

Skills and Competencies for Digital Transformation Initiatives

Development of a model to identify relevant skills and competencies for a company's individual digital transformation roadmap

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Abstract. The goal of this paper is to demonstrate the need for a structured method to identify skills and competencies that are required for a holistic digital transformation for a certain company in its particular environment. A framework called Transformation Compass, which includes all relevant business areas of an enterprise and where technology is seen as an enabler, serves as a starting point for the ascertainment of needed skills and competencies. The model developed as part of this research, named SkiCo (skills and competencies), maps the required skills and competencies based on the categories of the Transformation Compass. On top of that, SkiCo structures skills and competencies in three different levels: cluster, category, and sub-category and provides information about their origin.

Keywords: Skills, Competencies, Digital Transformation, Customer Centricity, Operational Excellence, Business Model, Organizational Excellence.

1 Introduction

The term *digital transformation* is frequently discussed in recent years since new technologies are emerging in a very high volume and with immense speed. Such new technologies bring many challenges, but on the other hand manifold opportunities for new businesses or business improvement [1]. "Real digital transformation isn't about getting your company to use a specific set of new technology; it's about your company's ability to react and successfully utilize new technologies and procedures – now and in the future" [2]. This statement of Lindsay Herbert emphasizes the difference of digitalization and digital transformation. Digitalization would mean to just implement new digital technology, but to successfully utilize it, it requires digital transformation.

Although the importance of digital transformation seems to be recognized, still the majority of companies struggles in acting effectively on this perception. A global survey with 340 participating organizations providing 1700 respondents identified four key hurdles: cultural issues, the presence of archaic IT systems and applications, lack of digital skills, and lack of clear leadership vision [3]. Similar results brought the study provided by the University of Applied Sciences and Arts Northwestern Switzerland about digital transformation of companies in Switzerland. The five major barriers of successful digital transformation were here named as missing know-how of executive managers, high expenditure of time, missing know-how of employees, little willingness to change of executive managers, and little willingness to change of employees [4].

The gap, which is being addressed by this study, is the lack of knowledge about the required skills and competencies. The current literature provides ideas and evidence about required skills and competencies for digital transformation, however, focusing on technical capabilities mainly. This refers to rather a digitalization of particular parts of a company (e.g. organizational units, products or processes) than the integral transformation of the whole company.

The terms skills and competencies are not very clearly defined in current literary contributions, as they are often intermixed. While for skills, the different definitions share some considerations, for competencies, the definitions are quite divergent. Skills are the ability to fulfill tasks in a particular environment applying knowledge [5]. For competencies, the current contributions rather relate to a person's ability to act in a certain situation, impacted by its personal attributes, experience, and motivation [6, 7-8].

Established frameworks for skills and competencies provide huge standardized collections and descriptions of skills and competencies, but without focusing on digital transformation. Those frameworks build a good starting point to determine or define skills and competencies in any area or industry. In addition, they give inspiration with regard to the structuring of a skills and competencies model. The main challenge with existing frameworks is to apply them meaningfully in the context of a certain company and to tailor them with regard to the identified focus areas and priorities of the digital transformation process.

With regard to skills and competencies for digital transformation, recent surveys amongst executive managers of world-wide acting companies pointed out, that the common understanding of the same refers to technical skills mainly [9]. However, other studies detected that this understanding is changing and companies ascertain, that for a successful holistic digital transformation, also other skills such as business acumen, entrepreneurship, critical thinking, agile mindset, and customer-centric design capabilities are more and more relevant [10,11].

The paper is organized as follows: in section 3, the definition of skills and competencies, based on definitions from the literature, is provided. Section 4 provides an overview and a description of four existing skills and competencies frameworks that were analyzed as part of this research. Based on this literature, the structure of a specific framework and approach for the identification of required skills and competencies is elaborated in section 5. Section 6 focuses on the evaluation of the developed framework. The last section presents the conclusion of this research paper.

2 Research method

The present research project followed a qualitative Design Research strategy since its main purpose was to develop an artifact to solve a practical problem. Doing so, the researchers at the same time added new knowledge to the body of scientific evidence [12]. Following the Design Research strategy, the SkiCo (Skills and Competencies) artifact was developed in five phases: awareness (of the problem), suggestion, development, evaluation, and conclusion [13]. To get a proper understanding of the terms digital transformation, skills, and competencies and to have an overview of existing skills and competencies frameworks, a literature review of these topics was conducted during the awareness phase. The second phase (suggestion) mainly focused on collecting requirements for the artifacts to be developed. This was done by excerpting requirements from the literature review and by holding expert interviews and joining expert meetings and group discussions. The focus of the following development phase was to develop a SkiCo model, to validate the model, and to improve and extend it based on the feedbacks collected by expert interviews. Further assessment of the artifact was done during the evaluation phase by testing it in a test scenario of a company. The conclusion phase summarized the outcomes of evaluation and the contributions of the developed artifact.

3 Definition of the terms skills and competencies

To achieve an understanding of the meaning of the terms skills and competencies, a literature review regarding literature with high relevance for definition or use of skills and competencies within the digital age was performed. As a result, a new definition, which combines the two terms skills and competencies, was developed. The research determined that in the existing literature the terms skills and competencies are not used consistently for both terms. In addition, there is no commonly used classification scheme. The definition of the terms varies especially for competencies, as there can be found quite different interpretations and inconsequent usage of the term.

Derived from the literature review, the following Table 1 lists definitions for the term skill.

Table 1. Overview of definitions for the term skill

Definition
A skill is an ability that is learned and practiced for a period of time (playing violin) [6].
Skills are used to designate the ability to use one's knowledge with relative ease to perform relatively simple tasks [8].
Skills are general tools and rules which are vital for the practitioner, covering general and context-independent knowledge only [7].
Skills are personal attributes that can be measured by quantitative measurement methods while having an objective character independent of the observer [14].
Individuals and jobs can be adequately characterized by defining a discrete set of skills – which might belong to a person's attributes or attributes required for a job [14].

As a conclusion, it can be said that all the definitions of the different authors have – besides the differences – something in common: a skill is looked at as a capability of a human that can be learned and is evolving over time. Furthermore, skills can be used to describe job characteristics as well as requirements for a certain position, but they do also describe a person's capabilities with regard to his or her working environment. Skills and their adapted level can be measured by the use of quantitative methods.

The definition of the term skill for the present research is determined by the authors as follows: *a skill is a capability that can be acquired by a human individual either by appropriate education/training or by on-the-job practice. Skills are measurable in two perceptions: first in their general existence and second in the level of mastery. Thus, skills are looked as techniques and methods that are needed to perform a particular position or role.*

Derived from the literature review, the following Table 2 lists four definitions for the term competencies.

Table 2. Overview of definitions for the term competencies

Definition
Competence of a person or group describes the relationship between the tasks assigned to or assumed by the person or the group and their capability and potential to deliver the desired performance [6].
Fulfilling complex demands and tasks requires not only knowledge and skills but also involves strategies and routines needed to apply the knowledge and skills, as well as appropriate emotions and attitudes, and effective management of these components [8].
Competencies refer to experience based and context-dependent knowledge. This means a competency can only be established if having enough organizational experience while acquiring context depending knowledge [7].
Competency is a proven ability to use knowledge, skills and personal, social, and/or methodological abilities in work or study situations and in professional and personal development [15].

As the discussion of existing literary contribution points out, also for the term competencies, a commonly used definition does not exist. The term is even used more inconsistently as the term skills. The term competencies is often used as a synonym of soft skills or people skills.

The following statement declares, how the term competencies is understood by the authors: *Competencies relate to a human's personal attributes that cannot be adopted easily as they are the result of a person's experience and self-development. Obtaining them helps a person to apply knowledge and use skills in a certain environment and context and to continuously improve the same. Competencies include motivation, emotions, and attitudes, but also strategies and routines.*

4 Related frameworks for skills and competencies

In order to understand how existing frameworks might be helpful in the development of the new instrument, existing and established frameworks for skills and/or competencies were reviewed by the authors. This research provided inputs for the development of a specific skills and competencies framework for companies to identify their specific demands for digital transformation.

The research revealed that the purposes of skills and competencies frameworks are manifold. Such frameworks can, for example, be used to improve the overview of supply and demand in labor markets. Another use in labor markets is to bridge the language gap from job descriptions to education and training in order to improve training schedules with regard to a specific job description [16]. Further applications of skills and competencies frameworks are an analysis of training needs, improving the individual performance review of employees and the development of continuous education packages for individual employees or groups of employees [17]. Furthermore, the research turned out, that no skills and competencies framework specifically for the needs of digital transformation exists. The analyzed frameworks rather represent huge collections of skills and competencies with a complex structure having many relations and interdependencies.

The selection of analyzed frameworks (DISCO, ESCO, SFIA and KODE[®]X) was made based on the relevance the frameworks hold in the literature, which was assessed by the frequency of mentioning in current literature. Other selection criteria were range and origin of the frameworks. Since the framework to be developed should fit for companies in a European context, mainly European frameworks were considered meaningful.

Table 3 shows the four different frameworks which have been analyzed for this research based on their main purpose and whether they are digital transformation (DT) specific or not.

Table 3. Overview of existing Skills and Competencies frameworks

Framework	Publisher	Main purpose
DISCO (Dictionary of Skills and Competencies)	European Commission and the Austrian Federal Ministry for Education, Arts and Culture	Enable standardized description of learning outcomes, so that they can be used for job descriptions, curriculum vitae's (CV's), and certificate supplements [15].
ESCO (European Skills/Competences, Qualifications and Occupations)	European Commission, department Employment, Social Affairs & Inclusion	Provide a reference terminology that makes the European labor market more effective and integrated and links both worlds, work, and training, more effectively together [18, 19].
SFIA (Skills Framework for the Informational Age)	SFIA Foundation, England	Provide a common language to define skills, abilities, and expertise specifically for work in information systems-related environments in a consistent way [20].

KODE®X (Kompetenz-, Diagnostik- und Entwicklungs-Explorer)	KODE GmbH, Germany	Support organizations or individuals in their definition of competency models and competency development. Target-/actual-comparison of competency portfolio. Support for competencies development with modular information and training programs [21].
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Each of the mentioned frameworks in Table 3 uses different classification patterns and structuring of skills and/or competencies. Unfortunately, a common pattern or structuring approach could not be determined. In order to further compare the four frameworks, an analysis regarding strengths and weaknesses was performed. Table 4 shows the highlights of that analysis.

Table 4. Overview of strengths and weaknesses of existing frameworks

Framework	Strengths	Weaknesses
DISCO (Dictionary of Skills and Competencies) [15]	<ul style="list-style-type: none"> - Well-grounded since it bases on existing national frameworks - Descriptive statements (phrases) specify skills and competencies more in detail 	<ul style="list-style-type: none"> - Very complex structure due to linkage and interrelation of the different element - Framework is not yet complete
ESCO (European Skills/Competences, Qualifications and Occupations) [18, 19]	<ul style="list-style-type: none"> - High acceptance and extension of usage - Very detailed description of each skill/competence 	<ul style="list-style-type: none"> - No clear definition and differentiation of skills, competencies and knowledge terms - Very complex structure
SFIA (Skills Framework for the Informational Age) [20]	<ul style="list-style-type: none"> - New versions released on a regular base - Clear and comprehensible structure - Description of the typical characteristics of every skill 	<ul style="list-style-type: none"> - Limited to skills only, competencies are not part of the framework - Limited to skills with regard to information and communication technology
KODE®X (Kompetenz-, Diagnostik- und Entwicklungs-Explorer) [21]	<ul style="list-style-type: none"> - Scientifically grounded framework - Clear definition of competency term 	<ul style="list-style-type: none"> - Limited to competencies, skills are not part of the framework - Limited to 64 predefined competencies

As the comparison reveals, all the four frameworks have their specific advantages but also disadvantages with regard to their extent, completeness, and structuring. An interesting finding out of the analysis of the frameworks DISCO and ESCO is that even in such standardized collections, the terms skills and competencies are not used distinctly, but are intermixed together which makes it quite challenging to understand the structure and use in a certain field of application.

Nevertheless, the four frameworks (DISCO, ESCO, SFIA, and KODE®X) that were reviewed in the context of this research represent good examples of established models that intent to be used by companies in practice. Their goal is to improve the skills and competencies management by classifying existing skills and competencies, discover

skills and competencies gaps, and determine needs for training and education within the different organizations.

However, the context of digital transformation is missing in all the analyzed frameworks, which makes them hardly reusable for the method developed as a part of this research project, which is broadly being introduced in the following chapter 5.

5 Development of a skills and competencies model – SkiCo

Based on the research results of chapters 3 and 4, this section focusses on developing an approach to help companies identifying the required skills and competencies for digital transformation. Accordingly, the developed skills and competence model, SkiCo, has a major use case, which is to enable companies to determine the required skills and competencies for their specific digital transformation roadmap. Furthermore, SkiCo has its own structure and classification scheme for skills and competencies and it provides information about the origin of skills and competencies.

5.1 Orientation on the Transformation Compass

The developed model, SkiCo, highly relies on the output of the Transformation Compass, a framework-based method that helps companies, just like a compass, to define their strategic alignment [22]. The output of both tools, the Transformation Compass and SkiCo, must be incorporated into a Strategy Map, which serves a company as a high-level transformation roadmap. In summary, SkiCo provides information about the required skills and competencies and their point of origin for a particular company in a given situation. It delivers the need for skills and competencies based on the output of the Transformation Compass, which is composed out of four main building block and fifteen main categories, as listed in Table 5.

Table 5. Overview building blocks and main categories of the Transformation Compass

Customer Centricity	Operational Excellence	Business Model	Organizational Excellence
<ul style="list-style-type: none"> • Customer Attention • Customer Interaction • Customer Experience • Customer Involvement 	<ul style="list-style-type: none"> • Strategic Management • Process Excellence • Corporate Management 	<ul style="list-style-type: none"> • Cooperation • Market Growth • Innovation 	<ul style="list-style-type: none"> • Change Management • Collaboration • Knowledge Management • Leadership Management • Corporate Culture

The output of the Transformation Compass, which defines focus areas and priorities of the digital transformation process, is taken as input for SkiCo.

5.2 The structure of SkiCo

One of the major requirements for the development of the new model was the need to have its own structure besides the Transformation Compass' main categories. The reason for this was the benefit of enabling better clustering of skills and competencies and to provide information about how and in which context skills and competencies can be acquired. Furthermore, an additional structure enables the usage of the model aside from the Transformation Compass. The model thereof consists of the following three structural levels:

- Level 1 – Cluster: main classification element, differentiates skills and competencies
- Level 2 – Category: splits both clusters into two categories each
- Level 3 – Sub-Category: two sub-categories for each category, eight sub-categories in total

These three levels of the SkiCo, with the corresponding components, are illustrated in Figure 1. The objective to structure the SkiCo model like this is to have the capability to map each existing skill and competency into this model so that it enables a structured representation of possible required skills and competencies for e.g. a role or a specific digital transformation task.



Fig. 1. Structure of SkiCo

For every single main category of the Transformation Compass, relevant skills and competencies have been identified by means of a literature review. The results have been collected and stored within an Excel spreadsheet in order to be capable of sharing this outcome with anyone as well as to have a structured artifact, which can easily be imported into any software tool. The SkiCo spreadsheet is one of the central artifacts and the major deliverable of this research. In total, 420 skills and 177 competencies were collected during the research and are captured in the SkiCo spreadsheet. Several skills and competencies are valid for more than one of the building blocks and are relevant to several main categories of the Transformation Compass. Thus, every skill and each competency is mapped to the corresponding building blocks and main categories. Furthermore, all skills and competencies are assigned to SkiCo's three structural levels.

5.3 Working with SkiCo

The major use case of SkiCo is to serve companies that are in a digital transformation as a tool to identify required skills and competencies for their individual digital transformation roadmap. Hence, the standard approach to apply it is to navigate from the Transformation Compass' main categories to SkiCo's clusters, then to SkiCo's categories and sub-categories. This process is shown in Figure 2.

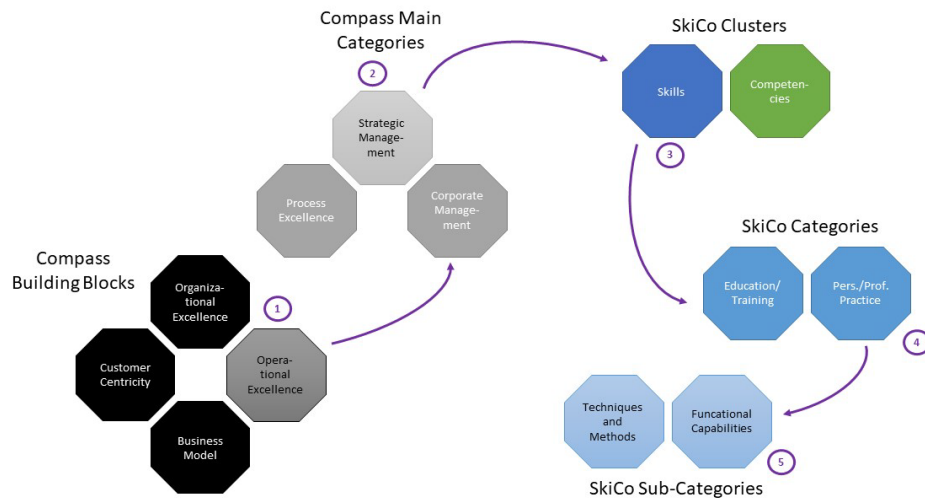


Fig. 2. SkiCo major use case

The standard navigation path from the Transformation Compass to relevant skills and competencies looks as follows:

1. A user (for example a transformation consultant) starts with the Compass' building block of his interest, like Operational Excellence in the above-given example.
2. Next, the user defines the relevance by selecting the appropriate main category within the Transformation Compass, like Strategic Management in the above-given example.
3. At this stage, the transition from Transformation Compass into SkiCo takes place by choosing the SkiCo cluster, which is either skills or competencies for the chosen main category of the Transformation Compass, like skills in the above-given example.
4. Based on the cluster, a drill down into the SkiCo category can be done, like Personal/Professional Practice in the above-given example.
5. By choosing the required SkiCo sub-category, the user will receive the appropriate skillset related to the chosen sub-category, like Functional Capabilities in the above-given example.

SkiCo's interaction with the Transformation Compass is not limited to the above-described use case. There are many other possibilities for linking the SkiCo with the Transformation Compass.

5.4 Outcome of SkiCo

The output of the Transformation Compass is the typical starting point for SkiCo. Based on the focus areas and priority derived by the Transformation Compass, SkiCo will provide a list of skills and competencies that are needed for the given situation. Furthermore, SkiCo holds the information how a certain skill might be acquired, either by education and training or rather by personal and professional practice, and where a particular competency originates, either in personal and professional experience or in motivation and attitude. The output of both instruments, Transformation Compass and SkiCo, must be incorporated into the Strategy Map, which serves a company as high-level digital transformation roadmap, and is part of the overall research project out of which the SkiCo was developed. In summary, SkiCo provides information about the required skills and competencies and their point of origin for a particular company in a given situation. It delivers the need for skills and competencies based on the output of the Transformation Compass.

6 Evaluation of SkiCo

In order to evaluate the SkiCo model and SkiCo spreadsheet, different evaluation techniques were applied:

- SkiCo model: evaluation by various *expert interviews*
- SkiCo spreadsheet: evaluation by application of a *practical test case* with a company scenario

The focus for the evaluation of SkiCo model was set to completeness, comprehensibility, meaningfulness, deepness of the structure, clarity of the naming, relevance, and suitability for practice. Interview partners were experts in the area of digital transformation, human resources, and skills and competencies frameworks. Major findings out of this part of the evaluation were continuously incorporated into the SkiCo model. An important change, based on the interview outcomes, was the renaming of the categories. For example, the category "Professional Experience" was renamed to "Personal and Professional Practice" and category "Personal Experience" was renamed to "Personal and Professional Experience". This renaming improved the comprehension of the categories by the experts. Other findings were declared as potential future improvements, for example, the mapping of skills and competencies to more than one SkiCo sub-category or the addition of a short description to each skill and every competency.

For the evaluation of SkiCo spreadsheet, a company scenario was applied in the online version of the Transformation Compass tool. The output of this evaluation was taken as input for the SkiCo spreadsheet. From a practical point of view what was done in this session was taking those main categories that were assessed with high priority and using the same main category as filter criteria in the SkiCo spreadsheet in order to get the appropriate list of skills and competencies. Afterward, this list was reviewed and discussed with a digital transformation expert. A major outcome of this evaluation was that the SkiCo spreadsheet delivers, what it actually is expected to deliver, a list of skills and competencies that are needed for a given business area, represented by the

Transformation Compass' main category. However, to identify the skills and competencies gap, it is essential that a company has a skills and competencies inventory available to compare it with the SkiCo outputs. Furthermore, to improve the incorporation of the output of the SkiCo spreadsheet into the Strategy Map, it may be helpful to compose roles or role profiles out of the list of skills and competencies that are delivered by the SkiCo spreadsheet.

7 Conclusion

Companies that are running through a Digital Transformation are facing various challenges. One of the major challenges is to identify the proper set of skills and competencies that is required for a holistic digital transformation approach for the particular environment and situation of a certain company.

This research developed a skills and competencies model (SkiCo model) and a collection of skills and competencies (SkiCo spreadsheet) that fit perfectly into the Transformation Compass, a holistic strategy alignment method that supports companies to set priorities and focus areas of the particular digital transformation roadmap. SkiCo enables companies to identify the required skills and competencies related to the same focus areas and priorities. The outputs of the Transformation Compass and SkiCo spreadsheet are directly incorporated into the Strategy Map, which represents the high-level digital transformation roadmap for a company.

Furthermore, the SkiCo model has its own structure which was defined in three levels: SkiCo cluster, SkiCo category, and SkiCo sub-category. This structure helps companies to achieve a better overview of required skills and competencies. Moreover, it gives information about their origin. For example, for skills, whether they can be acquired by education and training or rather by practicing on-the-job and for competencies, whether they base on a person's background and experience or on general motivation and attitude. With the help of SkiCo, a company is capable of identifying a set of skills and competencies that are vital to run their individual digital transformation journey, by referring to the outcome of the Transformation Compass.

However, the developed SkiCo artifacts are also useful without having the direct context of the Transformation Compass. The Transformation Compass and its main categories represent a holistic view of a company's organizational components and core activities. Since the SkiCo model is based on this structure, it also offers an overall viewpoint on skills and competencies that are relevant in an organizational context, which is useful for companies in any case.

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