequate justification of training performance outcomes. Govaerts and Dochy (2014) operationalized the supervisor's role in 24 categories of specific supportive behaviours and/or attitudes which could be considered by extension agents to support learning transfer processes.

Limitations and future research

First, there are likely other factors that relevant to transfer but not assessed by our instrument. For example, work attitudes (Holton *et al*., 2000) and training reputation (Laroche & Haccoun, 1999). Furthermore, future research should use 4th version of the LTSI whose items have been reduced to 48 (Bates *et al*., 2012), and employ more rigorous statistical methods to identify causal mechanisms and examine the LTSI predictive validity. Second, the research data were collected at one point in the time only. Future research should focus on longitudinal study. Third, we used a single respondent (participating farmers). Future studies should study similar factors with information provided by other actors in the system (e.g. extension agents, researchers, managers) and confirm the consistency of the results. Fourth, a large proportion of the variance in the dependent variable was explained in this study. This result should be interpreted with caution. Two explanations could be relevant: (1) proportion of variance explained in a dependent variable is context dependent, (2) and/or the nature of the dependent variable lends itself to higher levels of transfer.

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