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EXPLANATORY MULTIVARIATE METHODS: THE IMPORTANCE OF PERFORMANCE MATRIX: DATA ANALYSIS BY THE SPHINX SOFTWARE

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ABSTRACT

Multivariate analyses are characterized by a higher degree of technicality and a stronger returning with renewed vigor to mathematics; moreover, Multivariate analyses meet three objectives: explanation, synthesis and classification. In our contribution we are interested in one of the named explanatory multivariate techniques; importance-performance matrix. The latter makes it possible to understand how a variable is possibly influenced by a series of other variables: which have no influence. The illustration of this technique is based on a raw survey file on the satisfaction of pensioners with the services provided by the national pension fund. The analysis of survey data is done by the Sphinx software.

KEYWORDS

Importance, Performance, Satisfaction, Sphinx

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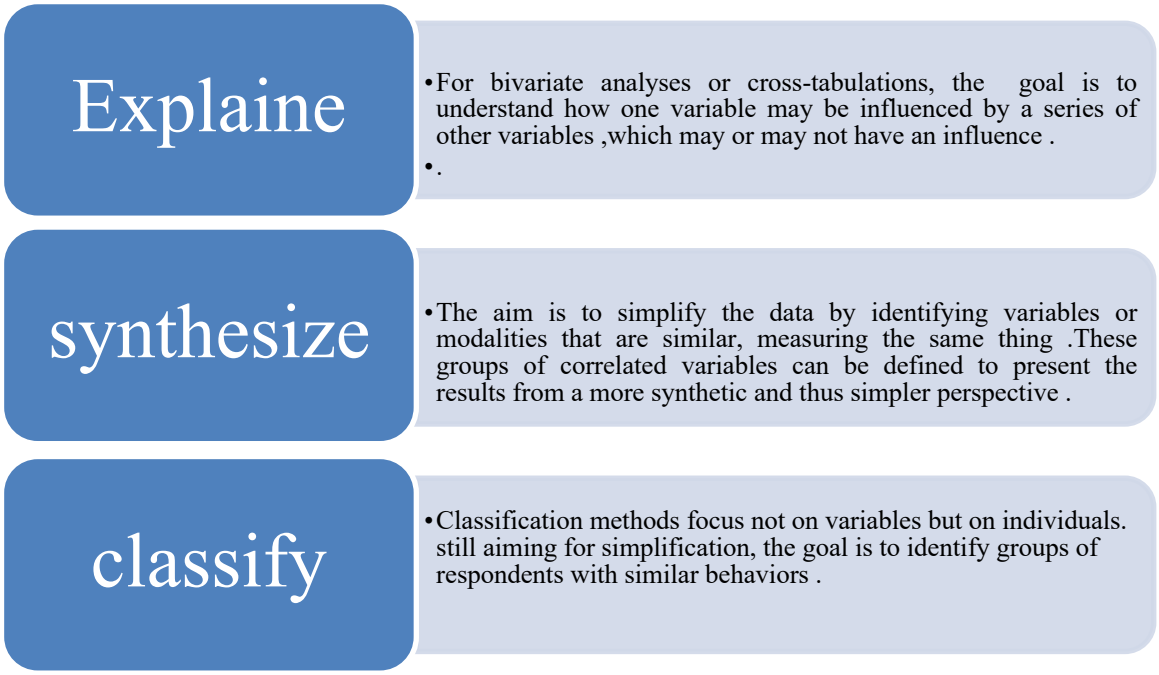
Introduction.

At the analysis stage, the answer to the questions or the transcribed data become "variables" on which statistical procedures are applied. When we want to analyze more than two pieces of information simultaneously, i.e. more than two variables, we use a series of so-called "multi varied" techniques. These are characterized by a higher degree of technicality and with going back to mathematics with more intensity. In addition, the vast majority of studies conducted in the professional demand rarely use these methods, which are often perceived as too complex and not necessarily useful.

Multivariate analyses schematically meet three objectives; explanation, synthetization and classification and this is done through several methods such as regression, structural model, factorial analysis in main components, and factorial analysis of correspondences, classification and the performance importance matrix

Focusing on the last method to make it more accessible, focusing not on the calculation formulas, but rather on the operational relevance of this method often mobilized in the context of satisfaction surveys as well as its formatting by the Sphinx software.

1-objectives and principles of multivariate analysis:



2-Some multivariate techniques:

2.1 –explanatory multivariate techniques:

Explanatory multivariate methods aim to identify, among a large group of variables, those that have a major influence on a key variable, the determinants of which are sought, among these methods:

- Multiple regression: this is the most useful method; this analysis technique is applied to numerical variables only. It is an extension of the "simple" regression analysis instead of treating only two variables; we will treat three, four or more.
- The importance-performance matrix: is a particular application of multiple regression analysis this technique will be the subject of this contribution and it will be well detailed since it is the subject of this contribution.
- Structural models have been a great success during the last two decades in the academic research community; they make it possible to deal with problems in a particularly effective way where a large number of variables and complex relationships are at stake.

As presented in the following figure, structural models first lead to the definition of "latent variables" that are in fact "concepts" that are measured via a set of variables (rarely only one), which are considered "manifest" variables.

It is for example when several indicators (life expectancy at birth, adult literacy rate, schooling rate, and GDP per inhabitant) make up a country's human development index (HDI). GANASSALI Stéphane, 2014)

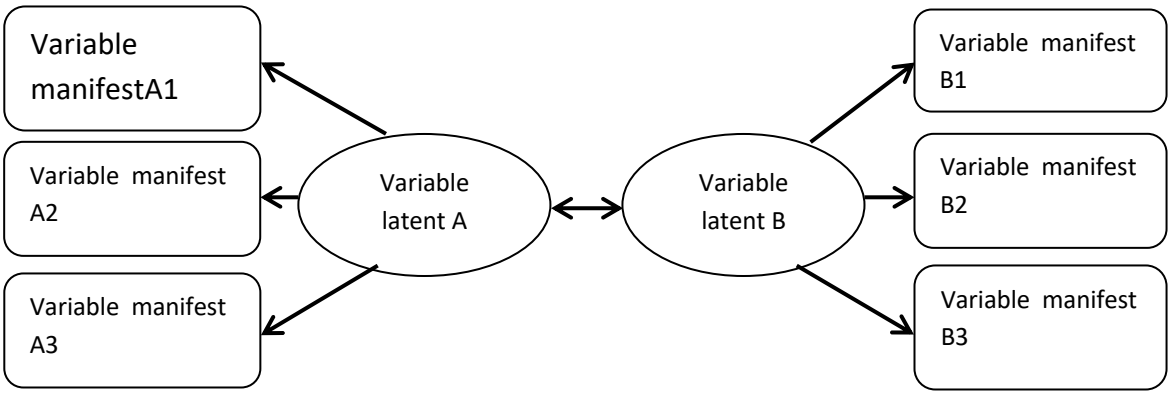


Fig. 1. *General diagram of a structural model: Source:(GANASSALIStéphane, pp175, 2014).*

2.2 Multivariate methods to synthesize:

This is one of the approaches to multivariate analysis that is based on a desire to reduce and simplify information. The so-called factorial analyses make it possible to search for the most characteristic information within a large complex table, which would result from the analysis of several variables, and to present them most often in the form of maps, the goal is to bring out the originalities; As for "a caricature, we choose to enlarge the most expressive traits - the factors -, even if it means erasing the details of lesser importance".

The ACP is used for numerical variables; open questions digital, closed scales or closed single binary. The principle of the ACP is quite simple it consists of looking for the best way to compose the evaluations of the starting table between them to replace the n criteria with only a few columns. They are called main components. Geometrically, these amounts to projecting the points of a n-dimensional space on the plane of least deformation; the one that best retains the distances in space. To define it, we first look for the line of the smallest squares, the one that adjusts the pond to the right perpendicular to the first, which in turn, best adjusts all the points. These two lines define the first plane sought.

AFC, on the same basic principles as the ACP previously described, the factorial analysis of matches, or AFC, applies to nominal or categorical variables; closed questions. With this technique, we are not interested in combinations of variables but in combinations of modalities in order to identify the large dimensions of the results, and the modalities that have statistically linked. The AFC will be used mainly to simultaneously cross more than two nominal variables-the answers to closed questions.

2.3-Multivariate methods to classify: typologies

Typological analysis makes it possible to proceed in the same way on individuals. Always for the sake of synthesis, or "segmentation". In marketing, we seek to identify groups of people whose answers are similar, in order to reproduce the results of the survey in a simplified way.

✓ Automatic classification by the mobile center: one of the best-known classification methods is called "by the mobile center" this technique makes it possible to break down a set of individuals into a number of classes chosen by priority. An iterative process successively produces several solutions while always keeping the best.

✓ Ascending hierarchical classification: it is one of the most powerful methods of typological analysis. Gradually, it groups two units, favoring at each stage the strongest similarity, depending on the distance either between two individuals or between two groups, or between a group and an individual. (GANASSALI Stéphane, pp186, 2014)

✓ This work makes it possible to make an illustrative example of the use of the importance-performance matrix on using a raw file of a satisfaction survey whose purpose was to measure pensioners' satisfaction with the services rendered by the CNR using the Sphinx software.

3-What is the importance-performance matrix?

The importance/performance matrix is a particular application of multiple regression analysis. It is often used as part of a satisfaction survey.

The importance/performance matrix makes it possible to put into perspective the satisfaction of the respondent with the importance he attaches to the different criteria evaluated. This analysis leads to the production of a map where each criterion is placed on two dimensions:

✓ Horizontally: performance, which is measured by the average score of the criterion on all respondents (average out of 10 for example).

✓ Vertically: the importance can be assessed according to several methods. In this case, the assessment is based on the double evaluation method.

We can distinguish between three methods; first Double evaluation method: On each criterion two questions are asked, one on satisfaction and the other on importance. In general, a group of questions first measures satisfaction and then another corresponding group records the importance.

The second method: Average rank on an ordered closed question,The second method is based on a single question. This is an ordered closed question where the respondent is asked to classify the 3 or 4 items most important to him from a list of criteria. Depending on the ranking of respondents, a kind of "average rank" can be calculated for each criterion.

The third method: Correlation with overall satisfaction. This method is the most commonly used today. The importance is measured thanks to the correlation coefficient of each criterion with the overall satisfaction, recorded thanks to a specific question placed at the beginning of the questionnaire, in any case before partial satisfactions. Depending on the nature of the data, the indicator used is the simple or most often multiple correlation coefficient. The more the criterion is statistically related to overall satisfaction and therefore, the more important it is.

So the analysis of a satisfaction survey frequently incorporates an importance-performance matrix intended to synthesize the results of the study and identify priorities for action. This matrix generally presents in abscise the level of satisfaction of each criterion and in order the importance of these criteria. The mapping generated highlights the essential actions to be taken that must focus primarily on unsatisfactory but very important criteria, therefore those located in the upper left part of the graph. (www.soft-concept.com)

4-Practical example of measuring satisfaction by the importance-performance method:

For the implementation of this method, we present below a description of the questionnaire related to the pensioner satisfaction survey of the CNR of Oran. This survey made it possible to measure the satisfaction of pensioners. To this end, several questions are asked to assess the degree of satisfaction of beneficiaries with the services provided by the CNR.

The questionnaire for pensioners / retirees, (sample of 100) is designed from repeated observation visits at the CNR agency in Oran.

It is composed of four sections, with 20 numerical questions divided between the second and third headings; the second aims to evaluate the satisfaction criteria and the third aims to assess the degree of importance of the satisfaction criteria. These questions have made it possible to measure the satisfaction of retirees with the services provided by the CNR.

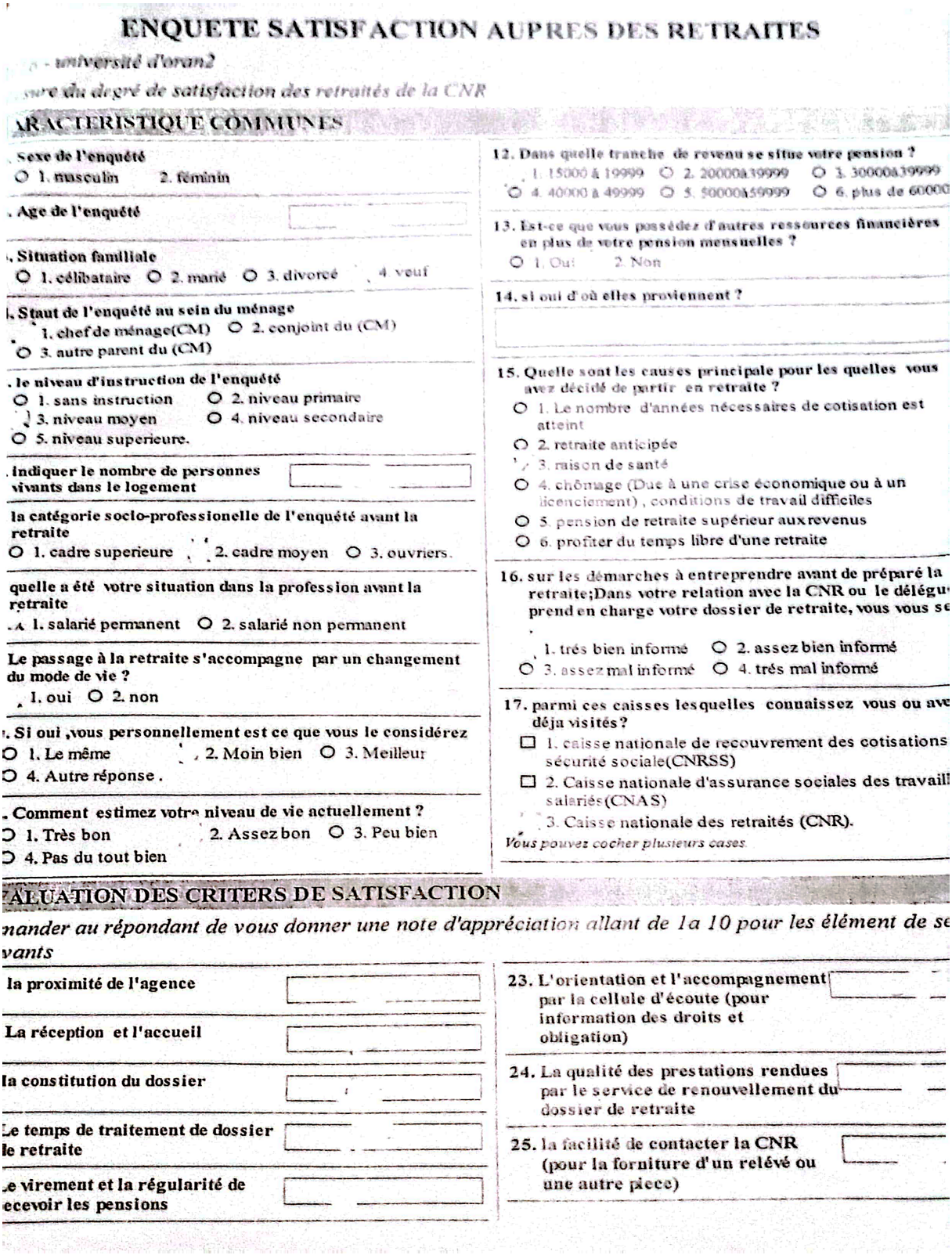
The last section, entitled the expectations of retirees, brings together three questions relating to expectations and preferences, in addition to a general opinion on the services of the CNR.

The first section aims to identify socio-demographic data on beneficiaries, to find out what are the specific needs of the different groups of beneficiaries.

Closed questions on a numerical scale (appreciation scores ranging from 1 to 10), this type of question makes it possible to measure the degree of satisfaction of people.

We want to identify, among the ten criteria studied, those that most strongly influence the overall satisfaction of the pensioner. The first method of measuring importance is used, on the same criterion, two questions are included, one for satisfaction and the other for importance.

4-1-Excerpt from a satisfaction questionnaire conducted during the pensioner satisfaction survey:



ENQUETE SATISFACTION AUPRES DES RETRAITES

- université d'oran2

sure du degré de satisfaction des retraités de la CNR

RACTERISTIQUE COMMUNES

. Sexe de l'enquêté
O 1. masculin 2. féminin

. Age de l'enquêté

. Situation familiale
O 1. célibataire O 2. marié O 3. divorcé 4 veuf

. Staut de l'enquêté au sein du ménage
1. chef de ménage(CM) O 2. conjoint du (CM)
O 3. autre parent du (CM)

. le niveau d'instruction de l'enquêté
O 1. sans instruction O 2. niveau primaire
3. niveau moyen O 4. niveau secondaire
O 5. niveau superieure.

. indiquer le nombre de personnes vivants dans le logement

la catégorie socio-professionelle de l'enquêté avant la retraite
O 1. cadre superieure 2. cadre moyen O 3. ouvriers.

quelle a été votre situation dans la profession avant la retraite
A 1. salarié permanent O 2. salarié non permanent

Le passage à la retraite s'accompagne par un changement du mode de vie ?
1. oui O 2. non

. Si oui ,vous personnellement est ce que vous le considérez
O 1. Le même 2. Moin bien O 3. Meilleur
O 4. Autre réponse .

. Comment estimez votre niveau de vie actuellement ?
O 1. Très bon 2. Assez bon O 3. Peu bien
O 4. Pas du tout bien

12. Dans quelle tranche de revenu se situe votre pension ?
1. 15000 à 19999 O 2. 20000à39999 O 3. 30000à39999
O 4. 40000 à 49999 O 5. 50000à59999 O 6. plus de 60000

13. Est-ce que vous possédez d'autres ressources financières en plus de votre pension mensuelles ?
O 1. Oui 2. Non

14. si oui d'où elles proviennent ?

15. Quelle sont les causes principale pour les quelles vous avez décidé de partir en retraite ?
O 1. Le nombre d'années nécessaires de cotisation est atteint
O 2. retraite anticipée
3. raison de santé
O 4. chômage (Due à une crise économique ou à un licenciement) , conditions de travail difficiles
O 5. pension de retraite supérieur aux revenus
O 6. profiter du temps libre d'une retraite

16. sur les démarches à entreprendre avant de préparé la retraite;Dans votre relation avec la CNR ou le délégu prend en charge votre dossier de retraite, vous vous se
1. trés bien informé O 2. assez bien informé
O 3. assez mal informé O 4. trés mal informé

17. parmi ces caisses lesquelles connaissez vous ou ave déja visités?
☐ 1. caisse nationale de recouvrement des cotisations sécurité sociale(CNRSS)
☐ 2. Caisse nationale d'assurance sociales des travail salariés(CNAS)
3. Caisse nationale des retraités (CNR).
Vous pouvez cocher plusieurs cases.

ALUATION DES CRITERS DE SATISFACTION

nander au répondant de vous donner une note d'appréciation allant de 1a 10 pour les élément de se vants

la proximité de l'agence

La réception et l'accueil

la constitution du dossier

Le temps de traitement de dossier le retraite

e virement et la régularité de ecevoir les pensions

23. L'orientation et l'accompagnement par la cellule d'écoute (pour information des droits et obligation)

24. La qualité des prestations rendues par le service de renouvellement du dossier de retraite

25. la facilité de contacter la CNR (pour la forniture d'un relévé ou une autre piece)

4-2-Key indicators:

-Overall satisfaction index:

Three indices make it possible to measure the degree of customer satisfaction with a product or service using data from satisfaction surveys.

These surveys address a number of variables that provide information on image, quality and service. It is common to ask respondents to rate from 1 to 10 the criteria that reflect their assessment. These scores give rise to two types of averages on the sample. A simple or arithmetic average and a weighted average. Of these two indices, the weighted average of the scores called the "overall satisfaction index" is the most preferred tool. (BEKHTAOUI Assia, pp211-225., 2018)

The formula that makes it possible to obtain it is: **ISG=**$\sum_{i=1}^{10} \boldsymbol{xipi}$

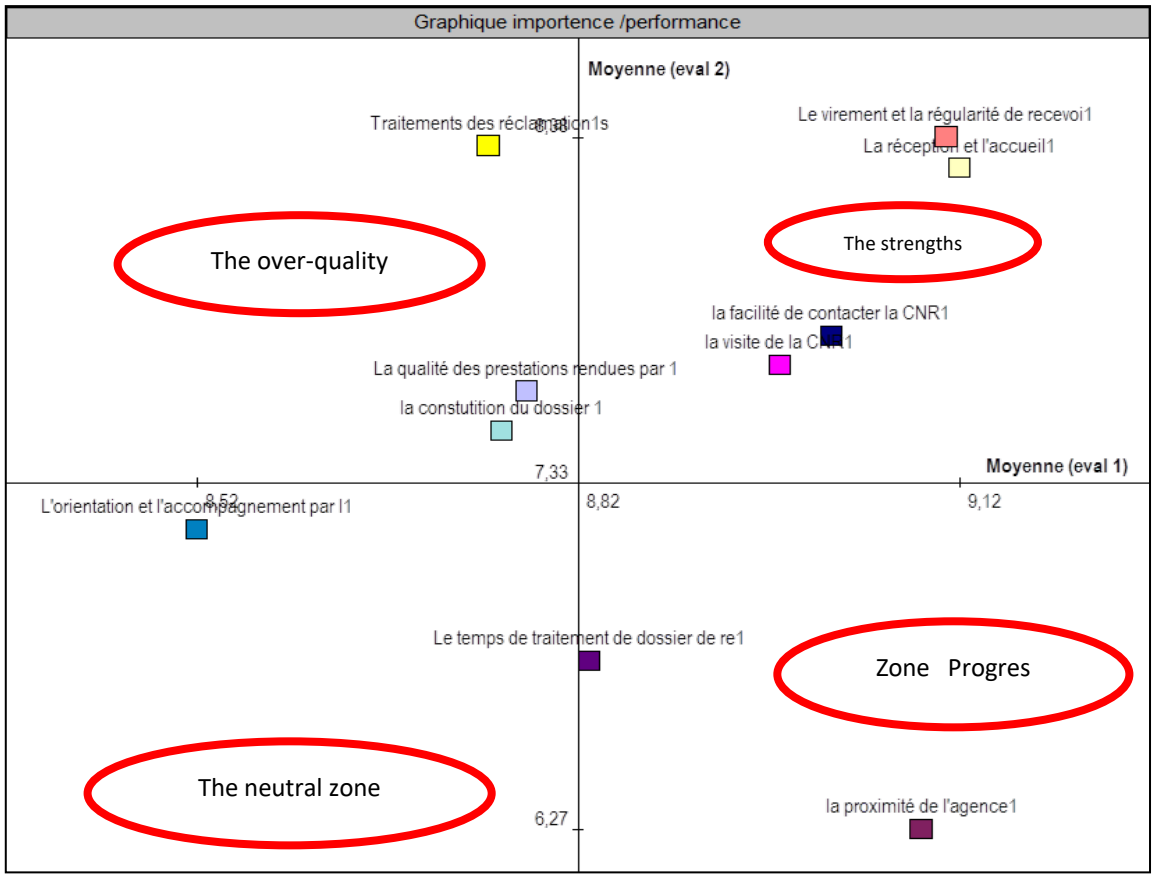
Criteria	Average score of the evaluation	Average score of importance	ISG
The proximity of the agency	6.27	9.09	0,640
The reception and reception	8.28	9.12	0 ,848
The constitution of the file	7.48	8.78	0,738
The processing time	6.78	8.83	0 ,672
The transfer and the regularity of	8.38	9.11	0,857
Orientation and ac	7.18	8.52	0 ,687
The quality of the services...	7.60	8.78	0,749
The ease of contacting the CNR	7.77	9.02	0,787
The visit of the CNR	7.68	8.98	0,775
Handling of complaints	8.37	8.58	0,823
ISG	7,58		

The level of satisfaction is assessed by a scale of 1 to 10 (parameter established on the rating), thanks to the weighting system, the overall satisfaction score is 7.58 this score is higher than 7 which means that CNR pensioners are satisfied with the services rendered. The satisfaction surveys consider that individuals are satisfied from an overall score equal to or greater than 7.

4-3--Matrix importance / performance:

To achieve this importance/performance matrix, the sphinx 1 software is used:

Graph 1. *Importance of performance*



The card allows the following reading:
-The strengths; the fund is judged positively on important criteria for respondents,
-The priority area of progress indicates the important criteria that are insufficiently well received.
-The neutral zone, the criteria are not very well received but they are not very important
-The over-quality area, these criteria are well evaluated but they are of less importance for respondents.

4-5-Interpretation of the matrix:

1. At the top right: the strong points:

The CNR is judged positively on very important criteria for pensioners. These are mainly the reception and reception, the transfer and the regularity of receiving the pension, which are very efficient and important, the ease of contacting the CNR and the visit of the CNR are also strengths sonly they are less efficient than the two previous criteria.

2. At the bottom left: the white (or neutral) zone:

These criteria are not very well perceived, but they are not very important. It is a relative surprise to find in this area the orientation and support by the listening cell therefore, unimportant elements with a low performance.

3. At the top left: the "on quality" area:

These criteria are well evaluated but they are of less importance for pensioners: the constitution of the file, the quality of the services rendered and the processing of claims.

4. At the bottom right:

the priority area of progress tells us the important criteria that are insufficiently well perceived: the proximity of the agency and the processing time of the file.

The three methods of measuring importance previously described are available in Sphinx. From the Analysis of Results stage, in the custom dashboards, there is a menu specific to importance-performance

analyses that is launched from the compound table insertion menu; it is possible to choose the variables concerned and the method of calculating the importance, to obtain the tables and then the desired matrices.

Conclusions

Multi-variety analyses allow researchers to effectively identify and represent the essential information contained in the results of a survey. Beyond the mastery of the statistical techniques that underlie them, they require an ability to interpret and therefore an excellent understanding of the subject of the study. In addition, they require a certain talent in formatting results, so that figures and statistics are transformed into useful information for knowledge and decision-making.

In addition, the results of our satisfaction survey conducted with the CNR of Oran, translate a relatively high degree of satisfaction with the services provided by the CNR. The weighted overall satisfaction index is 7.58 points out of 10.

The criteria that have contributed largely to this satisfaction are certainly those related to transfers and the regularity of receiving pensions, the processing of claims and the reception. These criteria, well rated by pensions, lead to a relatively high index of more than 8 points out of 10.

However, it should be noted that the most important level of dissatisfaction is observed for the criteria "proximity" "constitution of the file" and "processing time". The largest deviations from the average concern these criteria.

The efforts to be made with a view to improving the CNR's services must be oriented towards important criteria that are insufficiently noted: the proximity of the agency and the processing time of the file.

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