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Article

A Validation of Procedures for Business Management

Validación de procedimientos para la gestión empresarial

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ABSTRACT

Aim: To roll out a strategy for the application of business management procedures, which is complex, since the expected changes in the object of study cannot be corroborated often, due to the lack of time.

Methods and techniques: They were implemented according to the corroboration of objectivity, validity, and reliability, using semi-qualitative tools based on expert opinion.

Main results: A strategy based on structured steps and methods that enable the validation of managing tools, depending on their objectivity, usefulness, and reliability. The functionality of the strategy was checked according to a procedure for food safety management in food sales, with an objectivity index of 86.45 %, 83.93 % usefulness, and 0. 851 9 total validity. Moreover, the reliability of the procedure studied was established through the ANOCHI coefficient for 0.814 3.

Conclusions: The strategy suggested is easy to implement in the Cuban business environment, as it offers an affordable way for the validation of management tools, since it eliminates costs associated to case studies. Besides, expert opinion includes experience and expertise as valuable criteria in business decision-making.

Key words: reliability, business management, objectivity, validation, validity.

RESUMEN

Objetivo: desplegar una estrategia para la validación de procedimientos para la gestión empresarial, actividad que resulta compleja puesto que muchas veces no se cuenta con el tiempo necesario para constatar los cambios esperados en el objeto de estudio.

Métodos y técnicas: se sustentaron en la comprobación de la objetividad, validez y confiabilidad a partir de herramientas semicualitativas basadas en el juicio de expertos.

Principales resultados: una estrategia que consta de pasos y métodos estructurados que posibilitan validar instrumentos de gestión a partir de su objetividad, utilidad y confiabilidad. la funcionalidad de la estrategia se comprobó a partir de la validación de un procedimiento para la gestión de la inocuidad de los alimentos en servicios gastronómicos, con la obtención de un índice de objetividad de 86,45 % y de utilidad (83,93 %), para un índice de validez total de 0,851 9. asimismo, la confiabilidad del procedimiento estudiado se estableció mediante el coeficiente de anochi para un valor de 0,814 3.

Conclusiones: la estrategia propuesta resulta factible de aplicar en el entorno empresarial cubano y ofrece una vía de bajo coste para la validación de instrumentos de gestión, toda vez que elimina los costos asociados al estudio de casos. además, al emplear el juico de expertos, considera la experiencia y experticia como criterio de valor en la toma de decisiones empresariales.

Palabras clave: confiabilidad, gestión empresarial, objetividad, validación, validez.

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INTRODUCTION

The traditional assessment criteria for the suitability and quality of research are the already-known internal validation, external validation, reliability, and objectivity. In management research, the case study method is frequent; however, many scholars consider it ideal for exploratory studies, instead of hypothesis assessing (Masud, 2018). In that sense, João Fernandes (2016) states that the demonstration of the validity of proposals through the evolution of a practical case study is not always viable, due to the fact that the definitive

success may depend on multiple factors, and the complexity of the object of study, or the time necessary to assess the transformation desired. In that way, the concrete thought is manifested through principles, laws, and theories that must be under empirical demonstration to corroborate their practical objectivity. The final element is the one that closes the cycle of knowledge: practice-theory-practice, which is used to verify the level of objectivity of the knowledge created (Rodríguez Jiménez, and Pérez Jacinto, 2017).

Validity, along with feasibility, determine the quality of the instrument (Gómez, 2013, cited by Urrutia), Barrios, Gutiérrez, and Mayorga (2014). However, the two criteria apply mostly in the design of questionnaires (Holmes, 2018). In the context of business management, Pérez (2014) used four criteria to evaluate the quality of associated project and models. Firstly, the validity of the model referred to the variables studied; internal validity, associated with the level of objectivity of the study; external validity, dependent on the capacity of generating a proposal; and feasibility, associated with the capacity of the procedure of being replicated to obtain similar results. However, validation results from the argumentation of these criteria, not the application of techniques that confer strength.

Borsboom *et al*. (2004) (cited by Tristán and Corpus, 2017), noted that a test is valid when the attribute exists and its variations produce other variations in the measurements by chance. The previous suggests the need of a series of measurements to assess the validity of an instrument, a complex task to fulfill when the study focuses on business management. Although there are numberless experiences in terms of questionnaires and surveys, the validation of models, procedures, and instruments has been poorly dealt with. A search conducted in Google Scholar shows the little validation of business management (Table 1). The combination of the usual criteria utilized for validation (validity, reliability, and objectivity)[1], shows results in Spanish that scarcely surpass 3.5 million. Likewise, the combination of all the elements barely shows 31 700 and 139 000 results in Spanish and English, respectively.

Table 1. Results of the search for management validation elements

Input elements	Spanish	English
Management + reliability	134 000	3 740 000
Management + validity	214 000	3 110 000
Management + objectivity	153 000	327 000
Management + reliability + validity	64 200	2 520 000
Management + reliability + objectivity	44 700	195 000
Management + validity + objectivity	67 000	163 000

Management + reliability + validity + objectivity	31 700	139 000

Source: made by the authors based on Google Scholar, March 2020.

The previous explains the deficit of studies that focus on the validation of management tools. Hence, the aim of this paper was to design a strategy proposal for the validation of business management tools.

DEVELOPMENT

An Approximation to the Concept of Validation

Objectivity, reliability[2], and validity must be accepted to consider a test as satisfactory (Reiss and Sprenger, 2014). Both validity and reliability, applied to this object of research, are two moments that characterize their quality (Urrutia *et al*., 2014), since they show the objective character of the process. Validity expresses if the instrument is qualified enough to meet the goal of design (Urrutia *et al*., 2014), whereas reliability expresses the level of internal consistency of its attributes (Frías, Tarifa, and García, 2018).

Validity is understood as the level in which the instrument measures the desired parameters (Lucas *et al.*, 2017). In that sense, Pedrosa, Suárez, and García (2014) add that there is no valid instrument, but that the instrument is valid for something it measures, that which is intended to.

In turn, reliability is defined as the level in which the instrument produces coherent and consistent results (Paez and Filion, 2017), measurements do not vary under the same conditions in different time spaces.

Objectivity is profoundly rooted to the understanding with which persons tend to structure reality; it is part of the quality of an instrument, and it constitutes a fundamental criterion that enables the generation of valid knowledge of the objects investigated. Accordingly, it must be the first attribute defined in a test. Post (2015) said that objectivity requires systematic methods and transparent explanations. In that sense, the criteria of objectivity determine the validity. However, in the area of research, scientific objectivity understood as an assumption has not been entirely elucidated (Rosendahl, Zanella, Rist & Weigelt, 2015).

In spite of the previous contradiction, there is a consensus as to the distinct properties of objectivity. To Munro and Hardie (2018), they are a) specificity, b) neutrality, c) impartiality, and e) impersonality.

This study assumes impartiality as part of the validity of the instrument. If an instrument is capable of achieving what it was created for (validity), then it will be objective. In that sense, Tristán and Corpus (2017) recognize objectivity as the substrate of validity, and the assessing of validity can be used as a referent of objectivity.

Finally, Frías *et al.* (2018) referred to a fourth criterion for the validation of an instrument: usefulness. That criterion is helpful to evaluate customer satisfaction. It should not only produce objective, valid and reliable results, but also must be useful.

In any case, the validation of a business instrument is not determined, but assessed. That way, validation will depend on the assessing of validity, reliability, objectivity, and usefulness (Fig. 1).

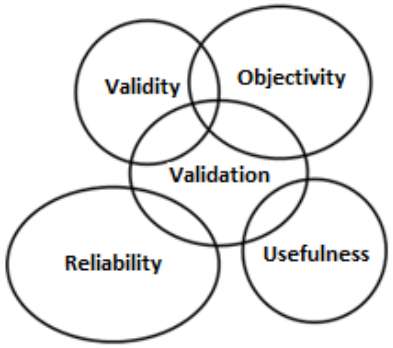

Fig. 1. Elements to be assessed for the validation of instruments

Source: made by the authors

Methodological rationale

To fulfill this validation strategy of business management instruments, the methods and tools available that could be applied to models, methodologies, or procedures, were analyzed. Upon the proposal to validate a strategy, it was implemented to validate a procedure for the safety of foods in catering businesses (García, 2018). That way, the feasibility of the strategy through a type case was evaluated. It relied on expert opinion through a questionnaire provided by the authors, processed in Microsoft Excel. The experts were identified according to the method of expert selection (Frías, Cuétara, González, González, and 2008).

The step sequence to implement the validation strategy was the following: 1) identification of the methods for assessing validity, usefulness, and reliability, applicable to instruments designed for management; logical structuring of methods selected; 3) design of an instrument to collect information needed for the application of the methods selected; 4) expert selection

through the expertise coefficient method of persons who will offer their judgement of the objects to validate, and 5) integrate the results achieved.

Determination of validity

Regarding validity, Hernández (2012), cited by Frías, González, González, and Cruz, (2016) referred to three types of content, criteria, and construct. The validity of content expresses the level in which the measurement represents the concept or a measured variable. Regarding the criterion validity, it suggests the validation of the instrument by comparing it with some external criterion that intends to measure the same. In turn, the validity of the construct refers to the level in which the instrument explains the theoretical-empirical model that underlies in the target variable.

Regarding the types of validity, Noble and Smith (2015) stated that the validity of content is a necessary condition that is growing in importance. Moreover, both the criterion and construct validity are applicable to instruments like questionnaires, surveys, or tests. However, they are not viable in terms of procedures, since both are established according to item correlation, following a pilot sample. The previous entails the need of several applications for determination and relatedness –through simple regression (criterion validity), and multiple regression (construct validity)– of the items of the instrument for measuring (Lucas *et al.,* 2017). Therefore, the validation of procedures and methodological instruments is required for content validity.

In relation to the methods to determine the validity of content, Urrutia *et al*., (2014) sets a couple of statements: methods based on expert opinion, and the utilization of statistical methods derived from the application of an instrument. In this particular case, the latter entails the need of several applications –not viable for procedures. However, in the methods based on expert opinion, the suggestions of Lawshe (1975) and Rubio (2003) stand out.

Lawshe (1975) used the index of validity of content (IVC), a method that values items according to their essentiality, which is well-adapted to a questionnaire, but it reduces the assessing possibilities of a procedure. Meanwhile, Rubio (2003), suggests the factorial validity index (FVI) resulting from the modification of data processing in Lawshe (1975) proposal. However, Pedrosa *et al.* (2014) referred to the validity coefficient of content (CVC) in which a broader assessing scale is introduced for expert opinion, and it includes the capacity of minimizing assessment errors. The previous justifies its use for the validation of procedures.

Likewise, other methods based on expert opinion, that may be used for the validation of content, are described. The utilization of several methods relies on the recommendations of Hernández, Fernández, and Baptista (2006) when suggesting that validity should not only rest on one type of evidence. That way, a selection was made to assess validity in procedures that included the consensus index (ICS) and the content validity coefficient (CVC).

The two methods focused on the assessing the validity of the procedure, and therefore, objectivity that ensures neutrality, impartiality, and independence, which is performed through expert opinion through questionnaires delivered individually.

Regarding the assessing of usefulness, the Iadov index for satisfaction and the Net Promoter Score (NPS) for the recommendation index were used.

The Iadov technique was developed initially to measure student satisfaction for pedagogic degrees, and reformulated by other authors for these purposes in different contexts. However, Medina (2016), García (2018), and Alarcón (2019) used it in their research within the technical sciences to achieve the purpose herein described.

The NPS (recommendation index) distinguishes from other metrics because it does not measure customer satisfaction in relation to a specific event or just a single interaction. This indicator was designed to measure the general loyalty of customers (Rowe, 2014). However, García (2018) and Alarcón (2019) interpreted it as an index that measures the intention of recommending their procedures and methodological set of instruments under the assumption that it occurs because the proposal is useful and therefore meets a need. The above justifies the utilization of content since the recommendation of users may be understood as an indicator that the procedure does what it is expected to.

As methods for the determination of reliability, Hernández *et al.,* (2006) note that, a) the stability measure (test-retest); b) methods of alternative or parallel alternatives; c) method of split halves, and measures of internal consistency (Cronbach alpha and the KR-20 and KR-21 coefficients.

In any case, the application of an instrument to a pilot sample is needed, in order to evaluate the variations of measurements and reliability. The previous becomes complex when it has to do with a procedure; nevertheless, the literature refers to the ANOCHI method (Guerrero, Capó, and López 2016; Madrid, Bustos, Ortiz, and Ríos 2013).

The ANOCHI concordance coefficient is non-parametric, thus enabling reliability studies by determining the association between *n* judges, evaluating *k* objects or variables through a

numerical scale. Accordingly, ANOCHI is a concordance index for effective agreement shown by the data related to the maximum possible agreement (perfect). The value is expressed between 0 and 1, where 1 means the perfect agreement and 0 shows the absence of total concordance (Fernández, Auquilla, Reyes, and Sancho, 2017).

The rationale consists in determining all the possible range evaluation differences of all the judge pairs. Thus, the total of combinations of two elements is expressed by *n ¦ / 2 ¦ (n-2 ¦)* according to the theory of combinations; the greatest range difference possible of two evaluators is the difference between the maximum and minimum values of the scale used.

Structuring of methods used

Upon the selection of methods to assess the validity of management instruments, the structure of the validation strategy was sketched (Fig. 2).

The first step is assessing objectivity and usefulness as validity elements. In relation to objectivity, the consensus index (ICS) and the content validity coefficient (CVC) are used.

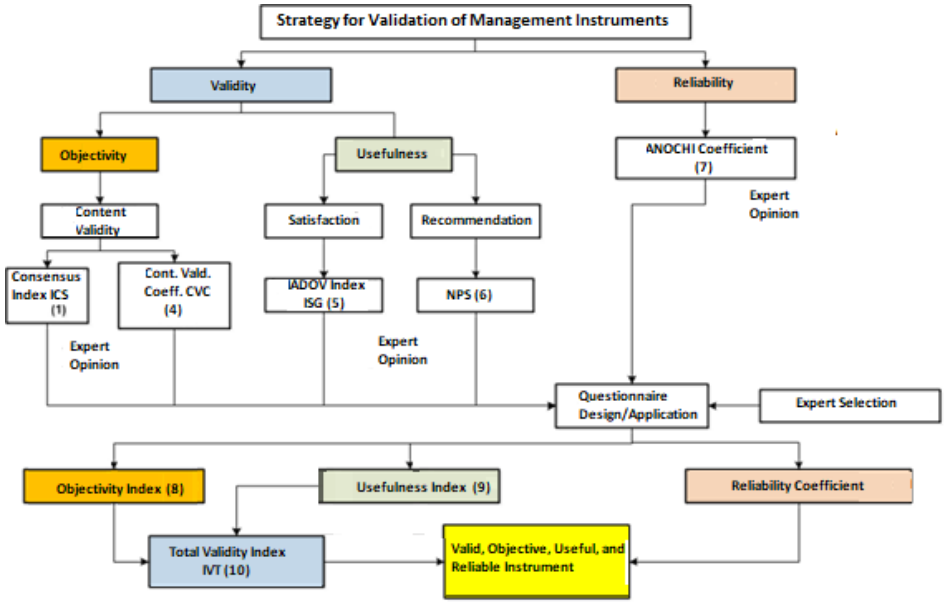

Fig. 2. A Strategy for Validation of Instruments for Business Management

Source: made by the authors

The determination of ICS suggests the methods used by Abreu (2004). This proposal relies on standard deviation of opinions given by experts, which strengthens the method (1).

$$(1) \quad \boldsymbol{ICS} = \left(\mathbf{1} - \frac{\boldsymbol{\sigma i}}{\boldsymbol{\sigma m\acute{a}x}}\right) * \mathbf{100}$$

Where:

σ_i = Standard deviation of expert opinion in relation to the "i" criterion,

σmax = maximum possible standard deviation[3] depending on the number of experts and the scale used.

According to Abreu (2004), the value content of ICS higher than 80% makes it valid. However, the validation of elements concerning procedures above 70% is acceptable.[4]

CVC calculation relies on the application of a Likert scale with five alternatives, using the means from every item, and accordingly, determine the CVC_i of each element. Finally, the error assigned to every item (2-4) is subtracted from the CVC_i calculated.

$$(2) \quad \boldsymbol{CVCi} = \frac{\boldsymbol{Mx}}{\boldsymbol{Vmax}} \qquad (3) \quad \boldsymbol{Pei} = \left(\frac{\mathbf{1}}{\boldsymbol{j}}\right)^{\boldsymbol{j}}$$

$$(4) \quad \boldsymbol{CVC} = \boldsymbol{CVCi} - \boldsymbol{Pei}$$

Where:

CVC_i = Coefficient of validation of the initial content for item i.

M_x = Means of experts voting for item i.

V_{max} = Maximum value of the scale for item i.

P_{ei} = Error from item i

j = Number of experts consulted in the study.

The acceptance of elements for CVC values greater than 0.8 individually, and as a mean for the validation of the procedure. The steps for the application are, 1) to define the characteristics of the procedure to be validated; to define the scale of values; 4) to summarize the results of questionnaires[6] and conduct the corresponding estimations based on formula (2, 3, and 4); 5) to analyze the behavior of every element; and 6) to calculate the mean based on the CVC values of all the elements separately, and to assess the validity of the procedure.

The Iadov index

The technique consists of three closed questions inserted in the questionnaire presented to the individuals[7], in which their interrelation is unknown. The first question is assessed in six categories of satisfaction, and the other two, in three categories.

Based on the answers and the Iadov's logic chart (Table 2), the group satisfaction index is determined, according to the expression (5) to establish six levels of satisfaction: 1) clear; 2) more satisfied than dissatisfied; 3) non defined; 4) more dissatisfied than satisfied; 5) clear dissatisfaction; and 6) contradictory.

$$ISG = \frac{A(+1) + B(+0.5) + C(0) + D(-0.5) + E(-1)}{N} \quad (5)$$

Table 2. The Iadov index

Question about usefulness	General question about usability								
	Yes			I don't know			No		
	Specific question about usability								
	Yes	I don't know	No	Yes	I don't know	No	Yes	I don't know	No
Very satisfied	*1*	*2*	*6*	*2*	*2*	*6*	*6*	*6*	*6*
More satisfied than dissatisfied	*2*	*2*	*3*	*2*	*3*	*3*	*6*	*3*	*6*
Indifferent	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
More dissatisfied than satisfied	*6*	*3*	*6*	*3*	*4*	*4*	*3*	*4*	*4*
No satisfaction	*6*	*6*	*6*	*6*	*4*	*4*	*6*	*4*	*5*
I don't know what to say	*2*	*3*	*6*	*3*	*3*	*3*	*6*	*3*	*4*

Source: Dini (2016)

In the expression (5), A, B, C, D, E, represent the surveyed individuals with individual[8] satisfaction indexes of 1, 2, 3, or 6 5, 4, and *N*, representing the total surveyed individuals. The ISG evaluation is within the [+1; -1] range, according to the scale in Fig. 3.

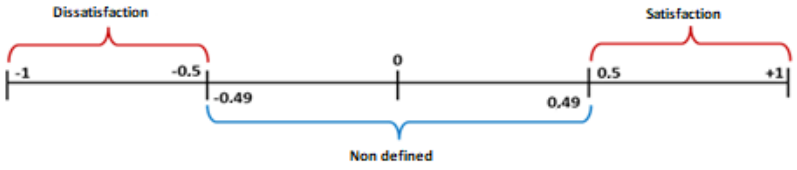

Fig. 3. Scale for assessment of the Iadov index

Source: made by the authors

Net Promoter Score (NPS)

Its application is based on a single question to customers: Would you recommend the implementation of the procedure to improve safety management. It was evaluated in a 0-10

scale as a maximum value (Fig. 4). Positive NPS values were considered as good behavior; whereas percent 50 points above the detractors were considered excellent.

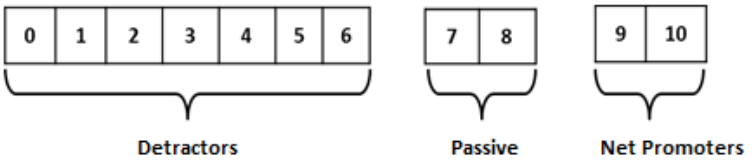

Fig. 4. Scale values and classification according to the NPS method

Source: made by the authors

The steps for the application are, 1) to make the question to the potential users;[9] 2) to summarize the information according to the scale;[10] and 3) to determine the NPS according to the expression (6).

(6) ***NPS*** = % *OF NET PROMOTERS* - % *DETRACTORS*

Reliability is evaluated through ANOCHI. The method relies on the maximum range difference (DRM) between *n* judges that use a *R* range (scale) to evaluate the attributes desired in the procedure. The necessary calculations are made according to the following expressions:

$$DRM = \left(\frac{n}{2}\right)\left(\frac{n}{2}\right)(Rmax - Rmin) \quad \text{for all} \quad \frac{n}{2} = 0 \ \textbf{(even)}$$

$$DRM = \left(\frac{n}{2}\right)^{s}\left(\frac{n}{2}\right)^{i}(Rmax - Rmin) \quad \text{for all} \quad \frac{n}{2} > 0 \ \textbf{(odd)}$$

$$FD = \frac{DR}{DRM} \qquad FC = 1 - FD \tag{7}$$

Where:

DRM = Value of the maximum range difference for *n* judges and the R range (scale)

n = Number of judges in the study

$(n/2)^{s}$ = Value approximated to the nearest value above

$(n/2)^{i}$ = Value approximated to the nearest value below

Rmax = Maximum value of the scale

Rmin = Minimum value of the scale

FD = Factor of discrepancy

DR = Range difference for each item depending on all the combinations of judge pairs, through the expression *n ǀ / 2 ǀ (n-2 ǀ)*

FC = Factor of concordance

The DRM values can be calculated according to the expressions shown in (7) or by using the reference values shown in Table 3.

Table 3. Maximum reference range values for n judges

Possible maximum range differences considering n judges for instruments with ranges (scale) used in the research (1-5), (1-7), (1-10).												
Ranges/judges	4	5	6	7	8	9	10	11	12	13	14	15
1-5	16	24	36	48	64	80	100	120	144	168	196	224
1-7	24	36	54	72	96	120	150	180	216	252	294	336
1-10	36	54	81	108	144	180	225	270	324	378	441	504

Source: Vinci *et al.* (2013).

Reliability is set depending on the value of the concordance fraction (FC), which was considered as very good if above 0.8; acceptable between 0.61 and 0.7; moderate between 0.41 and 0.60; weak between 0.21 and 0.40; and very low below 0.20 (Guerrero *et al.,* 2016). In short, the steps for determination are, 1) to determine the range differences (DR) assigned to each item based on all the judge pair combinations, with the expression *n ǀ / 2 ǀ (n-2 ǀ)*; 2); to calculate the factor of discrepancy (FD) of each item and the average of the n items, according to the expression *FD = DR/DRM*. The value of the maximum range difference (DRM) was taken from the maximum range difference chart of evaluations of n judges suggested; and 4) to calculate the fraction of coincidence (FC) of each item and the average as a ANOCHI coefficient according to the complement of value 1, using the expression *FC = (1-FD)*.

Design of an instrument for collecting necessary information

The elements used to validate the procedure are assessed through expert opinion. Accordingly, a questionnaire was designed (Appendage 1) which summarizes all the necessary questions for the evaluation of elements according to the methods suggested. Table 4 summarizes the information collected in every question according to the corresponding method and element evaluated.

Table 4.A summary of the information collected from the questionnaire

Question	Method	Element evaluated
1	ICS; CVC	Hypothesis
2	ICS; CVC	Process approach principle
3	Iadov; ANOCHI; ICS; CVC	Reliability. Satisfaction. Feasibility of application
4	Iadov	Specific feasibility of application
5	ANOCHI; ICS; CVC	Reliability Pertinence and current validity
6	Iadov	Usefulness
7	ANOCHI; ICS; CVC	Reliability Coherence among the phases
8	ANOCHI; ICS; CVC	Reliability Theoretical rationale
9	ICS; CVC	Variables used for risk assessment
10	ANOCHI; ICS; CVC	Reliability Relevance of results
11	NPS	Recommendation index
12	ICS; CVC	Principles of the procedure

Source: made by the authors

Each question is associated with the element to be evaluated and the method used. Hence, the resulting information can be processed more easily.

Expert selection

The method suggested by Frías *et al*. (2008) was applied. Based on the initial identification of possible experts, their knowledge coefficients (*Kc*) and self-assessment coefficients (*Ka*) were determined, which helped establish the expertise coefficients (*K*) (Frías *et al*., 2008). The experts with an expertise coefficient (*K*) above 0.8 were selected.

Relevance of the findings

Upon the application of the questionnaire, the information can be processed using Microsoft Excel. First, the ICS (1), and the CVC (4) were determined. The two values are used to calculate the objectivity index through the expression (8).

$$\boldsymbol{The\ objectivity\ index} = \frac{1}{2}(ICS + CVC) \quad (8)$$

The usefulness of the procedure can be established through the usefulness index (9), which is calculated using the values of ISG (5) and NPS (6).

$$(9) \qquad \boldsymbol{The\ usefulness\ index} = \frac{1}{2}(ISG + NPS)$$

The total validity index of the procedure (IVT) was determined through the expressions (8) and (9), based on (10).

$$(10) \qquad \boldsymbol{IVT} = \frac{1}{2}(The\ objectivity\ index\ +\ the\ usefulness\ index)$$

Values above 0.625 indicate a satisfactory total validity index[11]. The IVT analysis and the ANOCHI coefficient (FC) support the validation of the business management instrument.

Results

The strategy proposed was rolled out to validate the procedure for managing food safety in catering services (García, 2018). The capacity of the procedure to solve the hypothesis, principles and approaches was assessed. The feasibility, structural coherence, current validity, theoretical rationale, and variables used were evaluated as well.

A total of 14 experts from the academy, health institutions related to food hygiene, and directors of catering services were selected. All completed the individual questionnaires, ensuring the neutrality, independence, and impersonality of the test (Test 5).

Table 5. Relevant judgement issued by the experts

		Judgement issued in each question												
		Q1	Q2	Q3	Q4	Q5	Q6	Q6/CVC	Q7	Q8	Q9	Q10	Q11	Q12
EXPERTS	E1	5	5	5	Yes	5	MSM	5	5	5	5	5	10	5
	E2	5	5	4	Yes	5	MSM	5	4	5	4	5	9	4
	E3	5	5	5	Yes	5	MSM	5	5	5	5	5	10	5
	E4	4	4	4	Yes	5	MSI	4	4	4	4	4	6	5
	E5	5	5	4	Yes	4	MSM	5	4	4	4	5	10	4
	E6	5	5	4	Yes	5	MSM	5	4	5	5	5	10	5
	E7	5	5	4	Yes	5	MSM	5	5	5	5	5	10	5
	E8	5	5	5	Yes	5	MSI	4	5	5	5	5	9	5
	E9	5	4	5	Yes	5	MSM	5	5	4	4	4	10	4
	E10	4	5	5	Yes	5	MSM	5	5	5	5	5	10	5
	E11	5	5	5	Yes	4	MSM	5	5	5	5	5	9	4
	E12	4	5	5	NS	5	MSI	4	4	5	4	4	7	4
	E13	5	5	5	Yes	5	MSM	5	4	5	5	5	10	5
	E14	5	5	5	Yes	5	MSM	5	5	5	5	5	10	5

Source: made by the authors

The review of all expert responses evidenced the absence of significant differences (95% confidence) with an -F ratio value of -P (0.6896) confirmed through the hypothesis test, using the Kruskal-Wallis test.[12] The results were analyzed upon evaluation of the pertinence of judgement (Table 6).

Table 6. Consistency of the judgement issued by the experts

Table ANOVA					
Source	Sum of squares	Gl	Mid-square	-F ratio	-P value
Among groups	1.29286	9	0.143651	0.72	0.6896
Within groups	25.9286	130	0.199451		
Total (Corr.)	27.2214	139			

Kruskal-Wallis Test		
	Sample size	Average range
B.Col_1	14	74.0
B.Col_10	14	64.0
B.Col_11	14	74.0
B.Col_12	14	64.0
B.Col_2	14	79.0
B.Col_3	14	64.0
B.Col_5	14	79.0
B.Col_7	14	74.0
B.Col_8	14	59.0
B.Col_9	14	74.0

Source: made by the authors, using STATGRAPHICS Centurion V.

The value judgement was processed through Microsoft Excel to calculate the corresponding indexes. The objectivity values are shown in table 7. In all the cases, the ICS (1) and CVC (4) values were higher than 70% and 0.8, respectively, which meant that they were acceptable (Abreu, 2004; Pedrosa *et al*., 2014). Regarding the capacity of the procedure to solve the problem studied based on the operationalization of safety management –according to the hypothesis made– the ICS was 79%, thus corroborating a CVC of 0.9491. The process approach yielded 83% for ICS, and 0.9655 for CVC. The feasibility of the application showed ICS and CVC values of 76% and 0.9180, respectively.

Table 7. Results of ICS and CVC

	Q1	Q3	Q5	P6.cvc	Q7	Q8	Q9	Q10	Q12
E1	5	5	5	5	5	5	5	5	5
E2	5	4	5	5	4	5	4	5	4
E3	5	5	5	5	5	5	5	5	5
E4	4	4	5	4	4	4	4	4	5
E5	5	4	4	5	4	4	4	5	4
E6	5	4	5	5	4	5	5	5	5
E7	5	4	5	5	5	5	5	5	5
E8	5	5	5	4	5	5	5	5	5
E9	5	5	5	5	5	4	4	4	4
E10	4	5	5	5	5	5	5	5	5
E11	5	5	4	5	5	5	5	5	4
E12	4	5	5	4	4	5	4	4	4
E13	5	5	5	5	4	5	5	5	5
E14	5	5	5	5	5	5	5	5	5
Mean	4.7457	4.5901	4.8275	4.7457	4.5161	4.7457	4.5901	4.7457	4.5901
dev.	0.4258	0.4972	0.3631	0.4258	0.5135	0.4258	0.4972	0.4258	0.4972
max. dev.	2.0755								
ICS	79%	76%	83%	84%	75%	79%	76%	79%	76%
CVC	0.9491	0.9180	0.9655	0.9491	0.9032	0.9491	0.9180	0.9491	0.9180
				max. dev.					
				2.5944					

Source: made by the authors

Regarding the contribution of the procedure to the solution of the problem, the consensus reached 83%, which was confirmed with the CVC value (0.9655). Besides, the logical consistency and theoretical rationale were validated. According to the experts, the principles of the procedure were valid with 76% ICS and 0.9180 CVC.

The objectivity index[8] was calculated with the two values, for 86.45%, which was determined from the mean of the ICS and CVC values. These results supported the objectivity of the procedure as part of the validity, according to Tristán and Corpus (2017).

With respect to the usefulness of the procedure and the methodological instruments, the Iadov technique was used to obtain a group satisfaction index with an ISG of 0.8929 (5), which was greater than 0.5, and showed a positive grading (Table 8).

Table 8. Results of the Iadov technique

Scale	Result	Quantity	Percent
1	Clear Satisfaction	11	78.57
2	More satisfied than dissatisfied	3	21.43
3	Non-defined		
4	More dissatisfied than satisfied		
5	Clear dissatisfaction		
6	Contradictory		

(5) ***ISG*** **=11***(+**1**)+**3***(+**0.5**)+**0***(**0**)+**0***(-**0.5**)+**0***(-**1**) **= 0.8929**

Source: made by the authors

Frías *et al*. (2018) recommended the inclusion of usefulness as a variable in the validation studies.

The capacity of users to recommend the procedure as a measure of its adjustment to the problem described, and therefore, usefulness, resulted in an index of net promoters (6) of 78.57% (excellent), as shown in Fig. 5

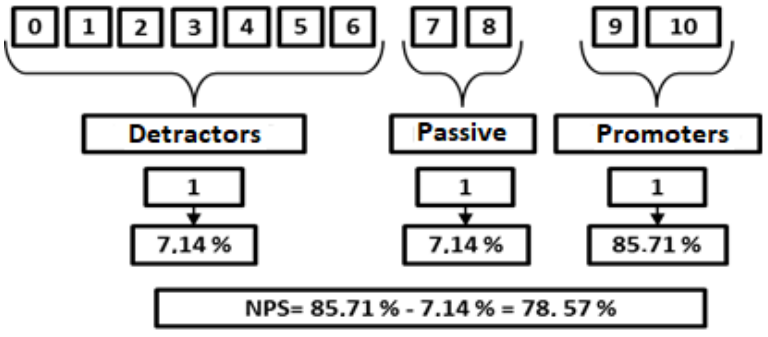

Fig. 5. Determination of the recommendation index (NPS)

Source: made by the authors

The usefulness index (9) was calculated from the ISG and NPS, with a value of 0.8393 (83.93%), for a satisfactory result.

The total validity index (IVT) was determined according to the expression (10).[13]

$$\text{Total Validity Index} = \frac{1}{2}(0.8645 + 0.8393) = 0.8519 \quad (10)$$

The procedure showed a total validity of 0.8519, which was satisfactory. Table 9 summarizes the elements of the procedure from which its validity and the corresponding methods and results were determined.

Table 9. Summary of the results of the validity of the procedure

Aspects validated from the general procedure	**Method**			
	ICS	CVC	Iadov	NPS
Confirmation of the hypothesis stated	79%	0.9491		
Contribution to the process approach to the problem solution	83%	0.9655		
Feasibility of application	76%	0.9180		
Contribution to problem solution	83%	0.9655		
Logical consistency	75%	0.9032		
Theoretical rationale	79%	0.9491		
Methodology for risk assessment	76%	0.9180		
Principles of the procedure	76%	0.9180		
Usability + specific usability + usefulness	-	-	0.8929	
Adjustment for the solution to the problem described	-	-	-	78.57%
Total validity index	0.8519			

Source: made by the authors

The evaluation of the process reliability showed an average concordance factor (7) of 0.8143 (very good). The criterion assessment to determine reliability is shown in Table 10.

Table 10. Results of the evaluation of process reliability

	CRITERIA					
	Pertinence and current validity	Theoretical rationale	Coherence between the phases and steps	Feasibility of application	Relevance of results	General
DR	45	24	47	33	33	36.4
FD	0.2296	0.1224	0.2398	0.1684	0.1684	0.1857
FC	0.7704	0.8776	0.7602	0.8316	0.8316	0.8143
	Acceptable	Very good	Acceptable	Very good	Very good	Very good

Source: made by the authors

Discussion

The utilization of the ICS and CVC indexes confirmed the notes of Hernández *et al.,* (2006) in relation to the advantage of using more than one method to confirm the validity of the object studied, since it permits to contrast the results. In all the cases the two techniques were concordant. The farthest values were 76% (ICS) and 0.9180 (CVC), though both were acceptable. It occurs because ICS uses typical deviation, so the minimum differences in expert judgement have a big influence on the final value. Nevertheless, the result is within the permissible range and it is confirmed by the CVC.

The assessment of procedure usefulness by the potential customers based on ISG and NPS, corroborated that the procedure is not only useful because it satisfies the managing needs for which it was conceived, but also, the users recognize their importance and are capable of recommending it. The previous can be understood as a higher level of satisfaction.

Being total validity higher than 0.625, the authors can claim that the general procedure and its methodological instruments are valid; that is, objectivity and usefulness are assessed. The importance of using several assessing methods, which provides scientific strength to validation, also permits the comparison of the results achieved through different ways (methods). This is one of the advantages of the strategy suggested.

The general procedure and its methodological instruments demonstrated their validity and reliability, in theory, to manage food safety in catering services. According to the experts, this procedure can produce similar results in different time spaces or contexts, in this case, under the same conditions (Lucas *et al.*, 2017).

Consequently, the strategy suggested for the validation of managing instruments is applicable in practice. Hence, its conception ensures the realization of every result through different methods, thus providing strength, and minimizing risk or erring.

CONCLUSIONS

The evidence of validation of instruments associated with business management is little. Most investigations refer to case studies; however, that are plenty of experiences in the validation of techniques or tools in the area of qualitative research based on scientific methods with a solid background.

Objectivity, usefulness, satisfaction, and reliability must be assessed for the validation of management instruments. Objectivity supports validity, and in turn, it includes usefulness and satisfaction of customers to the particular instrument. Reliability, for its part, assesses the capacity of the instrument of repeating the expected results in different time spaces and contexts (businesses), under similar implementation conditions.

The value of the strategy suggested lies in enabling the validation of management instruments in a short period of time through scientific grounds. Moreover, it permits to foresee the possible adjustments to instruments before application, which contributes to efficient use of human, financial, and technological resources. Likewise, the inclusion of expert for the evaluation of the elements to be validated confers neutrality, independence, and impersonality in the assessment of the object of analysis.

The validation strategy does not substitute other methods associated with instrument validation. Upon assessing the validity of the instrument in theory, the next step will be a practical validation through a case study, and integrate both results.

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Appendix

Appendix 1 Questionnaire used for the validation of the management instrument

Dear expert, we would like your assessment about the procedure and methodological instruments for food safety management, particularly the following aspects, in a scale between 1-5, being 5 the maximum value:

1. Do you think that the operationalization of the tools in the procedure suggested for safety management leads to improvements?

5___ 4___ 3___ 2___ 1___

2. Does the inclusion of process approach improve and contributes to the application of the procedure?

5___ 4___ 3___ 2___ 1___

3. Do you think that the procedure suggested is feasible under the current conditions of catering services?

5___ 4___ 3___ 2___ 1___

4. If you had to manage safety in a catering facility, would you use the procedure suggested?

___ Yes I don't know___ No___

5. Do you think this procedure is necessary and updated?

5___ 4___ 3___ 2___ 1___

6. Do you think that the procedure suggested is useful to implement effective improvement actions that contribute to safety management?

Very satisfied ____ More satisfied that dissatisfied _____ Indifferent _____

More dissatisfied than satisfied _____ Dissatisfied _____ I don't know what to say _____

7. Is there coherence between the phases and steps of the procedure?

5___ 4___ 3___ 2___ 1___

8. Are the phases and steps of the procedure supported by the theory associated with safety management.

5___ 4___ 3___ 2___ 1___

9. Do you think that the variables defined for risk assessment and their way of calculation are appropriate?

5___ 4___ 3___ 2___ 1___

10. Do you think that the results expected from the implementation of the procedure are important?

5___ 4___ 3___ 2___ 1___

11. Would you recommend the implementation of this procedure to improve safety management in catering facilities? Using 10 as the maximum value.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

12. The principles that rule the procedure are

a) **Creative-innovating** (can be implemented in a participatory environment and it is open to initiatives);

b) **Alignment to the APPCC system**;

c) **Flexibility** (the capacity of total or partial implementation depending on the facility);

d) **Logical consistency** (logical sequencing of steps);

e) **Systemic** (it is associated with safety and other processes;

f) **Participatory and team work character**. State to what extent you agree.

5___ 4___ 3___ 2___ 1___

Conflict of interest and conflict of ethics statement

The authors declare that this manuscript is original, ans has not been submitted to another journal. It contains no plagiarism, conflicts of interest, or ethical conflicts. The journal is exempted from any ethical or legal commitment, or both.

Authorship statement

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NOTES

[1] The terms used in Spanish were *validez, confiabilidad, and objetividad.*

[2] Also known as *fiabilidad*.

[3] The standard deviation of *n* evaluations of ii *criterion, where* n*/2* takes the minimum value in the scale and the other half takes the maximum value in the scale.

[4] The percent expression of the index is used to interpret the result; however, further calculations involving ICS will use the index value before its expression in percent.

[5] A Likert scale is suggested.

[8] Microsoft Excel spreadsheet is recommended to program the necessary calculations.

[7] In most cases, the selection of individuals for the survey to assess a proposal is based on the expert selection method.

[8] The individual satisfaction indexes are determined with the help of a logical Iadov chart (see Table 12), based on the interception of the answers in the chart.

[9] The expert opinion method is suggested in this case.

[10] Microsoft Excel is useful to facilitate further calculations.

[11] The value indicated represents the mean of the minimum values necessary to accept the coefficients used. As a condition, all were assumed to reach the minimum value for acceptance; otherwise it would entail a reformulation of the procedure. The index value is used for calculation without their percent expression used only for the interpretation of the results.

[12] To analyze the pertinence of voting, STATGRAPHICS Centurion software was used.

[13] From the ICS and CVC values, the mean corresponding to the index (not the percent expression) obtained in every aspect evaluates, is taken.