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## **Roots of innovative knowledge in small commercial enterprises in Ecuador**

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**Abstract:** Innovation is key to competitiveness. Small businesses base their innovation on knowledge, so knowledge is essential for competitiveness. The purpose of this paper is to investigate the roots of knowledge that generate innovation capability in small commercial enterprises. The research studies whether internal factors (training and skills) and external factors (cooperation and spillover networks) are used by small commercial enterprises to generate innovation capability in a province of Ecuador. The research uses a representative sample of 316 small commercial businesses in the canton of La Maná in Ecuador, using a structural equation model estimated by partial least squares (PLS). The results show the specific process of innovative knowledge in small commercial enterprises, indicating that training increases entrepreneurial skills, and that these skills require relationships with other agents to acquire knowledge through informal dissemination networks and/or formal cooperation networks to generate innovation capability.

**Keywords:** cooperation; training; innovation; skills; small business; spillover; structural equation model; Ecuador.

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## 1 Introduction

Small businesses are important for the development of countries (Ogundana et al., 2022). In Ecuador, small businesses are a source of income for many families who make a living from trade-related activities (Martinez-Ortiz et al., 2021). Businesses need to improve their competitive advantage to enhance the quality of life in the region. Therefore, competitive advantage is a prominent issue in strategic business management (Ismail, 2022) and especially in small businesses. An essential driver of competitiveness in these businesses is their capability for innovation (Shehzad et al., 2022). Innovation is a business’s ability to create processes, products, or services through the use of new operational practices, technology, skills, or competencies (Nieves and Diaz-Meneses, 2018). Innovation is considered an essential factor for success, opportunity, survival, performance, competitive advantages and the ability to compete with the commercial disruptions that companies face (El Chaarani et al., 2022; Rajapathirana and Hui, 2018). Innovation is based on knowledge (McAdam et al., 2014). Usually, this knowledge is specific to small commercial enterprises, since their innovation is based on the exclusivity of products associated with the territory and relationships with local

customers, aspects associated with the local knowledge that is more characteristic of these small businesses (Jardon et al., 2020).

Knowledge reaches a company through internal and external factors (Shehzad et al., 2022). The combination of both facilitates innovation (Dost et al., 2019). According to Sharafizad (2018), innovating and growing businesses requires the transfer of knowledge and the development of skills through training, which achieves a certain level of competence, skills, and knowledge. Therefore, internal factors are usually a consequence of the competencies and skills that company members acquire, together with the formalised knowledge that is transferred between departments or units of the company and that contributes to the capability for innovation (Shehzad et al., 2022).

Among the external factors of knowledge, the literature points to the existence of formal sources, such as cooperation networks (Schmidt et al., 2016), or informal sources resulting from interaction and relationships between colleagues and other agents in the territory (Nieves and Diaz-Meneses, 2018; Wu and Gao, 2022). Externally acquired sources of knowledge provide access to new knowledge resources (Dhanaraj and Parkhe, 2006).

Sources of innovative knowledge have been studied extensively for large and medium-sized companies, but very little for small companies that are subsistence businesses for many families. These enterprises have little organisational structure, tend to be riskier, invest little in formal training, and diligently manage the few financial resources they have to innovate adequately (Demirkan et al., 2022; Martinez-Ortiz et al., 2021). Jardon et al. (2020) analyse sources of innovation in small forestry enterprises. The characteristics of urban commercial businesses are different. First, commercial activities require a different type of knowledge from productive activities, which means that their sources may also be diverse. Second, the culture of Ecuadorian cities differs from that of forestry companies, which are usually associated with rural areas.

In addition, this work seeks to identify the roots of innovative knowledge found in internal or external factors. Complementarily, it studies how each of these knowledge factors affects the innovation capability of small commercial enterprises. The work establishes a specific mechanism used by small commercial enterprises to leverage different sources of knowledge to generate innovation capability.

The research contributes to a better understanding of the processes of innovation generation in small commercial enterprises. It analyses how different sources of knowledge are combined to carry out innovations, taking into account the specific culture of the territory. This study reports the existence of direct and indirect relationships between internal and external sources of knowledge that commercial enterprises of this scale leverage to gain innovative capability and achieve competitiveness in the territory. The results are expected to be useful for entrepreneurs and advisors. Complementarily, the results will be especially important for the development of public policies in developing countries to promote the growth of their small businesses.

The paper is organised into four sections. After the introduction, the theoretical framework of the variables considered in the study is presented, followed by the methodology used, then the results, and finally the discussion and conclusions.

## 2 Theoretical framework

The capability for innovation is important for generating competitive advantages. Through innovation, smaller companies can stay ahead of their competitors, satisfy customers, and take advantage of environmental opportunities by leveraging their strengths (Shehzad et al., 2022). This creates a positive fit between the entrepreneur and innovation that can bring long-term profitability and survival (Linton and Solomon, 2017).

For Witschel et al. (2019), the importance of innovation and creativity are prerequisites for success. Furthermore, innovation has changed the organisation and strategy of the company because it allows it to develop and implement new strategic designs to remain competitive and successfully adapt to constant changes in the business environment.

According to Rajapathirana and Hui (2018), innovation is considered a factor of success and opportunity for companies operating in constantly changing environments that require skills to cope with business disruptions. Likewise, Dunne et al. (2016) mention that innovation is a fundamental requirement for achieving the long-term viability of a business, and that marketing, the availability of financial credit, information and communication technologies, and training in business-related topics are considered innovation activities for small businesses, as they have flexible management structures and more informal decision-making.

The small size of small commercial businesses makes these aspects even more necessary, as they have to compete with companies superior in terms of business capabilities (Upson and Green, 2020).

The urban environment in which small commercial enterprises operate requires a continuous process of adaptation and the search for new approaches in order to remain competitive (Sahni, 2017).

### 2.1 *Knowledge as a source of innovation*

Knowledge is a valuable intangible strategic asset as a source of creativity and innovation that enables the creation of new products or services (Beltramino et al., 2022). Knowledge is important for making decisions to grow, innovate, and make the company more competitive, and it plays a role in innovation as a strategic resource for business. On the one hand, a lack of knowledge and information hinders innovation activities in companies (McAdam et al., 2014). On the other hand, knowledge sources increase leadership and management capabilities (Ciliberti et al., 2016), that facilitate innovation. However, their effect may be more limited in small businesses due to a lack of economic and physical resources (Abeson and Taku, 2009).

Although developed economies are likely to make greater use of knowledge to maintain sustained business growth (Panagiotakopoulos, 2020), knowledge is also important in small businesses in developing countries, such as Ecuador. For example, Belso-Martinez and Diez-Vial (2018) demonstrate the positive and significant relationship between knowledge and the performance of small businesses.

Previous literature distinguishes between internal and external factors as sources of innovative knowledge (Jardon et al., 2020; Molodchik et al., 2021; Osoro et al., 2016; Tseng et al., 2011). Internal sources of knowledge are related to the training and skills that company members acquire through experience and the processes carried out within

the company (Doloreux, 2015; Osoro et al., 2016). External sources of knowledge are related to collaboration networks and informal relationships (spillover) because they acquire learning indirectly from suppliers, new technologies, competition, globalisation, and companies in the environment (Shehzad et al., 2022).

Previous literature shows that companies require the strategic deployment of highly skilled and committed human resources to generate innovation results for commercial benefit (Saá-Pérez et al., 2012). Unlike large companies, small businesses find it difficult to take advantage of research and development projects because they require skilled human resources. In addition, small businesses have doubts about the benefits of investing in human resource training (Bryan, 2006).

However, training people is essential to increase innovation capability in small businesses as well. For example, Demirkan et al. (2022) explore the investments made by business management and administration to improve the skills and knowledge of employees to innovate in the products offered by SMEs, finding a positive association between investment in knowledge and formal training of employees to generate more innovation.

In addition, small commercial enterprises have specific knowledge associated with their local culture (Martynovich, 2017) to generate new ways of relating to customers and making more tailored products (Raymond et al., 2010). Therefore:

H1A Human resource training increases the capability for innovation in small commercial enterprises.

However, the personal characteristics of workers mean that innovation has been distributed in different actors, conditioning this effect. In fact, previous literature has shown that this effect is not always direct (Amoroso et al., 2018; Jardon et al., 2020).

The training received by the company's human resources enables them to acquire skills that improve their relationships with customers and suppliers, facilitating novel changes within the organisation. Consequently, we propose that:

H1B The knowledge acquired by training increases the creation of capacities and skills by human resources in small commercial enterprises.

The knowledge acquired by the company's human resources facilitates formal relationships between the company's employees and other entrepreneurs, customers, and suppliers (Jardon and Martos, 2012), facilitating the creation of collaborative networks. Therefore, the following proposition is proposed:

H1C The knowledge acquired by training increases the creation of collaborative networks in small commercial enterprises.

Similarly, training facilitates communication between human resources and their colleagues in other organisations, making it easier to transfer knowledge through information spillover (Croce and Ghignoni, 2012). Consequently, we propose:

H1D Human resources training facilitates the transfer of knowledge through information spillover.

Investment in management and emotional management skills is particularly important in small commercial enterprises and is linked to innovation because it creates an entrepreneurial attitude and managerial decision-making skills that are crucial to

innovation outcomes in small enterprises. For example, when entrepreneurs have entrepreneurial attitude skills, they can eliminate or unblock delays that the company has experienced in terms of innovation (Salmon and Allman, 2020).

Companies tend to value the skills of their employees and leaders, among which the following stand out: interpersonal and intrapersonal behaviour, emotion management, self-control, customer relations, decision-making, a positive, productive, and competitive environment, and achieving innovation in the company (Collet et al., 2015). Small businesses use their personal capabilities to seek new ways of relating to customers or to adapt products to their specific needs. Consequently, our next hypothesis states that:

H2A Small businesses need human resource skills to increase their capability for innovation.

The commercial business culture in Ecuador is very oriented towards fostering new forms of relationships based on the skills of merchants. The capabilities present in the organisation directly increase formal and informal relationships depending on the specific capabilities of the company (Martinez-Ortiz et al., 2021).

In the network-based approach, entrepreneurs make management decisions and share knowledge with potential allies with similar objectives, improving their innovative performance and achieving a relational platform for strategic renewal through the knowledge acquired (Ahuja, 2000). Likewise, customer-supplier relationships are the basis on which it is possible to build profitable relationships (Armstrong and Kotler, 2013). Cooperative networks and relationships foster direct or indirect collaboration to increase performance and gain a competitive advantage. For example, Belso-Martinez and Diez-Vial (2018) show that the knowledge acquired is provided by local collaborative networks that determine and generate knowledge flow to small businesses, thus giving them the opportunity to improve the products or services they offer.

In particular, the culture of merchants in Ecuador's cities facilitates relationships with other colleagues, customers and suppliers making it easier to create collaborative networks to cooperate in the sale and development of their products and services (Felzensztein and Gimmon, 2007). Consequently:

H2B Small commercial enterprises make use of existing human resource capabilities to increase their formal collaborative networks.

Spillover is a phenomenon that has been widely studied in economics and is often used when a company captures an idea from the activities of a competitor and benefits or suffers indirectly without compensating for that knowledge (Delgado et al., 2013). In general terms, external relationships are important for small businesses (Sharafizad, 2018). The essence of creating external knowledge is that it allows entrepreneurs the ability to grow, sustain themselves, and be competitive.

The relationship capabilities of small entrepreneurs, which are the result of local culture, facilitate relationships with other colleagues, acquiring new ideas and new ways of approaching their business (Martynovich, 2017). Consequently, it is proposed that:

H2C Small commercial enterprises make use of existing human resource capabilities to increase their informal knowledge transfer relationships through spillover.

Song et al. (2019) suggest, from a knowledge perspective, that to reduce the human and financial difficulties of small businesses, they need to exploit external sources of knowledge. Companies indirectly enrich themselves with knowledge from their

relationships with actors who interact directly or indirectly with the firm. Small commercial enterprises base their competitiveness on informal relationships with colleagues, suppliers, and customers. These relationships give rise to innovative ideas that enable them to improve their businesses. Therefore, the following hypothesis is established:

H3 Spillover, because of informal relationships with external agents, is a source of innovation in small businesses.

Small commercial enterprises do not usually have formal cooperation networks, except with some suppliers or colleagues, because of family or friendship relationships. However, these formal relationships usually meet the requirements of standard cooperation networks, facilitating the exchange of ideas to generate innovations (Ahuja, 2000). Therefore,

H4 Collaborative networks are a source of innovation capability in small businesses.

Companies need external and internal sources of knowledge to achieve innovation (Wu and Gao, 2022). External sources of knowledge such as cooperation networks, complementary organisations, competitors, customers, and spillovers are actors that drive companies to develop innovation (Nieves and Diaz-Meneses, 2018). In the same context, internal sources of knowledge such as competencies, skills, and formalised knowledge acquired by members within the company help to enhance innovation capability, and even more so when they acquire external knowledge (Shehzad et al., 2022).

Cooperation networks are used by small businesses to obtain information, training, and skills as a key role in innovation (Brache, 2018). Training for entrepreneurs in small commercial businesses is often scarce, which limits their innovation. However, it is useful for them to improve their skills and use them to increase formal and informal relationships with suppliers, customers, and other colleagues. It is through these relationships that they discover new ways to sell or buy or make improvements in products or processes. Therefore:

H5 Small commercial enterprises rely on training to improve their skills. Through these skills, they improve their relationships (formal and informal), and it is through the knowledge acquired through these relationships that they improve their innovation.

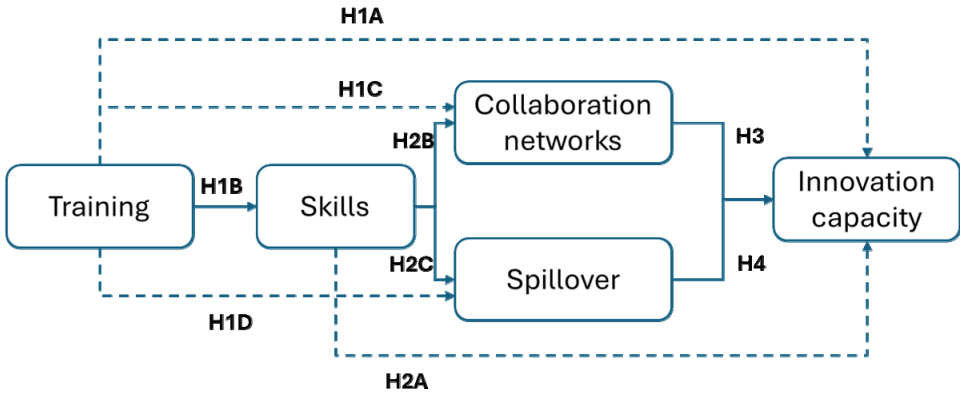
The figure shows the mechanism for generating innovation capability from internal and external sources in small commercial businesses. The solid lines represent direct effects, and the dotted lines represent indirect effects. The mechanism for obtaining innovation capability based on internal and external sources of knowledge has its roots in the training of the company's human resources. This training facilitates the use of the skills and knowledge included in these capacities to generate formal and informal networks, and it is through general knowledge via networks that innovation capability is achieved.

### **3 Materials and methods**

Research on business behaviour often requires qualitative data because the cultural environment in which entrepreneurs operate must be taken into account (Dana and Dumez, 2015). Although ethnography is an excellent tool, it is difficult to generalise it to

all small businesses. It aims to decipher behaviours based on one’s own values and beliefs through direct observation, complementing other types of analysis. Therefore, this study combines qualitative and quantitative analysis for data collection through a survey and questionnaire. In addition, it draws on the literature of previous authors who have studied small businesses for several years. Likewise, visits were made to the territory to gather the necessary information for the research. In turn, surveys were conducted with owners and proprietors in 2022.

**Figure 1** Model and hypotheses (see online version for colours)



The qualitative analysis served as a guide and support for the development of the questionnaire and the questions that made up the survey. It is also useful for developing and interpreting the analysis of the quantitative results obtained. In other words, the rest of the document uses the qualitative part to interpret the quantitative data obtained during data processing.

### 3.1 *Sample and population*

The study analyses small commercial enterprises in the canton of La Maná in the province of Cotopaxi. The La Maná Development and Land Use Plan describes the population projection for 2020 as 56,905 inhabitants with a growth rate of 1.66 from 2015 to 2020. Furthermore, only 3 out of 10 people of working age earn wages equal to or above the minimum wage (Plan de Desarrollo y Ordenamiento Territorial del Cantón La Mana – GAD Municipal La Maná – Ecuador, 2021). The study population corresponds to 1,760 small commercial enterprises according to fire department records. Commerce is an important and widespread activity, concentrated mainly in the urban centre. The canton is characterised by a significant number of small businesses, many of which are the main source of income for their families and are managed by the owner in all areas (Martinez-Ortiz et al., 2021).

A representative sample of 316 surveys was designed for small businesses in the canton. We confirmed the suitability of our sample by meeting the criteria proposed by (Erdfelder et al., 2009) based on statistical power analysis using G\*Power 3 software (Faul et al., 2007). The minimum sample size required for this study is 146 surveys (where the power level = 0.95, the effect size = 0.15, the significance value = 0.05, and

the number of predictors = 6). Therefore, the estimate suggests that the sample size is adequate for the research.

### *3.2 Measures*

The questionnaire design follows the pattern of Jardon and Martos (2012), based on scales found in the literature (Clarke et al., 2011). The questions to assess innovation capability inquire about the degree of growth in the company's innovation capability over the last two years, on a Likert scale from 1 (decreased significantly) to 5 (increased significantly), in relation to its competitors. The questions to measure sources of knowledge are shown in the appendices and are ranked from 1 (strongly disagree) to 5 (strongly agree) on a Likert scale. The appendix also includes the constructs to which each item refers.

### *3.3 Econometric methods*

The research will use partial least squares (PLS) to estimate the model. PLS-based solutions minimise the variance of all dependent variables with respect to causal variables. This technique uses average variance extracted (AVE) and Cronbach's alpha (CA) as criteria for validating the model. AVE measures the variance gathered by a latent construct. CA measures internal consistency to establish the reliability of the measurement and data collection instrument (Thorndike, 1995).

The limits used were 0.5 for AVE (Vinzi et al., 2010) and 0.6 for CA (Nunnally and Bernstein, 1994). We used bootstrapping to evaluate the t-statistics and calculate the p-values because the distribution law of the estimator was unknown (Vinzi et al., 2010).

The variance-based partial least squares estimation method in structural equation models provides researchers with a reliable method for processing and analysing data without problems, modelling complexity and specifying relationships, making it a useful tool for researchers (Wang et al., 2022). The SEMinR package of R is used. One of the objectives of this work is to determine the variables that most affect innovation. To avoid endogeneity and collinearity issues, given that the independent variables are correlated, the proposed model was developed using a two-step strategy: selection and estimation of the measurement model and the structural model through a bootstrap procedure (Hair et al., 2019).

## **4 Results**

The first step selects the best path model, estimating the effect of knowledge sources on innovation capability. The basic model directly relates all knowledge sources to innovation. This basic model allows us to directly test Hypotheses H1 to H4.

After various trials, we opted for a path model, seeking to maximise the goodness-of-fit criteria and significant effects. Table 1 shows the measurement details of the model, i.e., the constructs and variable names together with the elements.

We proceeded to create a measurement model incorporating all the elements of the observed variables of the latent variable. After data analysis and processing, the following items were removed from the study because they were not significant and did

not provide reliability. According to Roldán and Sánchez-Franco (2012), the reflective construct measurement model is evaluated in terms of individual item reliability, construct reliability, convergent validity, and discriminant validity.

First, the reliability of individual items is considered validated when their factor loading is greater than 0.7, which implies that the variance shared between the construct and its indicators is greater than the variance of the error. Second, construct reliability is assessed using a measure of internal consistency: composite reliability (CR). Following Nunnally and Bernstein (1994) values greater than 0.8 are required for basic research. Third, the average extracted variance (AVE) measure is applied to assess the convergent validity of each construct. AVE measures the percentage of variance in a construct explained by its indicators, and these values must be greater than 0.5. Since all constructs are valid according to the previously defined criteria, our model is correctly specified from a theoretical point of view.

The validity of the overall model is shown in Table 1. The AVE and CA are within the desirability parameters. It is also necessary to evaluate the discriminant validity of the constructs. Henseler et al. (2014) suggest that HTMT achieves high specificity and sensitivity rates in all simulation conditions and that all constructs have HTMT values below 0.85, indicating the existence of discriminant validity for all constructs. To test whether HTMT is significantly different from 1.00 or a lower threshold value, such as 0.90 or 0.85, to be defined according to the context of the study (Franke and Sarstedt, 2019). Bootstrapping is performed and the result values are different from 1.

**Table 1** Reliability measures

	<i>Alpha</i>	<i>AVE</i>	<i>HTMT*</i>			
			<i>Training</i>	<i>Skills</i>	<i>Spill</i>	<i>Redcoperac</i>
Training	0.902	0.774				
Skills	0.857	0.700	0.462			
Spill	0.646	0.738	0.321	0.620		
Redcoperac	0.683	0.759	0.162	0.461	0.726	
Innovation	0.812	0.638	0.093	0.318	0.636	0.701

Note: \*proportion of hetero-monothetic correlations.

*Source:* Own elaboration

Table 2 shows how each of the observable variables relates to the latent variables, contrasting their significance using bootstrapping. All values are significant, suggesting that all constructs are well defined.

It is advisable to analyse collinearity using the internal VIF values for the predictors. Table 3 shows all the VIFs, with values ranging from 1.302, below the threshold of 3.3 proposed by Kock (2015). Therefore, the collinearity test yielded satisfactory VIF results, and the model is considered free of collinearity.

The internal model estimate is shown in Table 4. To assess the importance and relevance of the structural model relationships and the importance of the structural paths, we examine Table 4, which shows the PLS-SEM, the estimated average and bootstrap values, the standard errors, and the confidence intervals (CIs). The use of bootstrapping generates CIs to assess the statistical significance of the path coefficients.

**Table 2** Loadings

		<i>Original estimates</i>	<i>Start-up average</i>	<i>SD at start</i>	<i>T. status</i>	<i>CI of 2.5%</i>	<i>97.5% CI</i>
Training	form1	0.812	0.810	0.027	30.264	0.754	0.857
	form2	0.914	0.913	0.010	94.168	0.893	0.931
	form3	0.884	0.883	0.018	49.584	0.847	0.914
	form4	0.905	0.906	0.010	92.902	0.884	0.923
Skills	skill1	0.822	0.822	0.022	37.416	0.776	0.861
	habil2	0.824	0.822	0.020	41.280	0.782	0.860
	habil3	0.827	0.827	0.019	43.567	0.788	0.862
	habil4	0.873	0.873	0.015	59.390	0.840	0.900
Spillover	spillover2	0.864	0.866	0.016	55.439	0.833	0.894
	spill3	0.854	0.853	0.022	39,142	0.806	0.890
Redcooperac	redco1	0.866	0.864	0.025	35.205	0.807	0.901
	redco2	0.877	0.877	0.019	47.399	0.836	0.909
Innovation	innov2	0.842	0.841	0.023	36.568	0.788	0.879
	innov3	0.746	0.747	0.033	22.491	0.676	0.806
	innov4	0.834	0.833	0.018	47.082	0.795	0.866
	innov5	0.768	0.767	0.036	21.360	0.688	0.826

Source: Own elaboration

**Table 3** Collinearity

<i>Innovation</i>	
<i>Spillover</i>	<i>Redcooperac</i>
1,302	1,302

The structural model indicates the sequence of constructs and the relationship between them. It shows that training affects skills, verifying Hypothesis H1B. Skills affect cooperation networks and spillover, verifying Hypotheses H2B and H2C. Spillover and cooperation networks affect innovation capability, testing Hypotheses H3 and H4. Taken together, the trajectory diagram shows Hypothesis H5.

**Table 4** Summary of effects between constructs

<i>Direct effects</i>	<i>Original estimates</i>	<i>Starting mean</i>	<i>SD at baseline</i>	<i>T. status</i>	<i>CI of 2.5%</i>	<i>97.5% CI</i>
Training -> skills	0.417	0.420	0.040	10.533	0.340	0.494
Skills -> spillover	0.460	0.463	0.047	9.754	0.374	0.552
Skills -> networking	0.352	0.351	0.051	6.885	0.247	0.447
Derivation -> innovation	0.272	0.271	0.048	5.701	0.176	0.365
Redcooperac -> innovation	0.402	0.402	0.054	7.440	0.293	0.502

Table 5 shows the overall effects. Training and human resource skills have a significant effect on innovation, but this is indirect, so Hypotheses H1A and H2A are verified

indirectly. Similarly, the table shows that there is a significant effect of training on cooperation networks and spillover, showing that Hypotheses H1C and H1D are also verified indirectly.

**Table 5** Overall effects

<i>Total effects</i>	<i>Original estimates</i>	<i>Starting mean</i>	<i>Starting SD</i>	<i>T. status</i>	<i>97.5% CI</i>	<i>97.5% CI</i>
Training -> skills	0.417	0.420	0.040	10.533	0.340	0.494
Training-> spillover	0.192	0.195	0.028	6.753	0.143	0.250
Training -> redcooperac	0.147	0.148	0.026	5,553	0.097	0.202
Training -> innovation	0.111	0.112	0.021	5.416	0.075	0.155
Skills -> spillover	0.460	0.463	0.047	9.754	0.374	0.552
Skills -> networking	0.352	0.351	0.051	6.885	0.247	0.447
Skills -> innovation	0.267	0.267	0.040	6.706	0.191	0.347
Derivation -> innovation	0.272	0.271	0.048	5.701	0.176	0.365
Redcoperac -> innovation	0.402	0.402	0.054	7.440	0.293	0.502

*Source:* Own elaboration

Table 6 shows the (adjusted)  $R^2$  values of the endogenous constructs.  $R^2$  represents the proportion of variation in endogenous latent variables that can be explained by the effect of one or more exogenous variables. The value judgment of  $R^2$  depends greatly on the researcher’s discipline. Some researchers, such as Hair et al. (2014) suggest that  $R^2$  above 0.67 can be considered high, while values ranging from 0.67 to 0.33 are moderate, and values between 0.33 and 0.19 are weak (Irimia-Diéguez et al., 2023). The model explains 0.34% of the variance in the innovative capability of small businesses, which can be considered moderate.

**Table 6** The  $R^2$

	<i>Skills</i>	<i>Spillover</i>	<i>Redcoperac</i>	<i>Innovation</i>
$R^2$	0.174	0.212	0.124	0.341
Adj. $R^2$	0.172	0.210	0.122	0.338
Training	0.417	.	.	.
Skills	.	0.460	0.352	.
Spillover	.	.	.	0.272
Redcoperac	.	.	.	0.402

*Source:* Own elaboration

Appendix shows the effect size of the predictor constructs and the predictive power of the model. The first is assessed as small (0.02), medium (0.15), and large (0.35) (Wang et al., 2022). The effect is small for the indirect effect (0.083), which predicts innovation capability. However, the effect size predicting innovation in small businesses due to cooperative networks is moderate. These results show that cooperation networks are necessary to generate innovation as an indirect consequence of skills and training in small businesses, confirming Hypothesis H5.

Two popular prediction statistics that quantify the amount of prediction error are the mean absolute error (MAE) and the root mean square error (RMSE), and prediction

errors are obtained after inspection. Researchers should compare the RMSE (or MAE) values with a naive linear regression (LM) model (Danks and Ray, 2018). The results in the table demonstrate low predictive power because the minority of indicators in the PLS-SEM analysis have lower RMSE (or MAE) values compared to the LM.

## **5 Discussion**

The research focuses on a topic of great interest: the sources of knowledge for generating innovation capability in small businesses (Cantú and Pineda, 2015; Doloreux, 2015; Jardon et al., 2020; Machikita et al., 2010; Osoro et al., 2016; Papula et al., 2013; Serrano-Bedia et al., 2016; Vega-Jurado and Schmutzler, 2017). The literature on sources of knowledge shows that knowledge is a source of innovation capability, increasing competitiveness (Cantú and Pineda, 2015; Doloreux, 2015; Machikita et al., 2010; Osoro et al., 2016; Papula et al., 2013; Serrano-Bedia et al., 2016; Vega-Jurado and Schmutzler, 2017). The model analyses whether knowledge sources generate innovation capability in small commercial enterprises. The results confirm the importance of knowledge sources for generating innovation in small businesses, according to previous literature (Cantú and Pineda, 2015; Doloreux, 2015; Machikita et al., 2010; Nieves and Diaz-Meneses, 2018; Osoro et al., 2016; Papula et al., 2013; Serrano-Bedia et al., 2016; Vega-Jurado and Schmutzler, 2017). The results confirm that knowledge is a particularly important element for business innovation according to Wu and Gao (2022), especially in developing countries. Small businesses with limited resources and few assets are likely to make use of all the elements at their disposal to generate innovation, due to the need to obtain economic income to meet the needs of their families, coinciding with previous studies (Jardon et al., 2020).

The results indicate some aspects of interest for management literature: first, training as a source of formal knowledge for entrepreneurs is necessary for innovation, coinciding with Doloreux (2015) and Sharafizad (2018), but its impact is not direct, according to Saá-Pérez et al. (2012), but unlike Smit (2017).

Second, training to acquire more skills is considered important. The results coincide with the fact that large firms with stable organisational structures, investment capital, and financing (Demirkan et al., 2022) emphasise training as an element of business innovation (Ho, 2019; Lange et al., 2000). This result coincides with Jardon et al. (2020), but unlike that work, the impact of skills is indirect.

Thirdly, the results are consistent with previous studies indicating that formal and informal networks have a positive effect on innovation (Czernek-Marszałek et al., 2023). The work of Dymitrowski et al. (2019) examines how informal relationships strongly influence the development of competitive advantages in the company. For this reason, small businesses place special emphasis on informal relationships and cooperation networks rather than investing in training to develop innovation capabilities. In line with these studies, the impact is direct, unlike other studies on small businesses such as (Jardon et al., 2020).

Finally, cooperation networks as an indirect consequence of training and skills do have a significant effect on innovation, according to previous literature (Faria and Schmidt, 2014; Russo and Rossi, 2009; Su et al., 2009; van Hemert et al., 2013). Similarly, spillovers as an indirect consequence of training and skills occur, as suggested

by previous studies (Armstrong and Kotler, 2013; Dymitrowski et al., 2019). These results suggest that small entrepreneurs use all sources of knowledge to innovate their products and obtain economic resources to support and feed their families. This result makes sense and can be explained by their characteristic of economic asset constraints (Salmon and Allman, 2020) and little or no organisational structure.

### *5.1 Implications for management*

The findings of this research could help small business owners improve their management by considering different sources of knowledge. The results show that small commercial enterprises tend to make use of all sources of knowledge to be more innovative and competitive. The results indicate that the root of innovative knowledge lies in training. Therefore, entrepreneurs need to consider ongoing training to become more competitive and improve their communication, management, production, relationship, and intellectual capital knowledge skills necessary to gain competitive advantages. Likewise, training and skills allow entrepreneurs to capture ideas from their environment and competitors, thereby gaining an advantage. In addition, formal and informal relationships increase innovation. Consequently, entrepreneurs must increase their social capital (Pratono et al., 2016; Wang, 2016).

The training should be conducted in a group setting to encourage discussion among participants, thereby facilitating the application of the material to their shared situations and fostering knowledge spillover. The training should consist of two types of sessions:

- 1 specific training on small-scale retail operations, focused on business management and customer service
- 2 training on the value chains of the products sold by small retail businesses, in collaboration with their suppliers.

The training should provide skills and examples of past business successes from similar ventures in other locations, so that each person can adapt them to their own situation. It must be tailored to subsistence-level businesses with limited resources. An example: in a small business, teaching how to create a voluntary WhatsApp group with the most loyal customers who have a cell phone and can read can improve service by communicating the arrival of specific products (food, books, clothing, etc.) so that customers can buy, reserve, or stay informed.

The training initiative can be launched by the public sector closest to subsistence businesses (such as municipalities) and by representatives of small businesses or clusters (where they exist).

Cooperation between suppliers and competitors is difficult to achieve; the best way to do so is by highlighting examples of shared success stories from other places (for example, the development of initiatives in streets or commercial districts, in marketing, or in shared security; or supplier-business relationships that use data to tailor product manufacturing to public preferences).

The results suggest public policies to direct greater efforts towards the formal training of entrepreneurs in these businesses with the aim of sustaining trade and limiting unemployment and poverty (Toledo et al., 2010). By improving and making the owners' businesses more competitive, the well-being of the territory is positively affected. In

addition, public actions for forestry cooperation among small businesses facilitate their innovation and competitiveness (van Hemert et al., 2013).

## **6 Conclusions**

This study examines the sources of innovative knowledge in small commercial enterprises in Ecuador. It analyses two sources of internal knowledge: skills and training, and two sources of external knowledge: spillover and cooperation networks, with the aim of understanding the process by which they affect the capability for innovation. The formal sources of knowledge are training and cooperation. Due to their nature, small enterprises have limited assets and formal knowledge.

Our results show that small businesses generate innovation through customers, suppliers, and competitors who are part of their relationships. However, training increases skills that improve formal and informal relationships. This indicates that small businesses use formal and informal sources of knowledge to be innovative. This result suggests the need for sources of knowledge and that small businesses use external and internal sources of knowledge to be innovative because they need to generate economic results to support their families. It is also considered that small business owners should be aware of the importance of training to enhance entrepreneurial skills, but due to their limited economic conditions, they use all sources of knowledge at their disposal to have innovative capability.

### *6.1 Limitations and future research*

Our research was conducted in a specific canton in the province of Cotopaxi in Ecuador. The data is from a survey conducted over a period. Therefore, the results should be generalised to all small businesses with caution. Sources of knowledge such as research, development, and technology were not considered in the study because small businesses do not usually carry out research or technological development to obtain results.

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## **Declarations**

All authors declare that they have no conflicts of interest.

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## Appendix

**Table A1** Measurements: sources of knowledge

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Training

Basic training

Technical training

Quality training

Specialised training for the task they perform

Skills

Interpersonal skills for development activities

Entrepreneurial skills (an individual’s ability to identify and seize opportunities)

Technical skills (oral communication, technical management, organisational, and writing skills)

Business management skills (planning, marketing decision-making, and accounting)

Spillover

Informal relationships to improve your performance

Cooperative attitude and partnerships on the part of the company

Direct relationship with end customers

Cooperation networks

Cooperation with suppliers to improve products/services

Cooperation with customers to improve products/services

Cooperation with competitors to improve products/services

Innovation capability

Continuous modernisation of the product or premises

Technological integration into the product or premises

Potential for innovation

New ideas proposed

Innovative spirit

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**Table A2** Effect size  $f^2$

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	<i>Skills</i>	<i>Spillover</i>	<i>Redcoperac</i>	<i>Innovation</i>
Training	0.210			
Skills		0.269	0.141	
Spillover				0.083
Redcoperac				0.190
Innovation				

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Source: Own elaboration

**Table A3** Predictive power

<i>PLS in-sample metrics</i>												
	<i>habil1</i>	<i>habil2</i>	<i>habil3</i>	<i>habil4</i>	<i>spill2</i>	<i>spill3</i>	<i>redco1</i>	<i>redco2</i>	<i>innov2</i>	<i>innov3</i>	<i>innov4</i>	<i>innov5</i>
RMSE	0.998	1.108	1.039	1.123	0.887	0.903	0.821	0.811	0.667	0.839	0.655	0.746
MAE	0.773	0.878	0.839	0.896	0.670	0.721	0.588	0.644	0.519	0.659	0.537	0.563
<i>PLS out-of-sample metrics</i>												
	<i>habil1</i>	<i>habil2</i>	<i>habil3</i>	<i>habil4</i>	<i>spill2</i>	<i>spill3</i>	<i>redco1</i>	<i>redco2</i>	<i>innov2</i>	<i>innov3</i>	<i>innov4</i>	<i>innov5</i>
RMSE	1.004	1.115	1.049	1.133	0.893	0.908	0.824	0.815	0.673	0.845	0.662	0.753
MAE	0.778	0.883	0.848	0.903	0.674	0.726	0.590	0.646	0.524	0.662	0.541	0.568
<i>LM in-sample metrics</i>												
	<i>habil1</i>	<i>habil2</i>	<i>habil3</i>	<i>habil4</i>	<i>spill2</i>	<i>spill3</i>	<i>redco1</i>	<i>redco2</i>	<i>innov2</i>	<i>innov3</i>	<i>innov4</i>	<i>innov5</i>
RMSE	0.912	0.937	0.966	1.012	0.792	0.784	0.703	0.690	0.656	0.823	0.633	0.716
MAE	0.707	0.729	0.762	0.792	0.626	0.606	0.516	0.524	0.496	0.647	0.510	0.538
<i>LM out-of-sample metrics</i>												
	<i>habil1</i>	<i>habil2</i>	<i>habil3</i>	<i>habil4</i>	<i>spill2</i>	<i>spill3</i>	<i>redco1</i>	<i>redco2</i>	<i>innov2</i>	<i>innov3</i>	<i>innov4</i>	<i>innov5</i>
RMSE	0.952	0.969	0.997	1.047	0.828	0.826	0.734	0.730	0.683	0.853	0.661	0.750
MAE	0.742	0.753	0.788	0.821	0.655	0.634	0.536	0.552	0.515	0.668	0.532	0.561