

An Adaptable Innovation Competence Framework - The Play4Guidance Framework and its Application

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Abstract. In this paper, we outline a Framework for Innovation Competences. The framework was developed using a mixed method approach and has been validated within the project Play4Guidance. The framework consists of key competence categories and competence descriptions including three proficiency levels. This framework can be used for building curricula of both, study programs as well as courses. We show how the framework was used in the design process of a digital business game. In particular, it was used to 1) set scope and contents of the business game, 2) to prioritize specific competences, and 3) to implement assessments and feedback. The results show that such a framework can be used meaningfully when designing and implementing courses and supporting digital tools.

Keywords: Innovation, Competence Framework, Innovation Competence

1 Introduction

Innovation is a key for businesses to be successful on a global marketplace, in particular for Small and Medium Enterprises (SMEs) [1] as well as regions and sectors [2, 3, 4]. In this article, we discuss how to create a framework for innovation competencies for individuals as a basis for organizational and individual development.

Innovation has been discussed from a variety of perspectives with a simple goal: to better understand which organizations develop successful innovations in complex markets. A variety of factors influence innovation processes, amongst them intellectual resources [5], learning capabilities [6], marketing capabilities [7] or networks [8]. The broad range of factors influencing innovation can be seen in research on success factors [9] or barriers [10] towards innovation. One key aspect in this research area is the contribution of individual and organizational competencies and capabilities [11, 12]. It is obvious that individuals contribute towards innovation success. However, it is not yet clearly understood which individual competencies are necessary to form a successful, innovative business. Furthermore, there are few frameworks which can be adapted for different contexts (e.g. markets) and target groups (e.g. for students, professionals).

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For this reason, we aim at answering the following questions:

- Which competencies are needed for individuals to successfully perform in innovation processes?
- How to build an adaptable competence framework for innovation / entrepreneurs?
- How to adapt the framework for designing a digital business game

In this paper, we discuss different competence schemes which have been developed in research and practice. As our analysis has shown, there is not a single standard (such as an “innovation curriculum”). To further explore which individual competences are necessary and different for certain target groups, we have performed a cross-European mixed-method study in different countries addressing different educational levels. The main result is a comprehensive framework for innovation competences. The framework specifies competencies including proficiency levels. The outcomes can provide guidance for organizations to develop their staff but also for curriculum development for different countries and educational backgrounds.

2 Innovation Competences

Most research on innovation focuses on explaining the innovation capability of a firm [13, 14, 15]. In the resource-based view of firms, capabilities comprise of (organizational) skills or processes to transform inputs into outputs of a greater worth [16, 17]. In our contribution, we focus on the individual contribution towards innovation, represented as competencies. These describe an organizational potential as competencies can be applied strategically to become organizational capabilities [18].

Generally, competencies can be defined as a “collection of skills, abilities, and attitudes to solve a problem in a given context” [19]. Thus, innovation competencies describe skills, abilities and attitudes to develop new technical, social or organizational ideas and corresponding processes and products covering all phases from idea generation to market entry. There is a strong relation to entrepreneurship competences: These should be integrated as entrepreneurship is one option to realize innovations [20].

There is no common methodology to develop competence frameworks. However, usually experts or even communities use different prioritization, feedback and consensus mechanisms (for example [21]). Competence frameworks, however, are the basis for curricula. Frameworks provide comprehensive concepts and their inter-relations. In the case of competencies, frameworks provide possible competencies which are then selected for specific curricula (e.g. for study programs or courses).

A first class of frameworks is based on (meta-)reviews. A starting point for the analysis on the current state-of-the-art on innovation competences is the comprehensive review by [22] distinguishing

- Entrepreneurial Competencies such as idea generation, environmental scanning, recognizing and envisioning taking advantage of opportunities

- Business and Management Competencies such as managerial experience, business operational skills, familiarity with industry, financial and budgeting skills, marketing skills, technical skills
- Human Resource Competencies such as delegation, motivation, hiring skills
- Conceptual and Relationship Competencies such as conceptual competencies, customer management, coordination, communication, decision making or analytical skills

As a second comprehensive approach, Morris et al [23] specify detailed competence descriptions for business as well as personal / social competences, amongst them Opportunity Recognition, Opportunity Assessment, Risk Management/Mitigation, Conveying a Compelling Vision, Tenacity/Perseverance, Creative Problem Solving/Imaginativeness. This framework is rather comprehensive but merges different competences so that these are complex to assess. Also, domain specific competences such as communication are not included which are frequently discussed in other sources.

While the above analyses focus on skills, Jain [24] performed a meta-analysis focusing on entrepreneurship motives and characteristics which can be seen as attitudes or affective competences: Examples are Achievement Motivation (Need for Achievement), Need for Independence/Autonomy/Personal Control, Need for Personal Growth and Development, Need for Social Recognition and Respect. While this analysis is comprehensive, it does not describe the specific competencies in detail and is thus not usable without interpretation bias.

Finally, the model by Deiling & Recker [25] relate organizational and individual capabilities to processes in open innovation settings. On the individual levels, skills are creativity, divergent thinking, business sense, architecture, development, marketing, operations and maintenance. Furthermore, the model contains affective competences such as motivation and attitude. The model is in particular when adapting frameworks to specific phases of the innovation process.

The second class of competence frameworks comes from practical contexts. As an example, Cooney [25] connects competence descriptions with guidance for application when starting a business, including the following categories: Technical Skills: skills necessary to produce the business's product or service; Managerial Skills: skills essential for day-to-day management and administration of the company; Entrepreneurial Skills: skills to recognize economic opportunities and acting effectively on them; Personal Maturity Skills: soft skills or attitudes such as self-awareness, accountability, and emotional skills.

Further models are considered by **industry consortia** such as the Consortium for Entrepreneurship Education [27]. Also, the European Commission [27] has provided a guide for educators for entrepreneurship education. These models aim at providing guidance for education and are usually based on experts and – methodologically – good practices. This kind of research focuses solely on non-rigorous observations from practice and are not reliable towards theory development. However, those can serve as an orientation for further investigation.

The last category of frameworks is based on empirical explorations and analyses. As an example, Izquierdo & Deschoolmeester [28] have derived the following competencies: Decision making, Innovative thinking, Identifying and solving problems, Having a different view of the market, Communication, Deal making and negotiation, Identifying business opportunities, Evaluating business opportunities, Networking, Team work, Team building, Intuitive thinking, Coping with uncertainties, Coping with stress, Taking calculated risk. While the analysis is also rather comprehensive, this study is related to undergraduate students and might not be transferable to other contexts and target groups.

As a final study, Wu [29] has conducted **expert interviews** to determine important entrepreneurial competencies: Analytical Thinking, Business Acumen, Client Service Orientation, Commitment to Learning, Communication, Conceptual Thinking, Order and Quality, Developing Others, Empathy, Expertise, Flexibility, Influence, Information Seeking, Initiative, Innovation, Organizational Awareness, Personal Motivation, Relationship Building, Results Orientation, Self-Confidence, Self-Control, Team Leadership, Verbal and Written Communication. This study has an appropriate level of detail and abstraction and is very comprehensive and well described. As only few studies are based on empirical work, are not suitable for our context, or are poorly explained or operationalized, we have chosen this approach as the basis for our further work. This choice does not limit us to the competencies proposed by [29]– the categories are mainly a starting point for further exploration, prioritization and validation. Summarizing this initial review, we have identified three main gaps in the domain of innovation competences:

- The broad variety of innovation competence models is in most cases not based on empirical evidence.
- Most competence models are not operationalized: in most cases, no proficiency levels are defined.
- Most models are normative whereas adaptation to certain contexts, situations or target groups are necessary.

3 Methodology

Our paper is based on a Design Science Research (DSR) approach [30, 31]. DSR connects the identification of current problems in practical contexts with the design of artifacts and evaluation [31].

Our initial problem statement is the lack of understanding which individual competences contribute to the success of innovation processes in different contexts. Especially for the European context, the European Commission defines entrepreneurship and thus innovation as one of eight key competences for the next decade [27]. However, as there is still a lack of understanding which and how to train competences for students and unemployed to increase employability [32, 27, 33].

As the initial starting point, we have done a broad literature review [34] to identify the main research gaps and to identify weaknesses in current solutions. As we have shown in the background, it is still necessary to explore the domain, in particular the

operationalization of competence frameworks. We therefore apply a mixed method approach [35] for the design phase of the proposed artifact: the comprehensive framework for innovation competences.

As a final step, the competence framework was validated in two cases: 1) designing courses and trainings, and 2) designing a business game for training entrepreneurs. In this paper, we focus on the second case study.

4 Innovation Competence Framework

In the following, we briefly show the competence framework: The initial step for the empirical part was to defining the competence framework. We used focus groups [36] in five countries and different contexts to identify missing competences and proficiency levels for different stakeholder groups: 1) Unemployed, 2) Students, 3) Teachers and Professionals: (N=151 - Greece n1=8, n2=3, n3=8, Turkey n1=20, n2=9, n3=9, Italy n1=20, n2=9, n3=9, Ireland n1=10, n2=8, n3=4, Bulgaria n1=7, n2=12, n3=15). The main outcome was a refined competence framework. As a second step, we performed a quantitative study in the countries involved. The survey [37] was the assessment methodology following the focus groups and literature review respectively. Accordingly, the aims were to 1) validate and enable to prioritize the competences for each target group, 2) identify missing competences and 3) identify proficiency levels. Based on the qualitative part of our study, we classified the competences mentioned and harmonized the terminology eliminating competences with different terms but same meaning. Additionally, we identified proficiency levels for each competence.

The framework is divided into competence categories which contain the competence descriptions. The following table outlines the categories and competences.

Table 1: Competence Descriptions

№	Category of competence	Description of the competence
1	Analytical Thinking	The ability to analyze problems systematically. Objectively assess the situation, including facts and events related to the business. Analyze alternatives, make choices for the development of qualifications, & focusing on perspective areas.
02	Business Acumen	The ability to discover opportunities and transform resources into performance Take matters into their own hands. Search, find and exploit new profitable opportunities for business development.
03	Client / Service Orientation	The ability to meet the needs of both internal and external customers. Ability to present the qualities and skills in the context of the benefits of products / services to potential customers. Ability to defend and justify the added value of their work in terms of the expectations of internal and external customers.

04	Commitment to Learning	The ability to actively pursue learning and develop competitiveness Proactive search and utilizing opportunities for further training, retraining and development of new skills that are needed to improve the organization and its workforce.
05	Communication	The ability to effectively receive and express information or feelings. Ability to understand ourselves and others. To present ourselves, our skills and ideas within different business contexts and situations. To understand the messages of others and to give effective feedback.
06	Conceptual Thinking	The ability to recognize patterns or trends in a problem Ability to apply theoretical knowledge and conceptual models in practical situations.
07	Order and Quality	The ability to reduce uncertainty and to control quality. Demonstrating good organization and knowledge of business etiquette. Demonstration of readiness to reduce uncertainty, knowing and observing specific standards, rules and requirements to ensure quality.
08	Developing Others	The ability to help others make progress Ability to work in a team and cooperation with others with a focus on others' personal and professional development. Demonstrate a willingness to share knowledge and experience.
09	Empathy	The ability to understand and respond to the concerns of others Ability to adapt and socialize quickly to the organization and individuals. Demonstration of readiness for understanding and commitment to the care of others.
10	Expertise	The ability to perform professional jobs. Expertise describes Professional competency in terms of domain knowledge and skills.
11	Flexibility	The ability to effectively adapt to a variety of situations. Ability to effectively adapt to new situations, environments and requirements. Striving to learn new skills and requalification. Tolerance to change and vagueness.
12	Influence	The ability to influence thoughts and actions of others. Ability to persuade, cope with opposition and influence the thoughts/behavior of others, assertiveness.
13	Information Seeking	The ability to find and capture information to increase knowledge or find solutions. Ability to use information and communication technologies. Finding and selecting the information necessary to solve problems. Ability to select appropriate sources to collate and assess the information, and to apply it in practical terms.
14	Initiative	The ability to be a self-starter and to meet the challenge of higher level objectives. Activity on the market to proactively develop an enterprise. Orientation to action. Exploring new opportunities and undertaking action related to successful business activities.
15	Innovation	The ability to make something new and to improve performance. Ability to create something new on the basis of which to launch a proper business project towards market maturity. Ability to show ingenuity, creativity, to generate and implement new ideas.

16	Organizational Awareness	The ability to recognize the power relationships in organizations. Create a realistic picture of the characteristics, nature and corporate objectives of the organization. Demonstrating commitment and clear understanding of the organization and its culture.
17	Personal Motivation	The will to succeed. Will and ambition for success in the realization on the market.
18	Relationship Building	The ability to build and maintain personal networks. Establishing and maintaining useful contacts that help finding information about business opportunities.
19	Results Orientation	The ability to set performance objectives, resulting targets and measures. Setting realistic goals and taking adequate measures in the process of business and personal development.
20	Self-Confidence	The ability to express oneself in a different / hostile situations. Ability to successfully present and express skills, potential and qualities in an environment that is skeptical about people with his/her social status. Objective assessment and confidence in their own abilities.
21	Self-Control	The ability to manage one's emotions under pressure or temptation. Ability to control your own thoughts, feelings and behavior. Keeping cool in contingency, tense and critical situations. Tackling and mastering states of stress and anxiety.
22	Team Leadership	The ability to create a favorable environment and mobilize people to succeed. Ability to express leadership qualities to demonstrate readiness, skills and experience to work with people, taking responsibility, communicating goals, planning, organization and control.
23	Basic competences	Ability to apply basic knowledge needed for running a business. Ability to apply basic related concepts such as mathematics, law, economics and finances
24	Decision making	Ability to make decisions. Ability to apply decision making models in different situations. Ability to find decision alternatives and information to support the decision process.
25	Personal determination	Ability and attitude to reach given objectives. Ability to positively react to different situations in an optimistic, determined, endurable manner

The full outcome includes proficiency levels (beginner, intermediate, advanced) which is provided as supplementary data to this article. The competence framework is a validated set of competencies which can then be used for different purposes:

- 1. Curriculum Building:** The competence framework can be used for building curricula for both, broad study programs as well as single courses or trainings. The competences need to be selected, prioritized and adapted to the context (e.g. if innovation competences are part of a broader curriculum such as engineering entrepreneurship). The competences would be prioritized and selected by stakeholders involving educators, researchers, practitioners etc.

2. **Course Design:** In this context, specific competences would be used. In most cases, only a few competences are trained in a single course. The competence descriptions are then used as the basis for the course outline.
3. **Competence Assessment:** In the third application, the proficiency levels are used for assessing the level of learners. For each competence, an assessment item is created and mapped to the proficiency levels.

The framework therefore can be used in different contexts. In the following, we show the use for designing a digital business game.

5 Case Study: Utilizing the Competence Framework for Designing a Digital Business Game

The competence framework was used in the European project Play4Guidance [38] which aimed at developing, implementing and validating a Business Game for training young entrepreneurs in five European countries. The following case study does not describe the full business game but focuses on the use of the competence framework in the design and development.

The Business Game is about managing a T-Shirt production company. The main interface allows to run the company using parameters for purchasing, production, marketing, sales and other decisions. The game is run in twelve periods, after each period intermediate results are displayed.

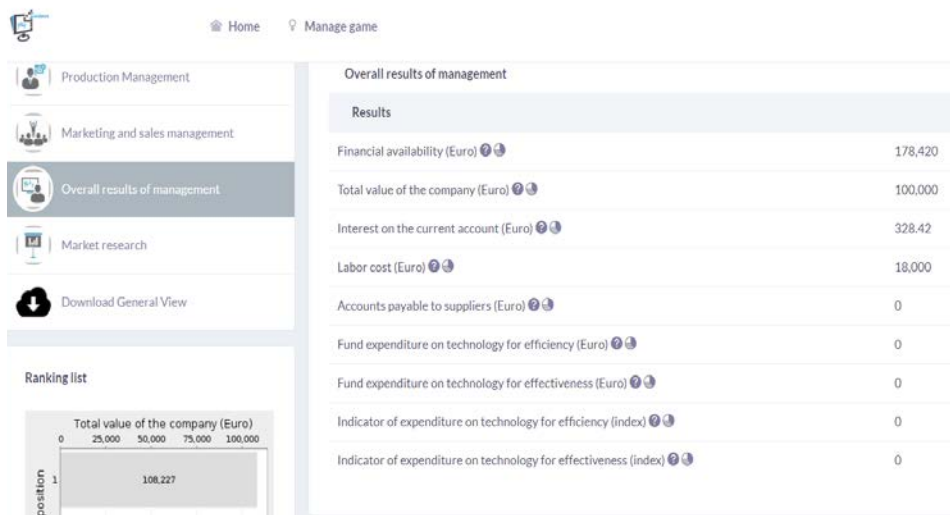


Figure 1: Play4Guidance result example

In the design process, experts were asked to prioritize competences for the Business Game. The competences selected were then mapped to (software development)

requirements for the business game and validated against their feasibility. As an example, affective competences (such as self-control or personal motivation) were excluded as they are hard to be trained in digital games. As an outcome, the following competences were selected and rated for each target group.

Table 2: Competence Rating

Competence Target Group	Analytical thinking	Business acumen	Commitment to learning	Order and quality	Expertise	Flexibility	Information seeking	Innovation	Results orientation	Decision Making
High School	3,58	3,59	3,49	3,41	3,38	3,32	3,52	3,60	3,53	3,98
Unemployed	3,45	3,47	3,60	3,39	3,35	3,49	3,46	3,46	3,61	3,77
University	3,42	3,47	3,39	3,45	3,16	3,31	3,56	3,47	3,53	3,82
Average	3,49	3,46	3,45	3,33	3,28	3,36	3,54	3,45	3,57	3,89

The ratings were then used as input for designing the game but also designing specific courses for each target group. Learning scenarios for different target groups and competences were thus built.

As part of the course design, competence assessments were designed. Each competence used in the game was mapped to certain game actions and decisions. As an example, the competence “Flexibility” is mapped to the choice of different suppliers within the stages of the game.

Result Orientation	The ability to set performance objectives, resulting targets and measures.	<ul style="list-style-type: none"> Growth of company value [25%] (<i>Do players increase company's value?</i>) Player's company value versus System's company value [25%] Strategy [50%] (<i>If the player hire new workers, does he invest the correct budget in training? Do players invest constantly?</i>)
Innovation	The ability to make something new and to improve performance.	<ul style="list-style-type: none"> New technology expenditure [50%] Player's actions that favour company's innovation [50%]
Flexibility	The ability to effectively adapt to a variety of situations.	<ul style="list-style-type: none"> Mix of suppliers chosen [50%] (<i>Do players use correctly the foreign supplier?</i>) Innovation dependence [50%]

Figure 2: Sample Competence - Action Mapping

As the final step of the game, a competence assessment and related feedback is given to the users. The feedback is also based on the competence proficiency levels of the framework.

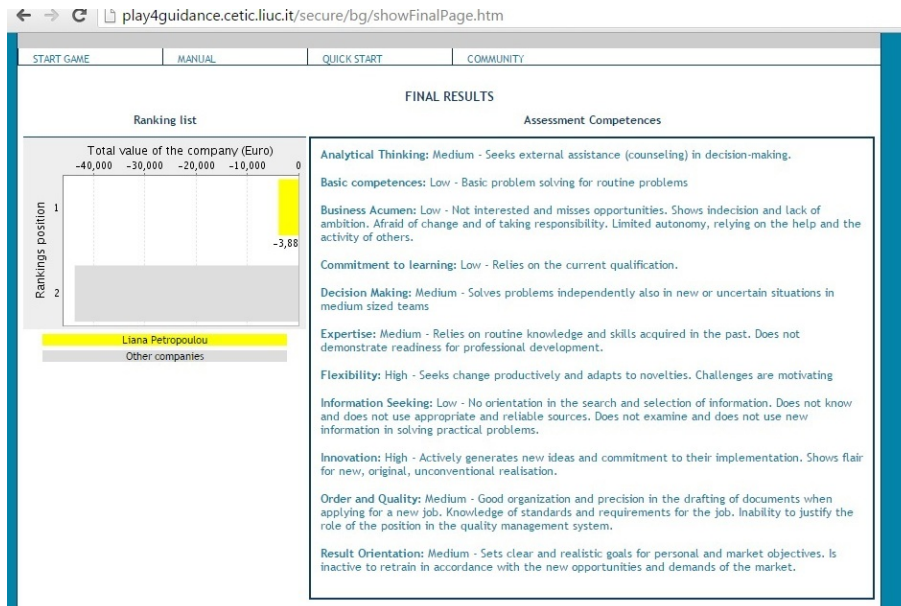


Figure 3: Assessment Feedback

The competence framework thus provides a solid basis for different parts of the game design, starting from building requirements to designing assessments and feedback.

6 Summary

In this article, we have outlined a framework for innovation competences and shown their use in the context of designing a business game. It has been shown that the framework strongly supports the design process, in particular for the design of contents, assessments and feedback. As a next step, we aim at testing the framework for curriculum building in different study programs and related courses.

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