

AN ECONOMIC STUDY OF POST-HARVEST LOSSES FOR WHEAT FARMERS IN IRAQ BAGHDAD GOVERNORATE –CASE STUDY-

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ABSTRACT

The research aimed to measure the loss and waste of wheat farms, using exploratory and confirmatory factor analysis. Although, loss has become a frightening reality due to the loss of large quantities of food produced by humans for human consumption, so Iraq possesses material capabilities, natural resources, and human beings, it is not self-sufficient, and the reason is the low yield per donnm of wheat, as the productivity rate ranged to 650 kg / donnm for the period 1990-2019. The one of the most important reasons for the decline in productivity is the loss and waste of wheat of post- harvest. And to identify the most important factors that work to reduce post-harvest wheat losses for wheat farmers at Baghdad, by use exploratory and confirmatory factor analysis. So the results indicated that the most important factors that work to reduce losses are the duration of the crop remaining in the field after harvesting until the date of marketing it to the central silos by exposing the crop to environmental hazards, as well as attacking birds, rodents, stray animal feces, and what mixes of grains with soil. The correlation is positive and strong, at a rate of 97%, and the distance to the silo to which the crop is marketed and the logistical operations associated with it, such as crop transportation vehicles that do not comply with the conditions for the proper transportation of grains, as most of them are without cover and there are gaps and holes in them that facilitate the fall of the grains on the road is 80%, and it has a direct relationship as well. Also farmers could be increase their production without increasing economic resources by preserving wheat from loss and waste of post- harvest.

Keywords: exploratory and confirmatory factor analysis, Losses, AMOS.

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علي وجبارة

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دراسة اقتصادية لخسائر ما بعد الحصاد لمزارعي القمح في العراق

محافظة بغداد أنموذج تطبيقي

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مدرس

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المستخلص

هدف البحث الى قياس الفقد والهدر لمزارعين القمح باستخدام التحليل العاملي الاستكشافي والتوكيدي. وذلك لان الفقد والهدر أصبح واقعاً مخيفاً لما يسببه من ضياع لكميات كبيرة من الغذاء الذي ينتجه الانسان للاستهلاك البشري، وعلى الرغم من ان العراق يمتلك الامكانيات المادية، والموارد الطبيعية، والبشرية الا انه غير مكتفياً ذاتياً ويرجع السبب الى تدني غلة الدونم الواحد من القمح اذ تراوح معدل الانتاجية الى 650كغم /دونم للمدة 1990-2019، وأن أحد أهم أسباب انخفاض الإنتاجية هي الفقد والهدر للقمح بعد الحصاد. حيث تم تحديد أهم العوامل التي تعمل على تخفيض خسائر القمح ما بعد الحصاد لمزارعي القمح في بغداد بأعتماد على التحليل العاملي الاستكشافي والتوكيدي ، بأستخدام برنامج AMOS ، وإشارت النتائج الى أن أهم العوامل التي تعمل على تقليل الخسائر هي مدة بقاء المحصول في الحقل بعد حصاده لحين موعد تسويقه الى السابيلوات المركزية من خلال تعرض المحصول الى مخاطر بيئية وكذلك مهاجمة الطيور له والقوارض وبراز الحيوانات السائبة وما يختلط من الحبوب بالتراب ، وكانت علاقة الارتباط طردية، وقوية وبنسبة 97%، والمسافة الى السابيلو الذي يتم تسويق المحصول اليه والعمليات اللوجستية المرتبطة بها كسيارات نقل المحصول التي تكون غير مطابقة لشروط النقل السليم للحبوب حيث تكون اغلبها بدون غطاء وتوجد ثغرات وفتحات فيها تسهل سقوط الحبوب على الطريق، وبنسبة 80% وعلاقة طردية ايضا، وإن المزارعين بإمكانهم زيادة إنتاجهم من دون زيادة الموارد الاقتصادية من خلال المحافظة على القمح من الفقد والهدر بعد الحصاد.

الكلمات المفتاحية: التحليل العاملي الاستكشافي والتوكيدي، الخسائر، أموس.

*بحث مستل من اطروحة الدكتوراه للباحث الاول

INTRODUCTION

Acknowledgment of reducing food losses is an important component of the food security. The study of the losses that occur between the completion of the harvest process and the human consumption are post-harvest losses, and they are the interrelated activities from harvest time from crop processing, marketing, and food preparation. on this basis, post-harvest losses are quantifiable losses and qualitative quantifiable losses in the post-harvest system. To identify the most important problems and constraints that work on post-harvest losses for wheat farmers in Iraq, Structural Equation Modeling (SEM) has been used as a model, a major component of multivariate statistical analyzes, and is increasingly used in educational, psychological, social and economic sciences (9) and behavioral. Despite its emergence at the beginning of the seventies of the last century, now it has become more widespread among researchers since the end of the last century, and perhaps the most important reasons for its popularity are the presence of specialized computer programs such as AMOS, LISREL, MPLUS and others, and the availability of specialized references and writings for them. With the constructive equation in the literature, we mention its definition as: a general analytical framework for many types of models, such as Path Models, Model Regression, Exploratory & Confirmatory Factor Analysis Model, and those methods that are special cases of modeling by structural equation, Hoyle 1995 defines it as a comprehensive statistical approach for selecting hypotheses about relationships between measured variables and latent variables, and the essence of using modeling in the human, social and economic sciences is for the researcher to construct a model that represents the relationships between the variables under study, and this construction is based on a strong theoretical basis he tests the extent of the match between this data he collected and the model that he built (Does the data match this model or not? Thus, the transition began with thinking about a small number of the variables of the studied phenomenon to thinking about the relationships of all kinds between a greater

number of variables in the form of a system or a model. The local, Arab and international studies have focused on studying the factor analysis (1,3,5,14) and the post-harvest losses thereof this study was aimed to (16,17,18,19,20).

MATERIALS AND METHODS

In order to achieve the goal of the research, data were collected from the wheat farmers in Baghdad, the Baghdad Agricultural Directorate, Al-Karkh and Al-Rusafa, which numbered approximately 145, through a questionnaire prepared for this purpose that included data and information on the crop for the year 2019, on production, costs, revenues, and cultivated areas, Extension services provided, the educational level of the farmers, and the experience through the time period of planting the crop(13). The loss of wheat in the field after harvesting, and the reasons for this loss, was studied using exploratory and confirmatory factor analysis to determine the most important factors that affect the reduction of these losses for wheat farmers after harvest. The total cultivated area of the study sample was 3931 downm and the total production was 3341.35 tons, which represents 10% of the volume. Population sample, data were analyzed using spss, ver24 and AMOS program.

Vocabulary factor analysis

- The Eigen Value: It is the sum of the squares of the saturations of all the variables on each of the factors of the matrix separately, and it represents the value of variance that the factor contributes to, and is defined as clearly in the program by the value one, which is according to the Kaiser criterion, and if the latent root is greater than one, we accept the worker, if it is less, we reject it.
- The Scree Plot test: is used to determine the maximum number of factors that can be extracted before the particular variance begins to control the general variance. This test consists of a graph that represents the vertical axis of the variance, while the horizontal axis represents the number of factors. This test determines the number of factors at the point where the curve turns into an almost straight line (15).
- Communality: The sum of the variable's contributions to the different factors that could

be extracted in the factor matrix, and since one variable contributes different amounts to each factor, and whether its contributions are substantial or not significant, the sum of the squares of these contributions, or the saturations on the matrix operators is the value of the prevalence of the variable, or communality.

- Loading: It is the coefficient of correlation or covariance between the variable, or the expression, and the factor or component.

- Rotation: after reaching the factors and their loading, the process of rotating the factors comes to another place that helps explain them. The main goal of rotating factors is to arrive at a suitable combination of factors that can be explained, and then the rotation of factors helps in interpreting the factors logically. There are two methods of rotation: Orthogonal and Oblique rotation (3).

- KMO and Bartlett's test of sphericity: - The Kaiser - Mayer - Olken test is to calculate the sufficiency and test whether the partial correlations between the variables are small, and the value of this test ranges between (0, +1), as the values refer to (+1) indicates sufficient or appropriate sample, and values less than (0.5) indicate insufficient sample.

- Bartlett's test for cocci / cyclic / cyclic is an indicator of the relationship between variables and must be statistically significant, indicating that the matrix is the unit matrix.

-Determinant: to measure the auto-correlation problem, and the value of the determinant should not be less than (0.001), If its value is less than that, we look at the highly correlated variables more than (0.80) and delete one of them.

Table 1. the value of indicators that match the model with the data

Indicator	Acceptable value for a match	Better matching value
Chi-square, degree of freedom df, and level of significance	If the value of chi-square is not significant and high	If the chi-square value is low, it indicates a better match
Ratio value (square / df)	Less than 5 acceptability and a good match	Lower values indicate a better match
Comparative, Fit Index (CFI)	0.90 or greater	The right one
Goodness of Fit Index	0.90 or greater	The right one
GFI	0.90 or greater	The right one
Adjusted Goodness of Fit Index, AGFI	0.90 or greater	The right one
Nomed Fit Index NFI	0.90 or greater	The right one
Tucker & Lewis TLI	Less than 0.05	Zero

Source: Results, obtain by using spss .

RESULTS AND DISCUSSION

Wheat is the main product for farmers, not only as a food crop but also as a cash crop that provides the main income for the family, as the crop (wheat) is collected in the field after the mechanical harvesting process is carried out for it, and it is covered, stored until the date of marketing, and sold to the state. Wheat after harvest causes losses through birds capturing part of it, and grains may also be contaminated with loose animals in addition to rodents (mice, rats) present in the field, causing losses at a rate of 1%, according to the farmers 'questionnaire. Or it is transferred directly to the silo according to a schedule prepared in coordination between the Ministry of Agriculture and the Ministry of Trade, according to the number of farmers or

marketers of the crop, and the local wheat crop (80-90%) is marketed to the state represented by the General Company for Grain Trade, and the farmers bear the cost of transportation. From the farm to the nearest silo, or silo, and often the inappropriate means of transport in which the wheat is transported, and in most cases it is without a cover that prevents the grains from being dispersed while the vehicle is moving, and sometimes there are gaps and holes in which it is easy to fall, and the scattering of wheat grains on the road, and from Through the questionnaire form, and the field visits to the farmers, it was found that before the crop is transferred to the granary, the crop is cleaned from the screening process for it to remove impurities in private laboratories for sifting wheat, and these

factories are spread near the farms designated for wheat production in Iraq, and in these laboratories a process is carried out Cleaning wheat from impurities, dirt, and barley is also used to remove atrophied and broken grains, as well as bush seeds to obtain a higher price for its crops. The wheat market in Iraq is considered the monopoly market of the state, as the final price that the farmer gets depends on the classification set by the government, as farmers can obtain a higher price by obtaining a higher rank in terms of first-class wheat, second-class wheat, and second-class wheat Third, and each variety has a price that varies according to grade, and it was also found that farmers used about 85% of the land they own in the area for the study sample to cultivate the wheat crop during the year 2019, and the farmers indicated that the allocation of their lands remains almost the same in normal circumstances. From farmers to not owning the land, and they work in agriculture by renting the land. Also it was found that most of the small farmers whose areas planted with wheat crops did not exceed 10 downm were marketing their crops to some traders at prices

lower than the price set by the government, and then these traders market the wheat. After it was collected in their own yards, cleaned, and sifted from impurities and dirt, and then marketed to the silo in the name of one of the farmers covered by the marketing plan, and the reason for selling their crops to the merchants was given by small farmers His daughter, the questionnaire form for this episode, is the exorbitant transportation costs of the crop to the granary, which amounts to 10 thousand dinars / ton, as well as the time constraints of the period for receiving the amount from the granary manager. Farmers keep an average of 10-20% of the crop for the purpose of their family consumption and for the purpose of planting for the next season. Farmers also explained the production of straw, which is wheat straw, which is the second product of the wheat crop after harvest, and is considered one of the important factors in the farm income, either directly through sales of straw, or indirectly through livestock feeding, and the subsequent sales of animal products. Wheat is the main product for farmers, not only as a food crop, but as a food crop

Table 2. The total production and total revenue of wheat farmers in the research sample for the year 2019

Tenure Categories Dounm	productio n quantity (ton)	Output value (1000 ID)	* The amount of hangover Hay Wheat (ton)	Hay value (1000 ID)	Total revenue (1000 ID)
1-10	202	113120	471.32	94264	207384
11-20	401.5	224840	936.82	187364	412204
21-30	795.79	445642.4	1856.57	371314	816956.4
31-40	499.24	279574.4	1164.72	232944	512518.4
41-50	780	436800	1819.74	363948	800748
more than-50	662.82	371179.2	1546.35	309270	680449.2
Summation	3341.35	1871156	7795.52	1559104	3430260

Source: Questionnaire Results

*It was calculated based on applied research in the College of Agriculture-Department of Field Crops to calculate the ratio of hay to seed (7). In Table 2, we notice the holding categories were divided on the basis of the highest production, the largest value for revenues, and the lowest value of production and revenues, and the largest quantity of production was 795.79 tons for the 21-30 category and the lowest quantity of production was 202 tons for the 1-10 category, while the highest value for revenues was 816956.4 thousand dinars for category 21 -30, and the

lowest value of revenues is 20,738 thousand dinars for Category 1-10.

Agricultural extension services: Agricultural extension services have a great impact on management, skill and efficiency used in agricultural production and agricultural development processes, through the use of modern agricultural technologies that increase production and productivity, reduce loss and waste, as well as reduce production costs (10). Table 3 show the importance of agricultural extension services for the crop wheat for the research sample for 2019.

Table 3. The importance of agricultural extension services for the crop Wheat for the research sample for 2019

the details	The number of farmers	percentage%
Agricultural extension services	85	58.620
There are no agricultural extension services	60	41.379
Total	145	100

Source: Questionnaire Results

Factor Analysis

Factor analysis is one of the statistical methods that aim to reduce the number of variables or data related to a particular phenomenon, and this is done by building a new set of specific variables on the relationships and then transforming them into a set of basic components that are not highly correlated with each other. Where the best match of the basic components constitutes the first factor, and the best reconciliation of the second basic components that were not counted in the first factor is determined to determine the second factor, and so on for the rest of the factors (1).

Types of factor analysis:

- There are two types of factor analysis:

Exploratory Factor Analysis: This type is used in cases where the relationships between

the variables and the underlying factors are unknown, and then the factor analysis aims to discover the factors to which the variables are classified (5).

Confirmatory Factor Analysis: This type is used for the purpose of testing hypotheses related to the presence or absence of a relationship between the variables and the underlying factors. It is also used to compare several models of extractive agents. Exploratory and confirmatory factor analysis was used using the statistical program spss, ver24 and AMOS model, to evaluate the factors that determine post-harvest losses of the wheat crop in Iraq in the study sample for the year 2019. The six variables are educational level, experience, cultivated area, distance to the nearest silo, extension services, crop retention time in the field to assess the loss factor in the field for farmers, included in the AMOS model. Figure 1 shows the reasons that farmers look at for post-harvest wheat field losses in the study area. Note that these six variables included in the confirmatory factor analysis model Confirmatory significantly affected the post-harvest losses of wheat. These six factors were chosen, depending on the exploratory factor analysis, as a first step for the analysis as shown in the frequency table or communalities.

Table 4. Values of common variance or saturations of the variables of post-harvest farmer losses for the research sample for the year 2019

Variables	Initial	Component
education level	1	0.492
Experience	1	0.385
Obtaining extension services	1	0.432
The distance to the silo	1	0.891
How long the crop will last in the field	1	0.914
Cultivated area	1	0.298

Source: Questionnaire Results

Table 4 shows the degree of contribution of each variable of farmers' post-harvest losses in forming the main factor of farmers' post-

harvest losses, and as shown in Figure 1, the exploratory factor analysis of farmers' post-harvest losses.

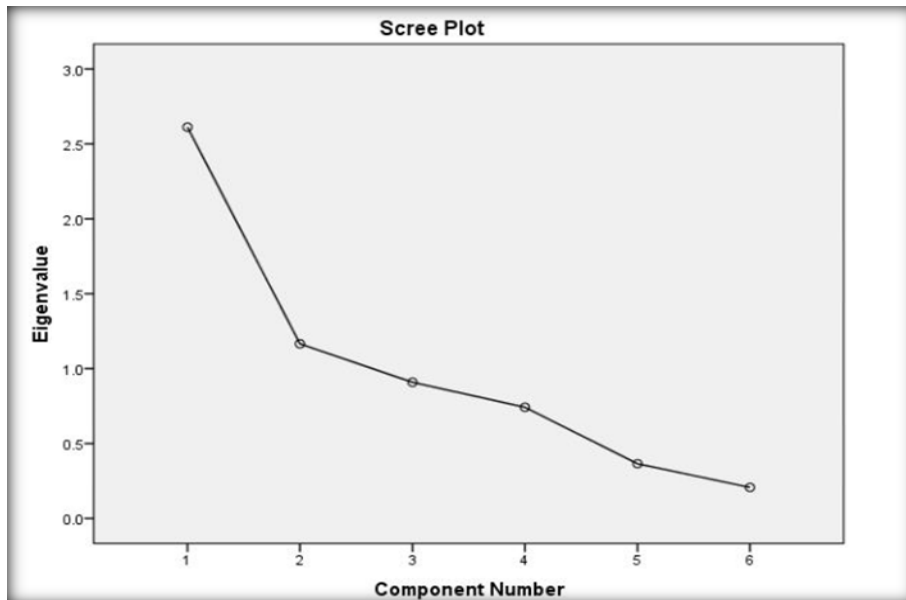


Figure 1. the exploratory factor analysis to determine the most important factor
Sources: plotted based on the frequency table in spss, ver24

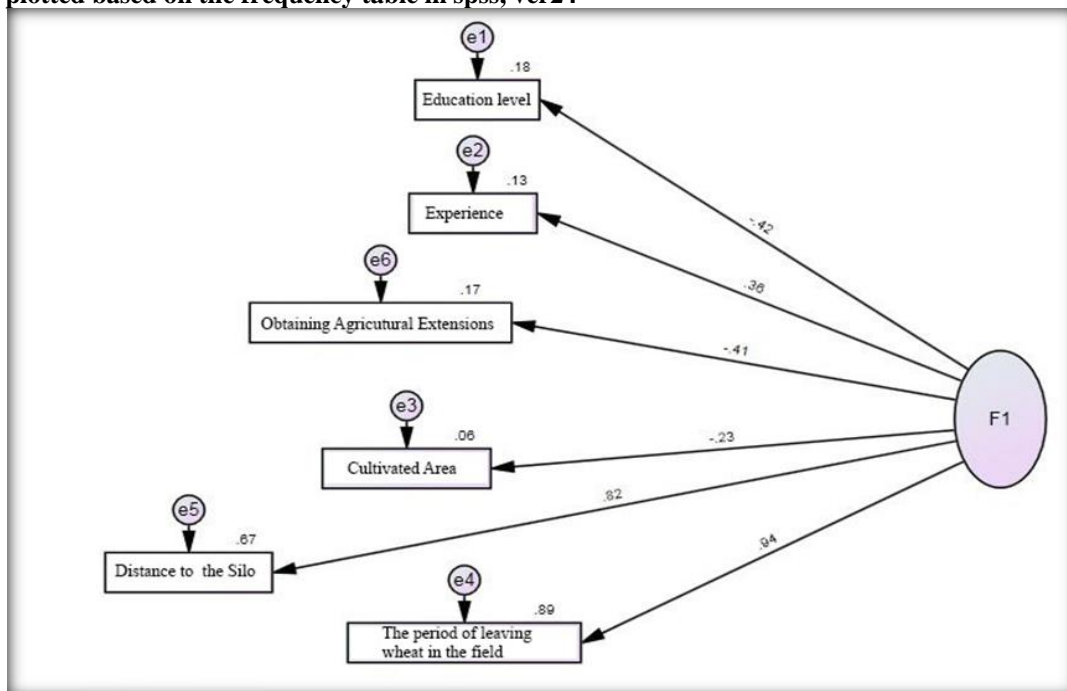


Figure 2. Confirmatory factor analysis of post-harvest wheat farmers' losses for the 2019 study sample

Source: Plotted and calculated based on the exploratory factor analysis table using AMOS model.

Table 5. Conformity indicators for the loss factor model of farmers' production cycle for a crop Wheat in Iraq for the study sample for the year 2019

Indicator	Limits of confidence or ideal range	the value
Chi-square	That its value is not statistically significant	8.9
Df	-	9
Chi-square/df	Do not exceed 0.05	0.05
RMSEA	0.08 -0	0.043
RFI	0.9-1	0.957
RMR	Less than 0.1	0.056
TLI	0.9-1	0.901
GFI	0.9-1	0.954
CFI	0.9-1	0.945

Source: Calculated using AMOS.

The model of the farmers' loss coefficient has good matching indicators, and as shown in Table 5, it shows us the saturations of the paragraphs of the transactions on the factor, or the dimension to which it belongs, and through the analysis of the confirmatory factor of farmers' losses after harvest for the study sample for the year 2019, it was found that the loss factor F1 that was determined depending on the factors that contributed to its formation and by using the AMOS program, and through the indicators used to judge the extent of the model's conformity in the confirmatory factor analysis, the value of (chi-squares = 8.9, df = 9) That is, not statistically significant. Also, the value of the model quality was GFI = 0.980, CFI = 0.990, TLI = 0.980 and RMSEA < 0.05. It is 0.043, meaning less than 0.05. That is, the model is appropriate, and identical to the data. As the loss factor F1 was determined depending on the important factors that contributed to its formation, and the factor of duration of crop survival in the field after harvest occupied the largest percentage in its formation by 94% and with a positive sign, that is, the relationship is positive between the loss factor and the duration of the crop remaining in the field, i.e. whenever The duration of the crop's stay in the field increases after harvesting, which leads to an increase in the loss factor, after which the distance factor comes to the silo, meaning the distance between the field and the silo to which the crop is marketed by 82% and its sign is positively related to the direct relationship between the loss factor, and the distance to the silo, and this means that whenever The distance between the field and the silo increased, which leads to an increase in the loss coefficient. As for the education level factor, it was 42% and it came with a negative sign, meaning the relationship is inverse to the loss coefficient and the educational level of the farmers, that is, the greater the percentage of the educational level leads to a decrease in the loss factor, while the factor of obtaining extension services represented 41% with a negative sign that reflects the inverse relationship between the loss factor and the possibility of obtaining extension services, and this means that the greater the possibility of obtaining extension services leads to the

possibility of a decrease Loss factor. Whereas, the experience factor added 36% and its indication was positive, that is, the more farmers' experience increases, the increase in the loss factor, and this is contrary to economic logic, and the reason may be that some of the farmers with long experience do not acquire modern technologies from production, and the planted area factor came last With his contribution of 24% and a negative sign that reflected the inverse relationship between the loss factor and the cultivated areas of the crop, that is, the more cultivated areas, this leads to a decrease in the loss factor, perhaps the reason is due to the possibility of more use of modern agricultural technique. We can conclude from the current study that the duration of the crop remaining in the field after harvesting has a great impact on increasing the loss of wheat, and has a strong influence on the decrease in production per unit area through exposure of the crop to environmental, such as the weather risks of moisture, dew and the wind drops, as well as attacks by birds, rodents and rats. Also, what is mixed with grains with soil, as well as the coefficient of the distance between the field and the silo. And the logistical operations associated with it, such as vehicles transporting the crop to the silo, which are often not in conformity with the conditions for the proper transportation of grains, so most vehicles are without cover, there are gaps and openings in it that facilitate The fall of love on the road, and these are all working on the scattering, and the spillage of wheat grains while the vehicles are on their way to silo, and that farmers can increase their production without increasing economic resources by preserving the crop from loss after harvest. Accordingly, the research recommends working to follow the following: the Ministry of Agriculture should provide the Ministry of Trade with schedules for the wheat crop cultivation plan for each of the governorates that grow wheat, the names of the farmers, their cultivated areas, and the quantities expected to be produced distributed according to the agricultural people. As well as making schedules for marketing wheat from farmers by the Ministry of Trade represented by the General Company for Grain Trade. Each silo

is given a schedule with the names of the farmers, and the date of marketing the crop depending on the date of planting, and informing the farmers of this date. As well as the provision of special transport vehicles to transport the wheat crop from the field to the silo. Also be in conformity with the specifications of the grain transportation belonging to the General Company for Grain Trade at reasonable prices. So, work to hold seminars and awareness, extension sessions for farmers and clarify the importance of preserving the crop after harvest. Finally, we need to expand of exploratory factor analysis and the assertion as an effective method gives an idea of testing the hypotheses related to the existence or absence of a relationship between variables and underlying factors. Also used for comparison between several models of the extracted factors.

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