Development of a Models of Interpersonal Competencies as a Complex System

Boris Blažinić   *info@iq-institut.hr*
Institut za kvalitetu i razvoj ljudskih potencijala
Zagreb, Croatia

Lovorka Gotal Dmitrović   *lgotaldmitrovic@unin.hr*
University Center Varazdin
University North, Croatia

Marko Stojić   *marko.stojic@unin.hr*
University Center Varazdin
University North, Croatia

Abstract

Competencies represent a dynamic combination of cognitive and metacognitive skills, knowledge and understanding, interpersonal and practical skills, and ethical values. Since there are many entities, as well as many activities between entities, according to system theory, the whole system belongs to complex systems. The paper develops a conceptual and computational model of interpersonal competences for the process of optimization and methodology design, using simulation modeling. The developed model enables: faster data collection, more accurate results, avoiding human error in data entry and processing, survey time can be measured and more easily restricted, NMAR (Not Missing at Random) data is avoided and socially desirable responses are more easily avoided.

Keywords: modelling, know-how, Likert scale, psychoinformatics

1. Introduction

Information science have a big impact on psychology. It allows psychologists to analyze variables such as personality traits, aptitudes, cognitive functions, as well as behavior. Most importantly, with information science in psychology it avoids most sources of bias, because the behavior of interest is directly recorded, while are many biases are inherent to standard psychological measures [8]. Yarkoni describes Psychoinformatics as "… an emerging discipline that uses tools and techniques from the computer and information sciences to improve the acquisition, organization, and synthesis of psychological data." [12]

The enterprises' success is determined by their ability to efficiently their activity and potential to changes and challenges, and successful companies must be able to

identify opportunities fast. Human capital is the superior factor, because they generate the potential of the organization. One of the factors describing the qualitative features of human capital are competences. [11]

Interpersonal competences are part of generic, general, shared, and transdisciplinary competencies that are not directly related to the field of study and profession, and are required in a wide range of jobs and situations. They are also referred to as transferable skills, key competencies, core skills, attainment targets and employability skills.

Competencies represent a dynamic combination of cognitive and metacognitive skills, knowledge and understanding, interpersonal and practical skills, and ethical values. Since there is a large number of entities, as well as a multitude of activities between entities, the whole system belongs to complex systems according to the system theory. Many organizations suggest that interpersonal skills are paramount when evaluating employees and especially potential new hires, but that most college students are lacking in these skills [5].

2. System Modelling

Analyzing and modelling of the system behavior is based on the process modeling approach. This approach ensures the correct description of the structure, the entities and their relationships. Studies on process modelling and model selection can be found in other works in this field. [9][1]

Numerous studies indicate that the model of assessment of personal potentials and competencies should be based on experience and empirical data. These empirical data enable the development of models to predict and make decisions about the future behavior of individuals within an organization.

Theoretical models related to the field of personal potential assessment in organizations are numerous and are still being developed. This paper uses the "IQ Assessment & Development Program" personal assessment model. This model was developed for the types of assessment that primarily serve to identify developmental needs.

The estimation model is based on:

- generally accepted insights on what characteristics are relevant in an organizational context,
- the need for a standardized procedure,
- the need for it to be applicable within the organization for various purposes (e.g. selection, development, evaluation),
- the need for the organization to be applicable at different levels and for different types and
- provided that several different assessment methods are used which complement each other.

2.1. Conceptual Models

Conceptual models offer a presentation given to the lawfulness of its behavior and structure, and thus allow the study of the most important parameters of the functioning of the entire system or its components [1].

Ishikawa diagram (or fishbone diagram) is a cause and effect diagram, which mean that this diagram is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. This diagram is useful in brainstorming.

Dr. Kaoru Ishikawa, a Japanese quality control expert, is credited with inventing the diagram to help avoid solutions that merely address the symptoms of a much larger problem. Fishbone diagrams are considered one of the seven basic quality tools and are used in the "analyze" phase of Six Sigma's DMAIC (define, measure, analyze, improve, control) approach to problem solving [3]. Interpersonal competencies depend on causes (Figure 1):

- Functional competences,
- Operational competences,
- Management competences and
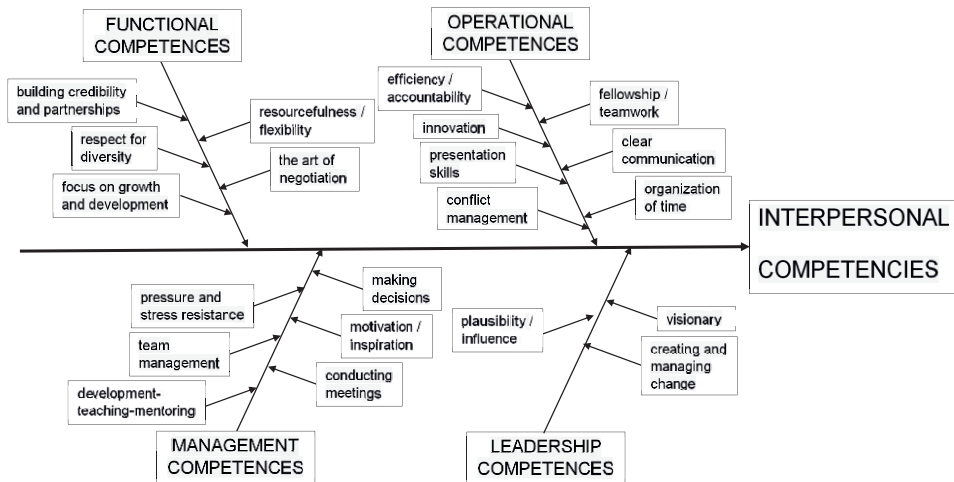- Leadership competences.

Figure 1. Ischikawa diagram

The causes of functional competences depend on sub-causes (Figure 1):

- Building credibility and partnerships,
- Resourcefulness / flexibility,
- Respect for diversity,
- The art of negotiation and
- Focus on growth and development.

The causes of operational competences depend on sub-causes (Figure 1):

- Efficiency / accountability,
- Fellowship / teamwork,

- Innovation,
- Clear communication,
- Presentation skills,
- Organization of time,
- Conflict management.

The causes management competences depend on sub-causes (Figure 1):

- Making decisions,
- Pressure and stress resistance,
- Motivation/inspiration,
- Team management,
- Conducting meetings,
- Development-teaching-mentoring.

The causes leadership competences depend on sub-causes (Figure 1):

- Visionary,
- Plausibility / influence and
- Creating and managing change.

Each cause has equal "weight". Figure 1 shows that the lack of leadership competence is the most difficult to compensate for. It is also, simplest to make up for the lack of operational competences, because of the much smaller sub-causes that cause operational competencies.

2.2. Computer Model

The system dynamics model was created using the Powersim Constructor program v. 2.51 Computer model useful to understand the structure and dynamics of complex systems. This modeling method enables to build formal computer simulations of complex systems and use them to design more effective policies and organizations. Together, these tools allow us to create simulators-micro worlds where space and time can be compressed and slowed [10].

Figure 2 shows the computer model for the presenter. The person answers a 50-claim competence questionnaire (Know-How). The Likert scale is used for agreements or disagreements with a claim.

The Likert scale is a type of attitude scale that consists of a series of statements devoted to different aspects of an attitude. It is given to the respondent with the task of expressing, for each individual claim, the degree of his or her agreement or disagreement, as a rule, on a five-point scale such as: "totally disagree", "disagree", " slightly disagree", "agree", "totally agree". In Figure 2, the claims are marked with q_x ($1 \leq x \leq 50$). Each respondent's response is scored appropriately, and then factor analysis is applied.

Factor analysis is one of the most popular multivariate techniques. The goal of factor analysis is to identify and understand commonalities for multiple variables.
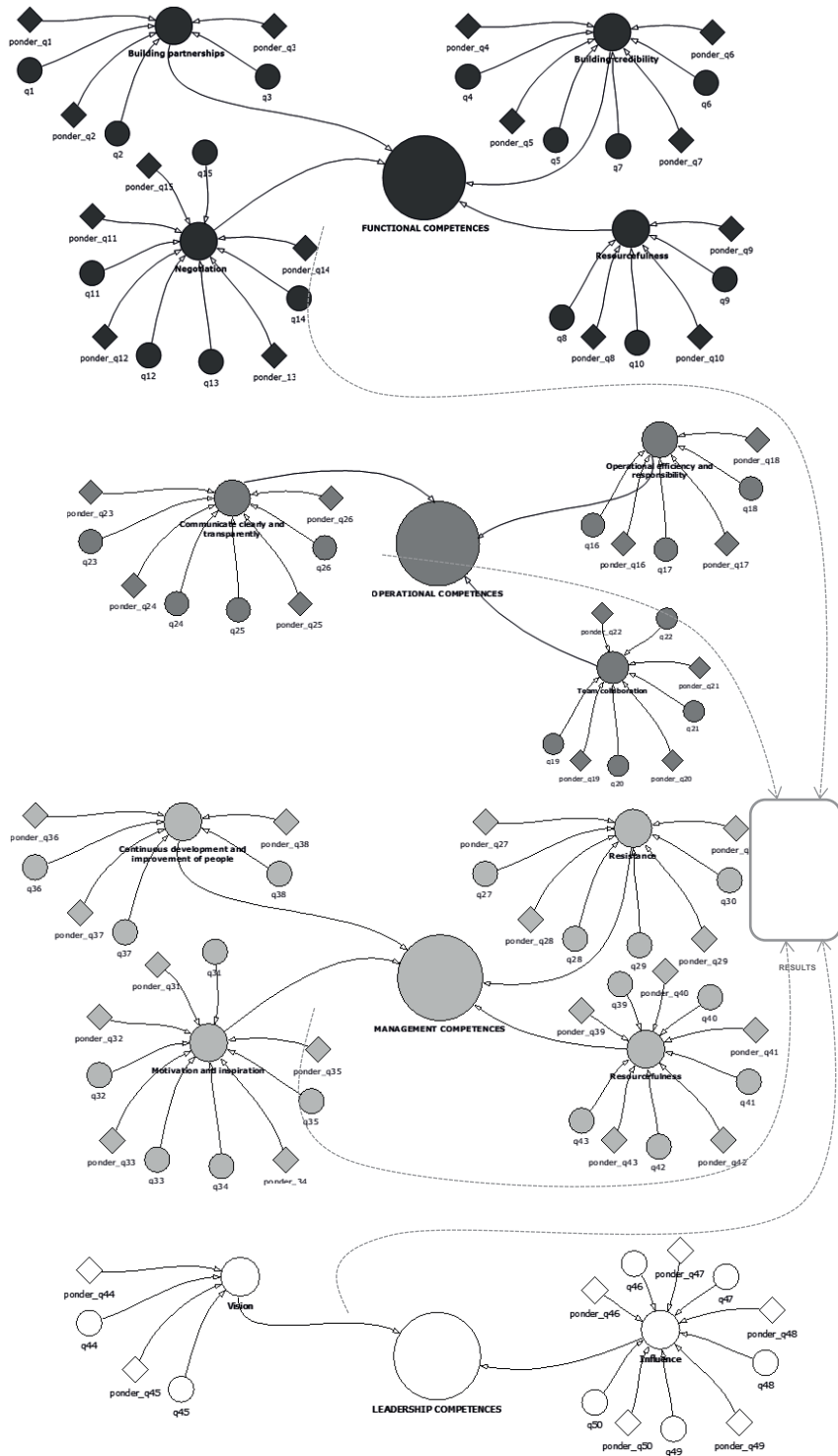
Figure 2. Computer model

This technique seeks to model a relationship between variables that makes sense from the perspective of a research problem. For the effective application of factor analysis, it is necessary that the variables overlap at least slightly in their meaning. Thanks to this redundancy, it is possible to discover a pattern in the behavior of variables, that is, the basic idea (factor).

Factor analysis actually seeks a group of similar testimonials from respondents because they express the same basic idea in ways that differ in hue. Generally, factor analysis identifies the basic idea and can be measured. These basic ideas are called factors. The factors are determined in the authors' previous scientific and professional work, and they depend on the type of occupation of the respondents, i.e. on the competences sought for that type of occupation. In the model they are labeled "ponder q_x".

3. Experiment

The model was applied to a voluntary survey of company leaders. Two tests were done, one with computer model, and other in paper form.

Method	Candidate 1		Candidate 2		Candidate 3	
	Comp.	Paper	Comp.	Paper	Comp.	Paper
ASSESSMENT OF FUNCTIONAL COMPETENCES						
Building partnerships	86	89	68	70	46	48
Building credibility	77	81	84	88	72	72
Resourcefulness	74	74	85	88	75	75
Negotiation	76	72	77	78	56	52
OPERATING COMPETENCE ASSESSMENT						
Operational efficiency and responsibility	71	74	75	80	63	60
Team collaboration	68	69	60	66	55	56
Communicate clearly and transparently	79	84	85	86	44	49
ASSESSMENT OF MANAGEMENT COMPETENCES						
Resistance	69	75	85	85	68	66
Motivation and inspiration	69	76	57	57	30	31
Continuous development and improvement of people	64	62	61	60	45	51
Continuous management of people	59	59	65	64	50	53
LEADERSHIP COMPETENCE ASSESSMENT						
Advocating strategic vision	58	56	73	72	30	34
Influence	77	78	65	68	51	47
RESULTS						
FUNCTIONAL COMPETENCES	313	316	314	324	249	247
OPERATING COMPETENCE	218	227	220	232	162	165
MANAGEMENT COMPETENCES	261	272	268	266	193	201
LEADERSHIP COMPETENCE	135	134	138	140	81	81

Table 1. The results of test

The results are shown in Table 1. Although the survey was voluntary, for the sake of GDPR, the paper presents results with no name (only Candidate 1, Candidate 2 and Candidate 3). This is an example of the result. More than 30 people were tested.

The results of test show that the Candidate 3 has the worst predisposition for leadership, but it is extremely good at operational levels. He lacks vision and is not a driver of change, but he is good at planning work and delegating tasks. He has a very well-developed interpersonal competence for intermediate leadership. Unlike Candidate 3, Candidates 1 and 2 have developed interpersonal competencies for higher levels of leadership, but are likely to have problems with the manager in the case that they work in the middle and lower levels.

The main differences in completing the survey are:

1. On paper, the respondent does not have to answer all the questions. On computer, can't see next question unless it answers this.

The survey is not anonymous, so the respondent can avoid answering the "unpleasant claim" by answering the paper. Although this is (probably) Not Missing at Random (NMAR) data, the Listwise Deletion Method is used.

Do Not Missing at Random (NMAR) data is data that is missing for a reason i.e. intentionally skipped questions in the questionnaire by the participants [2]. When one or more values are missing in a set of numbers, most use Listwise Deletion Method. It is a simple and most commonly used method for missing data treatment. Listwise Deletion Method is method which deletes rows containing gaps, and uses only the complete ones [4][6].

2. On the paper shows all the questions, so the possibility of calculations is higher and slightly, higher ratings are given more often, especially when the questions are related to personal ability or opinion about the employer. The person gives socially eager answers.

4.   Conclusion

Scientific progress depends on our ability to harness and apply modern information technology. Many advances in the sciences now emerge directly from advances in the large-scale acquisition, management, and synthesis of scientific data.

More recently, the scientific field of Psychoinformatics has been increasingly used, combining psychology and information sciences, especially in the form of the very way we collect, organize, and synthesize data. Psychoinformatics as an interdisciplinary scientific discipline is rapidly developing, using information and communication technology (ICT). Discovering, integrating and analyzing huge amounts of heterogeneous data is crucial in exploring the complex issues in psychology. Information science offers tools and approaches for the management of psychology data and transforms it into information and knowledge.

Interpersonal competencies belong to innate, social intelligence. These competencies are key to establishing, building and maintaining good relationships. They are also called people management because they are the basis for work that involves interpersonal action.

Interpersonal competencies are measured in order to know where weaknesses and strengths are, and to develop them further. It does not evaluate knowledge, but actions. The measurement is done mainly by solving a paper questionnaire in a group.

The development of information technology affects the quality of data and research itself and moreover, it provides a stable base for their further development. The goal of the simulation modeling, in this paper is development of a Model of Interpersonal Competencies for optimization process and methodology design suitable to significant behavior patterns.

The developed model enables:

1. faster data collection,

2. more accurate results,

3. human error in data entry and processing is avoided,

4. the time to complete the survey can be measured and more easily limited,

5. NMAR data are avoided,

6. not all questions are seen at once, but the next question is visible only after answering the previous question,

7. previous answers cannot be corrected when completing the survey.

Many organizations suggest that interpersonal skills are paramount when evaluating employees and especially potential new hires, but that most are lacking in these skills. The main scientific contribution, in addition to the above, is that measurement can be performed using the developed model. The research results show that the computer test gives greater efficiency and more accurate results of the test on paper.

This model is adaptive, that is, it can be applied to different occupational profiles. Also, it can be used to predict the development of employees' interpersonal competencies.

References

[1] Gotal Dmitrovic, L., Dušak, V., Anić Vučinić, A. (2015) The Development of Conceptual, Mathematical and System Dynamics Model for Food Industry Wastewater Purifying System, JIOS, 39 (2)

[2] Gotal Dmitrović, L.; Dušak, V.; Dobša, J. (2016) *Misssing data problems in Non-Gaussian probability distributions*, Informatologia, 49 (3- 4)

[3] Ishikawa, K. (1976) Guide to Quality Control, Asian Productivity Organization, UNIPUB

[4] Lessler, J.T., Kalsbeek W. D. (1992) *Nonsampling Error in Surveys*, New York, Chichester

[5] Lester, S.W., Tomkovick, C., Wells, T., Flunker, L. and Kickul, J. (2005), *Does service-learning add value? Examining the perspectives of multiple stakeholders*, Academy of Management Learning & Education, 4 (3), pp. 278-294.

[6]   Little, R.J.A., Rubin, D.B. (2002) *Statistical Analysis with Missing Data*, New York

[7]   McNatt, D.B. (2020) Service-learning - An experiment to increase interpersonal communication confidence and competence, Education + Training, 62 (2) pp. 129-144

[8]   Montag, C., Duke, Éilish, Markowetz, A. (2016) *Toward Psyhoinformatics: Computer Science Meets Psychology*, Computational and Mathematical Methods in Medicine

[9]   Pidd M. (1997) Tools for Thinking – Modelling in Management Science; John Wiley & Sons New York

[10] Sterman, J.D. (2000) Business Dynamics: Systems Thinking and Modeling for a Complex World, McGrow-Hill Higher Education

[11] Wlodarkiewicz-Klimek, H. (2020) *Qualitative Features of Human Capital in the Formation of Enterprise Agility,* Research Results in Polish Enterprises, Advances in Manufacturing, Production Management and Process Control, 971, pp. 63-72

[12] Yarkoni, T. (2012) Psychoinformatics: new horizons at the interface of the psychological and computing sciences, Current Directions in Psychological Science, 21(6)