Construction of a knowledge test to measure the level of knowledge of farmers on Geographical Indications in agriculture

Abstract

Geographical Indication (GI), which indicates the unique geographical origin of a product, is protected as one of the categories of intellectual property items included under Article 22 of the TRIPs Agreement. It insists on the quality, reputation, or other characteristic of the good, which are attributable to its geographical origin. Geographical Indications are valued in the market because of the uniqueness of quality parameters or the processes involved in production. As GIs have the potential to enhance market opportunities of the producer communities and other stakeholders, they must have sound knowledge of various aspects of this system of intellectual protection and its benefits. This paper explains how a knowledge test was developed to measure an individual's knowledge level on various aspects of GI as part of the study viz. Geographical indications in agriculture and community benefits: A cross-sectional analysis by the authors.

Knowledge on GI was operationalized as the accuracy with which various aspects of GI, registration, and the impact have been understood. The steps to develop and standardize the test included selection of items; item analysis and pre-testing; calculation of difficulty, estimation of discrimination index and point bi-serial correlation; final selection of items; and testing of reliability and validity. The final knowledge test retained 24 items out of 36 raw items. The test was found to be significantly reliable and valid, as indicated by a significant value of reliability coefficient and content validity. Researchers can use this test to measure farmers' knowledge on GIs.

Keywords: Geographical indications, knowledge test, traditional knowledge, impact

Geographical Indication (GI) is as an effective tool to identify the geographical uniqueness of a product and protect its authenticity. It not only protects the inherent rights of the community that have traditionally produced it, but also performs the prime economic function of maintaining its goodwill and reputation in the market, thus expanding the market's access for better revenues. GIs have great potential to enhance the income levels of the producer community leveraging the uniqueness. Hence it is important that the stakeholder communities have sound knowledge on various aspects of GI systems followed in the country as well as its global significance. GIs can be considered a unique case of informal institutions that are thereafter translated into a globally recognized formal

regulation (Rodríguez-Pose, 2020). Researchers concluded that rural areas endorsing space-sensitive agri-food productions through GIs eventually experienced better performance in terms of local economic development than others (Bonanno *et al*., 2019; Torok *et al*., 2020 and Crescenzi *et. al*., 2022)). Similarly, Chatterjee *et. al*. (2020) administered knowledge test to access the knowledge level of dairy farmers manufacturing traditional dairy products that could fetch additional income to farmers besides providing considerable employment opportunities.

Bloom *et al*. 1956, defined knowledge as that behaviour and test situation that emphasized remembering either by recognition or recall of ideas, material, or phenomena. Here, knowledge of the GI system is defined as farmers' understanding of geographical indication. Their knowledge levels must essentially contain the theoretical and functional aspects of GI as it is process-oriented and has several outcomes and implications. Therefore, the knowledge test covered the definitional components of GI as a concept, the process of registration, the impact of registration etc.

Methodology

Locale of study and testing plan

The knowledge test was developed as part of the study entitled 'Geographical Indications in agriculture and community benefits: A cross-sectional analysis' which was done with the objective of assessing the community benefits of four important GIs in Kerala. The GIs selected for the study were Kaipad rice, Changalikkodannendran (plantain), Marayoor jaggery, and Tirur betel vine. These products hail from Kannur, Thrissur, Idukki, and Malappuram districts respectively. To test the reliability and validity of the proposed knowledge test, two sets of 30 respondents each were selected.

Construction of knowledge test

The authors developed the knowledge test following the procedure explained by Lindquist (1951) as given below:

Collection of questions

The questions of the knowledge test, whichare also referred to as items, that reflect various aspects of GI were collected from different sources such as literature, specialist scientists working in related fields, extension scientists, and field extension personnel. The questions were on basic knowledge of GI, the process of registration, the advantages of GI, and its impact on society. Thus, a total of 52 items for farmers were selected. While selecting the items, necessary care was taken to ensure that the items abetted in differentiating the well-informed

respondents from the poorly informed ones, had certain level of difficulty value, and encouraged rational thinking rather than mechanical memorization (Ray & Mondal, 2014).

Jury opinion

The collected questions were sent to fifty judges from different disciplines who are experienced in the extension, geographical indications, and Intellectual Property Rights in agriculture. The items were evaluated for their relevance by these experts on a five-point scale that represented different levels of relevance, viz. *highly relevant, relevant, undecided, not relevant,* and *not at all relevant.* Relevant items wereselected based on the mean score obtained by each item. Only those items scoring abovethree were selected. Accordingly, a total of 36 items were selected for creating the farmers' knowledge test.

Pre-testing and item analysis

The collected items were administered to 30 farmers selected for pre-testing.Answers were marked as correct or incorrect, with marks '1' and '0' respectively. Thus, the knowledge score of farmers would be the sum of scores for allthe correct answers.

Item analysis of the knowledge test was done based on the estimates of difficulty and discrimination, expressed as indices. The item difficulty index refers to how difficult an item is, whereas the item discrimination index indicates the degree to which an item discriminates the well-informed respondent from the poorly informed one. Difficulty index and discrimination indexwere the criteria considered for the final selection of items in the knowledge test (Sinha *et. al.*, 2020).

Item difficulty index (P)

The difficulty index indicates the extent to which an item is difficult for the respondent to answer. An item should not be so easy that all persons can give the right answer, nor should be so difficult that none can answer it correctly. Garret (1966) described several ways to determine the difficulty of an item: (i) by the judgments of the competent people who rank the items in the order of difficulty, (ii) speed with which the items can be correctly solved, and (iii) by the number of examinees in the group who can solve the item correctly. This study followed the third method for estimating difficulty index. Here, difficulty index wasoperationally defined as the proportion of the respondents giving correct answer to a particular item (Ray and Mondal, 2014). In this study, difficulty index of an item was worked out as P; that is, the proportion of respondents answering an item correctly to the total number of

respondents who attended the item, using the following formula:

P =NC/N

Where, P = Difficulty index, NC = number of respondents who answered correctly and N is the total number of respondents. Difficulty index was calculated for all the items in the test, and eventually, those items with P values ranging from 0.3 to 0.8 wereconsidered for being included in the final knowledge test.

Item discrimination index (DI)

The second criterion applied for item selection was the discrimination index. Beans (1953) defined discrimination index as the degree to which a single item separates the superior individual from the inferior oneregardingthe trait or group of traits being measured. The function of item discrimination index is to find out whether an item really discriminates a well-informed respondent from a poorly informed respondent. The discrimination index can be obtained by calculating the phi-coefficient as formulated by Perry and Michael (1951). However, Mehta (1958) in using $E^{1/3}$ method to find out item discrimination emphasized that this method was analogous to phi-coefficient and hence, a convenient substitute for the phi-coefficient.

To work out the discrimination index of each question, the total scores obtained by 30 farmers for the 36 questions were ranked. The scores obtained were arranged in descending order of total scores and the respondents were divided into six equal groups – G1, G2, G3, G4, G5, and G6 with five respondents in each group. The middle two groups, namely G3 and G4, were eliminated, and the four terminal groups, that is, high-score groups (G1 and G2) and low-score groups (G5 and G6), were retained for further analysis. The following formula was used to calculate the discrimination index of each item.

$$E^{1/3}= ((S1+S2) -(S5+S6))/(N/3)$$

Where, $E^{1/3}$ =Discrimination index, S1, S2, S5, and S6 are the frequencies for correct answers in the group G1, G2, G5, and G6, respectively. N is the total number of respondents in the sample selected for item analysis. In the present study, the item with a discrimination index value of more than 0.20 was considered for inclusion in the knowledge test.

Point-bi-serial correlation coefficient

Point-bi-serial correlation coefficient is the statistics used to work out the internal consistency of the items of dichotomous or binary nature, which signifies the relationship of the total score to a dichotomized answer of any given item.

The point bi-serial correlation for each of the item of initial knowledge test was calculated by using the formula given by Garret (1966):

$$rpb = Mp - Mq / \sigma * \sqrt{pq}$$

where, rpb = point bi-serial correlation

Mp = mean of the total scores of the respondents who answered the items correctly.

Mq =mean of the total scores of the respondents who answered the items incorrectly.

p = proportion of the sample in the first group

q = proportion of the sample in the second group

σ = standard deviation of the entire sample

A summary of the criteria of the questions or items included in the knowledge test is given in Table 1.

Table 1: A summary of the criteria for selecting the items of theknowledge test on geographical indications

Items	Difficulty index	Discrimination index	Point bi-serial correlation	S/R
Meaning of Geographical Indications (GI)	0.8	0.375	0.395	S
Actual product that got GI	0.63	0.375	0.695	S
Registration procedure- who can apply	0.467	0.5	0.408	S
Understanding on farmer collective for GI registration	0.7	0.375	0.376	S
Understanding on the institutions involved in assistance for registration and promotion	0.3	0.375	0.415	S
Use of GI tag- common logo	0.6	0.375	0.657	S
Knowledge about proprietor	0.13	0.25	-0.312	R
Knowledge about authorized user	0.67	0.375	0.386	S
Use of GI logo of their GI product	0.73	0.5	0.515	S
Indication of GI tag	0.3	0.37	0.4	S
Validity of GI registration/ renewal period	0.567	0.35	0.637	S
Procedure for renewal	0.633	0.5	0.475	S
Product eligibility for GI registration	0.8	0.375	0.965	S
Characterization of GI products as a unique product	0.76	0.5	0.524	S
Link between GI and traditional knowledge	1	0	0.05	R
Role of GI in economic development	0.7	0.375	0.535	S
Type of right offered by GI registration	0.4	0.375	0.416	S
Infringement action procedure	0.135	0.25	-0.312	R
Value addition of GI products	0.53	0.375	0.475	S
Knowledge on most successful other GI products in India	0.73	0.375	0.416	S
Need of GI status	1	0	0.05	R
Benefit sharing system	0.46	0.5	0.584	S
Environmental benefit by GI	0.4	0.125	-0.408	R
Marketing strategy used for GIs	0.63	0.5	0.584	S
Promotional measures	0.8	0.375	0.385	S
Quality control mechanism/ monitoring mechanism	0.165	0.25	0.083	R
Similar products/ counterfeits / imitation products	0.967	0	0.244	R
Uniqueness of their product	1	0	0.05	R
Demand of their product	0.93	0.25	-0.05	R
Adulteration/ practices that reduces the quality	0.46	0.5	0.584	S
Understanding on GI value chain	0.53	0.5	0.475	S
Premium price obtained in market	0.367	0.375	0.385	S
GI systems in other countries	0.76	0.5	0.385	S
Organisations promoting GIs and their value-added products	0.933	.25	0.175	R
Mechanisms of benefit sharing for other products/other places	0	0	0.244	R
Understanding on GI registry	0.96	0	0.04	R

S=Selected Item; R=Rejected Item

Reliability of the knowledge test

Reliability is the accuracy or precision of a measuring instrument (Kerlinger, 2004). The reliability of the knowledge test was determined by the split-half method. For this, the test was divided into two halves by taking a random sample of half of the items in the survey. The two halves were

administered to a new sample of 30 farmers, and scores obtained by each farmer for both tests were recorded. The reliability of the test was calculated using the Spearman-Brown formula (Guilford and Fruchter, 1978). The reliability coefficient obtained for the test was 0.81, which was highly significant.

$$r_{tt} = \frac{2r_{hh}}{1 + r_{hh}}$$

Where, r_{tt} = reliability coefficient of the test and r_{hh}= the correlation between two halves of the test. The reliability coefficients provide an estimate of the internal consistency of the test and thus the dependability of the test scores. The reliability coefficient determined by this method indicates that this knowledge test is highly reliable.

Validity of the knowledge test

It was ensured that the knowledge items in the preliminary test represented the entire universe of the relevant behavioural aspects of the farmers concerning knowledge about GI. The authors meticulously included items that should cover all the fundamental concepts of geographical indications. The concerned experts in the relevant field validated all the items. Therefore, it was assumed that the scores obtained by administering this test measured the respondents' knowledge as intended.

Result and discussion

By the steps followed in developing knowledge test to measure farmer's knowledge on GI, a total of 24 items were finally selected for the main study. In the development of knowledge test, discrimination index and difficulty index are to be dealt with caution as these determine the comprehensiveness of the developed test.

In the main study, those items with a difficulty index between 0.30 and 0.80, discrimination index value between 0.30 and 0.55, and point bi-serial correlation coefficient at five and one percent significance level were selected, as seen in Table 1. A total of 24 out of 36 items that met the criteria mentioned above were included in the knowledge test. This knowledge covers all critical dimensions of geographical indications and hence can measure the comprehensive knowledge of farmers. This test would have wide application in identifying knowledge gaps of farmers about geographical indications and their practical applications. Since GI is regarded as a tool for sustainable development of rural communities, an appraisal of the knowledge on GI would bring a light on understanding the system which would help in assessing the real impact of GI on the registered farmers. Assessing the knowledge gap regarding the advantage of GIs and the support

mechanism to sustain the indigenous production system would help formulate exclusive strategies and policies to address the post registration constraints of GIs effectively.

Conclusion

Knowledge significantly influences farming-related behavioral patterns. Therefore, involving the farming community in any vital issue concerning them will require a clear understanding of their present knowledge level on various aspects of production, value addition, and marketing. This knowledge test would be an effective instrument to measure the comprehensive knowledge of farmers on geographical indications, which would be of significant use in conscientizing them about their rights. From the practical point of view, the results of this test will also help us devise strategies for training the farming communities to reap the benefits of scaling up and marketing the legally protected indigenous practices.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

References

Bean, KL 1953. Construction of educational and personnel tests. McGraw- Hill Book Co., New York.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H. and Krathwohl, D. R. (Eds.). 1956. Taxonomy of educational objectives: The classification of educational goals. *Handbook I: Cognitive domain*. New York: Longmans. D. Mckay.

Bonanno, A., Sekine, K., & Feuer, H. N. (Eds.). 2019. Geographical indication and global agri-food: Development and democratization. Routledge.

Chatterjee, D., Jha, S.K., and Maiti, S. 2020. Development of Knowledge Test Regarding Method of Preparation of Traditional Dairy Products. *Indian Res. J. Ext. Edu*. 20 (1), 9-14

Crescenzi, R., Filippis, F. D., Giua, M., and VaqueroPiñeiro, C. 2022. Geographical Indications and local development: the strength of territorial embeddedness. *Regional Studies*. 56:3, 381-393, DOI: 10.1080/00343404.2021.1946499.

Garrett, H.E. 1966. Statistics in psychology and education. International book bureau,Hyderabad.

Guilford, J.P. and Fruchter, B. 1978. Fundamental Statistics in Psychology and Education. 6th ed., McGraw-Hill.

Kerlinger, F. N. 2004. Foundations of Behavioral Research. 2nd ed. Surjeet Publications, Delhi.

Lindiquist, E.F.1951. Educational Measurement. American Council of Education, Washington.

Perry, N.C. and W.B. Michael. 1951. Systematic error in estimates of tetrachoric R. *Educational Psychology Measurement*, 11: 629-39

Ray, G.L. and Mondal, S. 2014. Research methods in social sciences and extension education. Kalyani Publishers, Noida (UP).

Rodríguez-Pose, A. 2020. Institutions and fortune of territories. Regional Science Policy Practice, 1–16. https://doi.org/10.1111/ rsp3.12277

Sinha, S., Sankhala, G., and Lal, S. P. 2020. Construction of Knowledge Test to Measure the Knowledge Level of Dairy Farmers vis-a-vis Environment Friendly Dairy Farming Practices *Ind. J. Ext. Edu.* 56 (1): 6-11.

Torok, A., Jantyik, L., Maro, Z. M., & Moir, H. V. J. 2020. Understanding the real-world impact of geographical indications: A critical review of the empirical economic literature. Sustainability, 12(22), 9434. https://doi.org/10.3390/su12229434