

Proposal of a Framework for Innovation Competencies Development and Assessment (FINCODA)

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Abstract

In this article we propose a model of innovation competence of people, based on the existing literature to integrate and complement the existing models. The main contribution of this work consists in demonstrating the differences and similarities of current models and in providing a conceptual definition for each model element. In this way, both researchers and people in charge of Human Resources in companies can obtain a framework to design measuring instruments to assess the innovation competence, which can fulfil the twofold demand requirement of validity and reliability.

Keywords: *competence assessment; innovation; model; literature review*

Introduction

Innovation has been a fashionable term for some years up to now. A considerable number of people have proposed innovation as the magical recipe for all, or almost all, of today's problems in companies. In fact it is normal to find in media specialized in Economy or Business statements that link the survival of organizations to the way in which they empower, manage and exploit innovation.

In this context, we can define innovation as a presentation of the novelty (an idea, procedure, device, invention or process) or improvement of something that exists and adds value, and is useful for organizations. In order to improve organizational or group performance, innovation begins with generating ideas and finishes with implementing and using them (Marin-Garcia, Aragonés Beltran, & Melón, 2014; Marin-Garcia, Perez-Peñalver, & Watts, 2013; Perello-Marin, Marin-Garcia, & Marcos-Cuevas, 2013; Ramirez Bayarri, Marin-Garcia, & Atares-Huerta, 2016).

Innovation may not be the main priority for many companies given the type of product or service offered, or due to the internal or external setting they move in. For other companies, however, which base their strategy on developing new products, services or markets, or on creating or exploiting technological advances, innovation-related performance indicators (kpis) are the most important issue of their balanced scorecards. In volatile, complex and ambiguous settings with uncertainty, it is hard to believe that an organization can survive without innovation, hence innovation is included as a priority in its agenda. Today's reality is that attracting and retaining innovative talents form an urgent issue for Human Resources managers in many organizations (Juárez Tarrega, 2011; Juárez Tarrega, Marin-Garcia, & Santandreu-Mascarell, in review). In particular, they consider that helping set up this transformation toward an organizational Innovation Culture is a need. In fact, we can find considerable bibliography on what innovation in organizations consists in and how it is measured.

Unfortunately, although innovation is carried out by people, it is not easy to find models that allow us to analyze the behavior of our collaborators who help build an innovation culture in companies.

In this article we offer a literature review and propose an innovation competence model of the people who work or will work in organizations in the near future.

Method

Our aim is to verify if a consensus about the innovation competence model has been reached and, if not, to propose a more complete and integrative model. For this reason we undertook a literature review of innovation competence models and of the surveys used to measure them. We worked with three data sets provided by three teams of three researchers who worked on three different bases independently:

- Search 1. Web of Science, Scopus and EBSCO. Search strategy: TITLE: innovation and (skill or competenc*); published between 2000 and 2013 in social science journals. From the 295 resulting articles, 71 were manually filtered, which evaluated innovation competence in people. Of these 71, 14 presented innovation models in the main article or in annexes, or offered the possibility of obtaining them by contacting the authors of these articles.
- Search 2. Web of Science, Scopus and Google Scholar. Strategy: Innovation and Behavior, along with work or Employee. This produced some 1,400 references. After filtering them manually, we retrieved the 200 valid ones, of which 12 were selected and were suitable to help identify models.
- Search 3. IEEE Xplore, Web of Science, and Scopus. Strategy: (competenc*) and (innovat* or leadership or creativity) and (software or “software industry” or “software development”) in the title, abstract/summary, key words and full text of articles, conference speeches, books and book chapters in English. From 2000 to 2015. Findings: 754 references. After manually filtering, 18 articles were selected whose title and abstract were suitable to identify models.

After summarizing and integrating the information of 44 papers collected from the reviews, we discussed the available material in different group dynamics: four of the authors met with three Human Resources managers and one person in charge of innovation who works for two multinationals located in Valencia (Spain). The proposal prepared by this group was worked and re-elaborated on a 2 day workshop with a new work group made up of nine researchers coming from other European universities and 17 managers from nine European innovative medium- and large-sized companies.

Results

In the literature that we reviewed, we found 12 innovation models: INCODE (Marin-Garcia et al., 2013; Watts, Garcia-Carbonell, & Andreu Andrés, 2013); i-skills (<http://www.i-skills.eu/>); (Kleysen & Street);(Scott & Bruce);(Waychal, Mohanty, & Verma, 2011); (Kirton, 1976); (Berdrow & Evers); (Cerinsek & Dolinsek); GISAT 2.0 (Conference Board of Canada, 2013, 2014; Luke, 2013); The innovation Potential Indicator (Burch, Pavelis, & Port, 2008; Patterson, 1999); (De Jong & Den Hartog, 2010);(Spiegelaere & Gyes, 2012).

All of these models (Annex 1) present a different degree of specified development and validation. Some are simple proposals that were put forward during conferences, whereas others form part of long-term financed projects. Some present innovation as a one-dimensional construct, whereas others divide it into several factors. Some models do not specify the dimensions in which innovation competence is divided. Generally speaking, none of these models is linked to any publication in scientific journals in which a rigorous complete and replicated validation process with independent samples and research groups has been communicated. No detailed analysis of the dimensionality of multi-item based models has been published (Marin-Garcia, Ramirez Bayarri, & Andreu Andrés, 2015).

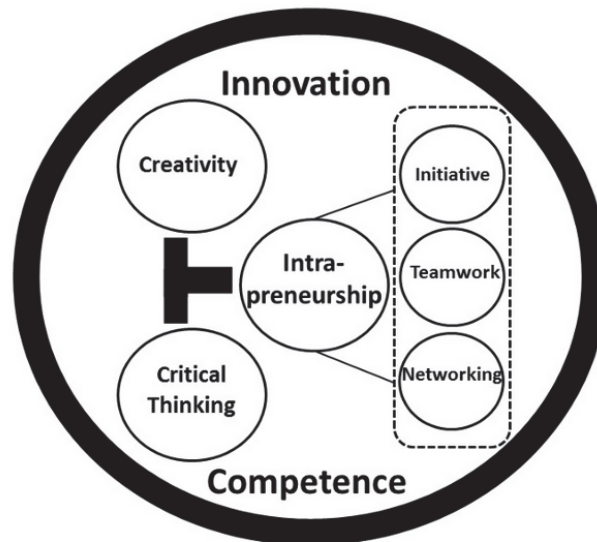
After analyzing the innovation competence models found in the literature, we created a new model that complements and extends the existing ones (Figure 1), which includes the information available in published models, and defines competence innovation as: Ability to create, introduce, adapt and/or apply beneficial novelty at any organizational level (Kleysen & Street; Marin-Garcia, Ramirez Bayarri, & Andreu Andrés, 2015; Ramirez Bayarri et al., 2016; Scott & Bruce; West & Farr). Innovation is the introduction of a novelty (an idea, a method, a device, an invention, a process) or the improvement of something that already exists that must be useful to people or organizations as added value to meet their needs. As a competence, innovation can be considered a cluster of separate or even overlapping competences, capacities and skills which can be regarded jointly as innovation competence (Watts et al., 2013). In seeking improved performance for the organization or group, innovation starts with the proposal and generation of new ideas and finishes with the use of the outcomes (Goffin & Mitchell, 2010; González Pernía & Peña-Legazkue, 2007; Klippel, Petter, & Antunes; Lehto, Kairisto-Mertanene, & Penttilä, 2011; Marin-Garcia, Aznar-Mas, & González-Ladrón-de-Guevara, 2011; Mol & Birkinshaw, 2009; Schumpeter, 1934; Tonnessen, 2005; Vaccaro, Jansen, Van Den Bosch, & Volberda, 2012)

Such competence can be considered a group of capacities, skills or behaviors that overlap to a certain extent. The FINCODA innovation competence model comprises three dimensions, creativity, critical thinking and a cluster of capacities, which come under the intrapreneurship label and is composed by initiative, teamwork and networking. The definitions of the elements that make up the model are summarized below:

- Creativity: ability to transcend (think beyond) traditional ideas, rules, patterns or relationships, and to generate or adapt meaningful alternatives, ideas, products, methods or services independently of their possible practicality and future added value
- Critical thinking: ability to analyze and deconstruct issues with a purpose (evaluate advantages and disadvantages, foresee how events will develop, estimate the risks involved)
- Initiative: ability to take decisions or carry out actions to operationalize ideas that foster positive changes, as well as to mobilize and manage creative people and those who have to implement ideas

- Teamwork: ability to work efficiently with others in a group
- Networking: ability to involve external/outside stakeholders (outside the work group)

Figure 1.- FINCODA Model of Innovation Competence



These five dimensions can be observed through innovative behavior in the workplace as, for example: thinking differently, finding new ways to implement ideas, evaluating advantages and disadvantages, anticipating how events will take place, estimating the risks of possible alternatives, assuming an acceptable level of risk to support new ideas, convincing others to support an innovative idea, sharing relevant information with suitable stakeholders, coordinating work with others, encouraging positive relations in the team/group, etc.

Our objective in the future is to materialize this model by creating a competence diagnosis tool to help companies identify the most suitable people to be included in the teams that encourage innovation from among their collaborators. The intention here is to provide a tool that offers value in selecting, managing and developing innovator talent in both companies and universities.

Conclusions

This work forms part of the European project FINCODA (<http://bit.ly/FINCODA-EUsite01>). It includes the development of two questionnaires (a long and a short version) that employ Likert scales (Marin-Garcia, Ramirez Bayarri, & Atares-Huerta, 2015) to self-assess the innovation competences of the people who opt to occupy a job post. These people either may have recently graduated, be experienced professionals or stem from a company's internal promotion. The longer version questionnaires should contain 50-60 items at the most to be answered in a maximum time of 20-30 minutes. The shorter version questionnaires should be completed in less than 5 minutes, containing no more than 10-15 items. These figures do not include the questions on adjustment variables. Although it is not the main objective the use of the questionnaires, our proposal may extend the natural context for which they have been devised and might be used with people without university qualifications. The shorter version may also be employed

for peer or expert assessment (university teachers, supervisors, management or Human Resources personnel in companies).

Before preparing the questionnaires, it is required a model that provides information about whether the innovation competence has got one dimension or several, and what the conceptual definition of innovation competence will be and also it will provided us a conceptual definition for each dimensions. This will enable us to make progress in the future in preparing a questionnaires to be used to detect requirements, to determine personalized development actions, and to also assess the results of interventions that may be taken in companies to encourage innovation. These questionnaires could also be used as further information on selection and internal promotion processes. The shorter version is expected to be used for 180-degree assessments or by experts (consultants, university teachers, supervisors, directors or human resources personnel in companies).

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References

- Berdrow, I., & Evers, F. T. (2011). Bases of competence: A framework for facilitating reflective learner-centered educational environments. *Journal of Management Education*, 35(3), 406-427. doi:10.1177/1052562909358976
- Burch, G. S. J., Pavelis, C., & Port, R. L. (2008). Selecting for creativity and innovation: The relationship between the innovation potential indicator and the team selection inventory. *International Journal of Selection and Assessment*, 16(2), 177-181. doi:<http://doi.org/10.1111/j.1468-2389.2008.00422.x>
- Cerinsek, G., & Dolinsek, S. (2009). Identifying employees' innovation competency in organisations. 6, 164-164. doi:10.1504/IJIL.2009.022811
- Conference Board of Canada. (2013). General innovation skills aptitude test (gisat 2.0). Retrieved from <http://www.conferenceboard.ca/cbi/innovationskills.aspx>
- Conference Board of Canada. (2014). *Skills for business innovation success: It's people who innovate*.
- De Jong, J., & Den Hartog, D. (2010). Measuring innovative work behaviour. *Creativity and Innovation Management*, 19(1), 23-36. doi:10.1111/j.1467-8691.2010.00547.x
- Goffin, K., & Mitchell, R. (2010). *Innovation management*. New York: Palgrave-MacMillan.
- González Pernía, J. L., & Peña-Legazkue, I. (2007). Determinantes de la capacidad de innovación de los negocios emprendedores en España. *Economía Industrial*(363), 129-147.

- Juárez Tarrega, A. (2011). Uso de indicadores financieros para evaluar el impacto de las prácticas de alta implicación (use of financial indicators to evaluate the impact of high involvement work practices). *Working Papers on Operations Management*, 2(2), 32-43. doi: <http://dx.doi.org/10.4995/wpom.v2i2.847>
- Juárez Tarrega, A., Marin-Garcia, J., & Santandreu-Mascarell, C. (in review). What are the main concerns of human resource managers in organizations? . *The International Journal of Human Resource Management*, In review.
- Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology*, 61(5), 622-629. doi:<http://dx.doi.org/10.1037/0021-9010.61.5.622>
- Kleysen, R. F., & Street, C. T. (2001). Toward a multi-dimensional measure of individual innovative behavior. *Journal of Intellectual Capital*.
- Klippel, A. F., Petter, C. O., & Antunes, J. (2008). *Management innovation, a way for mining companies to survive in a globalized world*. Paper presented at the Utilities Policy European Regulatory Perspectives.
- Lehto, A., Kairisto-Mertanen, L., & Penttilä, T. (2011). *Towards innovation pedagogy. A new approach to teaching and learning for universities of applied sciences*. Turku: Turku University of Applied Sciences.
- Luke, R. (2013). Measuring innovation skills acquired by college and polytechnic students through applied research. *Technology Innovation Management Review*(October), 36-43.
- Marin-Garcia, J. A., Aragonés Beltran, P., & Melón, G. (2014). Intra-rater and inter-rater consistency of pair wise comparison in evaluating the innovation competency for university students. *Working Papers on Operations Management*, 5(2), 24-46. doi:<http://dx.doi.org/10.4995/wpom.v5i2.3220>
- Marin-Garcia, J. A., Aznar-Mas, L. E., & González-Ladrón-de-Guevara, F. (2011). Innovation types and talent management for innovation. *Working Papers on Operations Management*, 2(2), 25-31.
- Marin-Garcia, J. A., Perez-Peñalver, M. J., & Watts, F. (2013). How to assess innovation competence in services: The case of university students. *Direccion y Organizacion*(50), 48-62.
- Marin-Garcia, J. A., Ramirez Bayarri, L., & Andreu Andrés, M. A. (2015). *Comparación de los métodos de escalas y frecuencia de comportamiento para valorar la competencia de innovación. El punto de vista de alumnos y profesor en el caso de una asignatura de máster*. Paper presented at the Congreso Nacional de Innovación Educativa y Docencia en Red- Universitat Politècnica de València-Valencia 30/06/15 al 1/07/15.
- Marin-Garcia, J. A., Ramirez Bayarri, L., & Atares-Huerta, L. (2015). Protocol: Comparing advantages and disadvantages of rating scales, behavior observation scales and paired comparison scales for behavior assessment of competencies in workers. A systematic literature review. *Working Papers on Operations Management*, 2(6), 49-63. doi:<http://dx.doi.org/10.4995/wpom.v6i2.4032>
- Mol, M. J., & Birkinshaw, J. (2009). The sources of management innovation: When firms introduce new management practices. *Journal of Business Research*, 62(12), 1269-1280. doi:doi: 10.1016/j.jbusres.2009.01.001
- Patterson, F. (1999). *The innovation potential indicator. Manual and user's guide*. Oxford: OPP Ltd.
- Perello-Marin, M. R., Marin-Garcia, J. A., & Marcos-Cuevas, J. (2013). Towards a path dependence approach to study management innovation. *Management Decision*, 51(5), 1037-1046. doi:10.1108/MD-08-2012-0605
- Ramirez Bayarri, L., Marin-Garcia, J. A., & Atares-Huerta, L. (2016). How has been assessed the innovation competency in companies and universities? *Working Papers on Operations Management*, 7(in press), in press.

- Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of management Journal*, 37(3), 580--607.
- Schumpeter, J. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.
- Spiegelaere, S. D., & Gyes, G. V. (2012). Innovative work behavior: Concept & measurement. *ISPIM Conference Proceedings*, 1-1.
- Tonnessen, T. (2005). Continuous innovation through company wide employee participation. *TQM Magazine*, 17(2), 195-207.
- Vaccaro, I. G., Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2012). Management innovation and leadership: The moderating role of organizational size. *Journal of Management Studies*, 49(1), 28-51. doi:10.1111/j.1467-6486.2010.00976.x
- Watts, F., Garcia-Carbonell, A., & Andreu Andrés, M. A. (2013). *Innovation competencies development: Incode barometer and use guide*. Turku: Turku University of Applied Sciences.
- Waychal, P., Mohanty, R. P., & Verma, A. (2011). Determinants of innovation as a competence: An empirical study. *International Journal of Business Innovation and Research*, 5(2), 192-211. doi:10.1504/IJBIR.2011.038781
- West, M. A., & Farr, J. L. (1990). *Innovation and creativity at work: Psychological and organizational strategies*. Oxford: John Wiley & Sons.

Annex 1.- Comparative table of innovation competence models

	Marin-García, Ramirez Bayarri, & Andreu Andres (2015)	i-skills	Kleysen & Streer (2001)	Scott & Bruce (1994)	Waychal, Mohanty & Verma (2011)	Kirton (1976)	Berdows & Evers (2011)	Cerinek & Dolinsek (2009)
Creativity	Creativity	Creativity	Generativity	Generate ideas	creative ideas	Innovator	Creativity/innovation/change	Creativity
Critical Thinking	Critical thinking	Critical thinking Risk assessment	Opportunity exploration AND Formative investigation Championing AND Application	Searches out technologies, processes...	Industry vision stretch mindset		Ability to conceptualize Problem Solving/analytic Risk taking	Ability to Observe Curiosity
Influential Initiative	Leadership	Confidence/resilience/ Initiative/ entrepreneurship Project management		Promotes champions others Investigate secures founds Develops adequate plans	ownership to organization		Coordinating Decision making Leadership/influence Managing conflict Planning and organizing visioning	Autonomy Motivation Ambitiousness Intrapreneurship
External collaboration	Network	Networking			external networking relationships			
Internal collaboration	Teamwork	Negotiation Communication Leadership & teamwork Global Mindset Valorization			internal networking relationships		Communicating	
Value Added	Impact				focus on tasks /decision-making competencies	Adaptor		Intrapreneurship
Use of problem-solving tools		Problem Solving		Problem solving-style			Problem Solving/analytic	

