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## Qualifications Frameworks and the Underlying Concepts of Education and Work – Limits and Perspectives

Bremen : Institut Technik und Bildung 2014, 42 S. - (ITB-Forschungsberichte; 55)



Quellenangabe/ Reference:

Hupfer, Barbara; Spöttl, Georg: Qualifications Frameworks and the Underlying Concepts of Education and Work – Limits and Perspectives. Bremen : Institut Technik und Bildung 2014, 42 S. - (ITB-Forschungsberichte; 55) - URN: urn:nbn:de:0111-opus-91036 - DOI: 10.25656/01:9103

<https://nbn-resolving.org/urn:nbn:de:0111-opus-91036>

<https://doi.org/10.25656/01:9103>

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ITB-Forschungsberichte  
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**55**

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ITB-Forschungsberichte 55

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ISSN 1610-0875

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## **Zusammenfassung:**

Neben dem europäischen Qualifikationsrahmen wurden inzwischen auf nationaler Ebene in allen Mitgliedsländern der Europäischen Union Qualifikationsrahmen entwickelt und implementiert. Trotzdem gibt es eine weitere Diskussionsebene, wo der Frage nachgegangen wird, ob sektorbezogene Qualifikationsrahmen entwickelt und implementiert werden sollen. Das Für und Wider hat viele Aspekte. Dieses Spannungsfeld wird im vorliegenden Forschungsbericht beleuchtet und es werden Rückschlüsse für die weitere Diskussion gezogen.

## **Abstract:**

Apart from the European Qualifications Framework, further qualifications frameworks have meanwhile been developed and implemented on a national level by all Member States of the European Union. Nevertheless there is another level of discussions dealing with the question whether self-related qualifications frameworks should be developed and implemented. The pros and cons for such frameworks are manifold. This field of controversy is highlighted in the present research report and conclusions are drawn for further discussions.

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# 1 Aim of the paper and hypotheses for analysis

This paper sets out to analyse the structuration principles and the aspiration level of five sectoral frameworks<sup>1</sup>, namely

- the European e-Competence Framework,
- the automotive sector framework service and repair,
- the sectoral framework construction,
- the sectoral framework logistics and
- the 4ING sectoral framework for graduates in engineering and computer science.

A sector related qualifications framework (SQF), or sectoral framework in short, includes qualifications and competences (learning outcomes) that are relevant in a specific economic sector. From the point of view of vocational education, a sector is an area of expertise that is concerned with comparable or similar work tasks and work processes and has similar production or service structures. This definition is based on the “Nomenclature statistique des activités économiques dans la Communauté européenne” (NACE). This Statistical Classification of Economic Activities in the European Community allows for a differentiated view of sectors, e.g. the automotive sector, by distinguishing between manufacturing, service, maintenance and sales (cf. Hess, Spöttl, Tutschner 2005: 16, 17). The sectoral approach is most suitable for developing solutions for education in the European and international contexts with a view to improving the realisation of European cooperation in Vocational Education and Training (VET) (cf. Hess, Spöttl, Tutschner 2005: 15).

The analysis of sectoral frameworks aims to draw conclusions for the design of SQFs and, if applicable, National Qualifications Frameworks (NQFs), and to investigate the applicability and the use of the European Qualifications Framework (EQF). The last-mentioned issue also refers to the controversial position of the European Commission (EC) that qualifications and competences cannot be referenced to the EQF directly (direct mapping approach) but only via National Qualifications Frameworks (NQF mediated approach) (cf. Coles et al. 2011: 10)<sup>2</sup>. An “NQF mediated approach” of this type is inconsistent with the sectoral approach referring to the European countries, and it can be expected to work as a counter-productive, bureaucratic hurdle in practice.<sup>3</sup>

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<sup>1</sup> The development of the sectoral frameworks presented here took place in the Leonardo da Vinci sub-programme of the Lifelong Learning Programme (with the exception of the e-competence framework).

<sup>2</sup> Coles, Mike u.a. (2011): Referencing National Qualifications Levels to the EQF- European Qualifications Framework, Series: Note 3, Luxembourg. The passage on p. 10 reads:

*“There are no qualifications directly referenced to the EQF and there is no process envisaged to make this a possibility. Only national qualifications levels are formally linked to the EQF through the referencing process [...]. In other words a concrete qualification will be described by an EQF level only because the qualification has an agreed level in the national system and it is the system that has been referenced to the EQF. If the formal link between the qualification and a national system (...) is missing, there is currently no procedure for linking the qualification to the EQF. [...] There are many qualifications that exist outside national systems, for example those awarded by professional bodies for business sectors or those awarded by international companies or certificates awarded by international companies or certificates awarded by the volunteering organizations. As said above, there is currently no mechanism for describing the EQF level of these qualifications other than through national qualification systems....”* (p. 10).

<sup>3</sup> Another problem is that the sectoral description of learning outcomes may lead to other levels than the description by the NQF.

The framework analysis needs to be preceded by a discussion of the structure and the deficits of the concept of qualification and competence in the EQF, which has been adapted by some partner countries (e.g. Malta) in their NQFs – mostly for lack of conceptions of their own. The second step will be to analyse the “aspiration level” of sectoral frameworks, which is determined by their more or less implicit understanding of qualification, competence, education and work. Two groups of frameworks can roughly be distinguished: frameworks whose descriptors reflect merely market oriented requirements and employers’ perspectives, and frameworks whose descriptors include additional claims to education that go beyond a partial market perspective. Here one might point at a statement by the Deutsche Gesellschaft für Erziehungswissenschaften (DGfE) criticising the narrow perspective on education and work in the EQF and the German Qualifications Framework (DQR) (DGfE 2011). According to the DGfE statement the conception of the EQF and the DQR is dominated by the perspective of fulfilling functions in work and economic processes. The statements say that this unbalanced concentration on functions in the economic sphere is inappropriate and insufficient for the description of desirable outcomes of educational, training and learning processes (cf. DGfE 2011: 2). Particularly unacceptable features are “the bracketing of linguistic and cultural competence” and of “normative and ethical aspects of personality development” as well as of “intercultural competence”. According to the statement this is “incompatible with the claim that the descriptor ‘personal competence’ should cover social and self-oriented competences”. What is also considered not quite plausible is the fact that the skills related to “new solutions” are mentioned only from level 6 onwards, and “the general restriction of ‘social competence’ with regard to the management of teams or the self-competent reflection of possible societal, economic and cultural effects” of objectives and tasks to the highest levels only (cf. DGfE 2011: 3 [own translation]).

These considerations lead to four hypotheses to guide the analysis with a view to problems of referencing and comparability of qualifications and competences acquired in European countries. The hypotheses to explain these problems are the following:

1. There are different interpretations of the notions of qualification and competence.
2. There are different aspiration levels of frameworks, based on the implicit understanding of education and work.
3. There are different and more or less empirically backed “sources” that are used to describe qualifications in terms of actual or desirable “learning outcomes” (training regulations, curricula, examinations, job descriptions, business processes, work processes, informal and non-formal learning processes).
4. This leads to the fourth hypothesis: The EQF, which is intended as a meta framework for all frameworks, turns out to be deficient when it comes to the referencing (via NQFs) of qualification profiles, competence profiles and occupational profiles that were identified on the basis of empirical work-process-analyses and are based on the principle of *vocationalism* as well as on professional acting competence, and which build on the idea that work processes and the work

organisation can be shaped.<sup>4</sup> This can be shown at the example of the automotive sector framework service & repair.

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<sup>4</sup> This applies also to the DQR descriptors.

## 2 The fragmented concept of qualifications in the EQF

The EQF defines qualification as a bundle of learning outcomes in the dimensions (descriptors) knowledge, skills and competence (k/s/c), which are referenced to the eight qualification levels of the EQF.<sup>5</sup>

Accordingly competence is seen in the EQF structure as an isolated category, or rather a fragment of qualification. This fragment addresses only the “soft skills” *autonomy* and *responsibility*. In contrast, vocational education in countries with elaborate VET systems like Germany or Austria follows a different understanding of competence. Qualification is defined here as holistic professional acting competence, consisting of professional competence (knowledge, capabilities and skills) and personal competence (social competence and independence/dt. *Selbständigkeit*).

These different interpretations and formal descriptions of competence – as a dimension of qualification or as holistic professional acting competence – are structurally incompatible and can cause problems with regard to the referencing of qualifications to the EQF.

This compatibility problem is aggravated by the use of different descriptors in the various frameworks (see the DGfE statement mentioned above). Whereas the EQF views *competence* as autonomy and responsibility – these characteristics are also referred to in the Employability Grid according to Thiel (cf. Thiel 2011) –, the DQR and the sectoral frameworks to be analysed include, in the category of “personal competence” (social competence and independence), additional competences like reflexivity, learning competence, communicative competence, team/leadership competence and co-shaping. These are not captured by the EQF. In addition there are conceptual inconsistencies that make referencing difficult. For instance, the EQF uses the term “autonomy” (freedom to decide) while the DQR and, if applicable, SQFs use the term “independence” (freedom from external control). These two terms are no synonyms. Independence exists already when assignments or routine tasks are fulfilled without external control or supervision. Professional autonomy is more than that. It means self-defined and self-determined activity and decision. These activities or decisions are neither assigned nor explicitly formulated as learning objectives or tasks. Unlike independent agency, autonomy presupposes some *discretion* to do something one way or another, or not at all.<sup>6</sup> Autonomy is necessary for tasks that cannot be performed according to some plan or with the help of certain routines. This is the case, for example, when new problems arise in the production process or in the handling of materials for which no “state of the art” solutions are available yet, in situations of strategic decision making, or in the case of technical innovation (research and

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<sup>5</sup> The levels 1 and 2 are usually filled with simple semi-skilled jobs. The levels 3-5 are reserved for qualifications below the academic level, which are acquired in Germany and other countries such as Austria or the Netherlands in the system of dual VET or in school-based VET programmes. The levels 6-8 represent the academic levels Bachelor, Master and doctorate.

<sup>6</sup> In vocational education there is a distinction of modal programming and final programming of tasks. Modal programming means that the courses of action and the methods are defined with a view to achieving a specific learning outcome or work result. Final programming means that only the target result is defined but not the way to get there. In the first case there is “only” independent activity whereas in the case of final programming one can already speak of autonomous learning or working. Autonomy refers to the opportunity to make one’s own decision about the way to reach the target. A third level refers to the autonomy with regard to strategic (management) or professional decisions and activities (e.g. research and development) where the results are open.

development). Seen from this point of view, autonomous agency starts only at EQF level 5 while the levels 1 to 4 describe the different stages from guided to independent and self-responsible learning and work. However, the use of two different terms in the DQR (Selbständigkeit, engl. independence) and the EQF (autonomy, dt. Autonomie) is made invisible in the English translation (version) of the DQR by adopting the EQF term autonomy. (If the Germans would have wanted to use the term autonomy in the DQR they could have used “Autonomie”).

*Ultimately the incompatibility of concepts and descriptors as well as the incompatibility of the EQF's concept of qualification (K/S/C)<sup>7</sup> with the concept, prevalent in vocational education, of qualification as comprehensive acting competence put into question the use and the successful implementation of the EQF.<sup>8</sup>*

But the critique needs to address a deeper level, namely the inconsistency of the k/s/c (knowledge/ skills/ competence) structure of the EQF. The reason is that, contrary to the formal representation, the categories are not necessarily located at one and the same level but stand in a hierarchical relationship instead. Moreover, the definition of *competence* exhibits a lack of conceptual distinction from knowledge and skills<sup>9</sup>: “‘Competence’ means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.”<sup>10</sup>

*Competence* is thus defined in a twofold way: first, as autonomy and responsibility; second, as proven ability to use knowledge, skills, personal, social and/or methodological abilities. There is a rupture between these two definitions. Thiel (2011) interprets the definition in the sense that *competence* is a meta-category that steers or rules knowledge and skills or their application. But can knowledge or skills be steered? And how can competence steer knowledge or skills? Another problem is that autonomy and responsibility (competence) can be described not only as individual “abilities”, but also as organisational requirements or responsibilities, which is not the same thing. When the EQF – as it is stated – describes competence as the ability to use (or to steer?) knowledge, skills and various types of abilities, this is not only difficult to understand, but also a tautology. For this is tantamount to maintaining that autonomy and responsibility consist, among other things, in the ability to utilise personal attributes like

<sup>7</sup> K/S/C = Knowledge, Skills, Competence

<sup>8</sup> According to Hoffmann (2009) this incompatibility is the “fault” of those who do not apply the EQF qualifications grid. This argument fails to recognise that establishment of NQFs is the responsibility of the participating countries. Countries that have their own elaborate terminology will not be prepared to replace it with a European conception that contradicts their own national traditions.

<sup>9</sup> Concerning the problem of levels see also Thiel: “If knowledge, skills, and competence are considered separate columns which independently from each other have been described for eight levels, then the EQF is not a good tool for this purpose. (...), and thus many debates of the EQF have dealt with the issue how it is possible to determine the level of a qualification which refers to level 4 with regard to knowledge, but to level 3 with regard to skills. However, if we have a look at the definitions of knowledge, skills and competence to be found in the Annex of the legal EQF text, we discover that these categories by no means are to be understood as descriptions standing equally side by side, but are related to each other in an hierarchical sequence...” (Thiel: Draft Employability Grid, 4.11.2011: 8, [http://www.project-nqf-sqf.eu/fileadmin/Dateien/Workpackages/WP2/NQF-SQF\\_WP2\\_de07\\_empgrid\\_final.pdf](http://www.project-nqf-sqf.eu/fileadmin/Dateien/Workpackages/WP2/NQF-SQF_WP2_de07_empgrid_final.pdf)).

<sup>10</sup> Cf. Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning, Annex I. Quoted from Thiel, Gerald: Draft Employability Grid, 11. 04. 2011: 8.

autonomy and responsibility. And it is almost unthinkable what to make of it when autonomy and responsibility are specified with a view to the interaction with others (“action with regard to action of others”) and to the (shaping of) work contexts (“action with regard to context”) (see EQF and Thiel 2011: 13). It must also be criticised that the specification of autonomy and responsibility tends to ignore the professional tasks that have to be fulfilled in an autonomous and responsible way as well as the level of these tasks. This reductionism is inherent in the EQF and becomes visible through the Employability Grid, which reconstructs the implicit logic of the EQF.<sup>11</sup>

If, in spite of all criticism, one pursued further the idea that competence (autonomy and responsibility with regard to the interaction with others and the organisation of work contexts) is the decisive criterion for referencing and controls knowledge and skills, one would come to the conclusion that the hierarchical level of competences indicates or determines the general level of qualification or competence (professional competence or knowledge and skills). A painter, decorator or hair stylist who works in a small enterprise or family business and who is “autonomous” in every aspect would belong to a higher qualification or competence level than an engineer who has a Ph.D. but lacks managerial responsibility or the competence to organise his work and learning environment on his own. This is the case in enterprises which distinguish between specialist hierarchy (no managerial responsibility) and line organisation (managerial responsibility). Here the design of learning and work contexts is conceived by specialists (consultants, who cooperate with staff if applicable). The idea of a linear relationship between the level of autonomy and responsibility (competence) and the level of knowledge and skills therefore seems not to be plausible. Moreover, the formulation of the EQF descriptors follows the hierarchical positions and corresponding requirements in the classical line organisation (differentiated into 8 hierarchical levels like the EQF). This is not compatible with other empirical types of enterprise organisation such as matrix organisation or small business.

There is another aspect that is relevant for the operationalisation of autonomy and responsibility in the context of frameworks. The two characteristics are *discrete* variables, that is, autonomy and responsibility are in place or not. This rules out a quantification in the sense of “more” or “less” autonomy or responsibility as a criterion for referencing.<sup>12</sup> The crucial point for referencing is rather the question what autonomy and responsibility are referring to. The difference between responsibility and autonomy also needs to be pointed out. For instance, there might be the requirement to perform a task responsibly, but the competences or powers to do this autonomously might be missing. For example, project managers might be responsible for the implementation of projects in line with the budget and the time frame, but at the same time lack the competence to recruit the required staff from the different departments. The different

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<sup>11</sup> A translation device like the Employability Grid cannot mend the deficits and design faults of the EQF. Instead the aim was to reconstruct as far as possible the implicit logic of “levelling” competence. “In order to (...) identify – as far as possible – the implicit logic used for levelling *competence* the following procedure is applied: (...) The *actions* to which *competence* refers and their *context*, the field of work or study within which action takes place, shall be considered in order to identify *hierarchical relationships* based on a uniform principle” (Thiel 2011: 11).

<sup>12</sup> Cf. the description of EQF level 2: “work or study under supervision with *some* autonomy” or the description of level 4: “taking *some* responsibility for the evaluation and improvement of work or study activities” Here an explanation of what is meant by “some” would be helpful (see also the criticism in Thiel 2011: 10).

meanings of competence as authority (dt. Befugnis) on the one hand and individual ability on the other is not taken into account in the EQF.

Taking into consideration the fact that autonomy and responsibility depend on various factors such as the size and type of an enterprise and its organisational structure, the limited applicability of the EQF is fairly obvious.

### 3 Employability and vocationalism as reference models for frameworks

The question how to generate qualifications frameworks, and on which basis, depends essentially on the underlying model of qualification for the world of work: employability or vocationalism. Whereas the qualification for the labour market below the level of higher education in Germany, Austria, Switzerland or the Netherlands follows the principle of *vocationalism*, the education and training policy of the European Commission is based on the notion of *employability* (cf. Greinert 2008: 10). Thus the Anglo-Saxon concept of employability became the reference model for the European Qualifications Framework and a number of other frameworks (SQFs<sup>13</sup>, NQFs) whose design in terms of the concept of qualification and the descriptors used follows the EQF.

In contrast to vocational education, which is traditionally input oriented in the first place (principle of occupations), the EQF aims at an output oriented or learning outcome oriented description of qualifications (k/s/c), irrespective of the pathways, models and systems of qualification for the labour market. This begs the question as to whether the EQF can fulfil the function of a meta-framework (i.e. a framework of frameworks). If descriptors are identified on the basis of the employability model, then it has to be expected that these descriptors are in principle inadequate for representing qualifications that are achieved in the system of dual vocational education and training, that is, qualifications based on the model of vocationalism. To put it another way: The EQF can only be a meta-framework for frameworks that unambiguously follow the model of market oriented employability and adapt the EQF qualification structure. This undermines the aspiration of the EQF to allow for competence assignments that are independent of the national VET systems and the processes of competence acquisition. This is likely to be an obstacle to the successful implementation of the EQF, especially in those countries that have elaborate systems of vocational education. The Employability Grid by Thiel (2011) is narrowly focusing on employability in the Anglo-Saxon sense, too. A consequence would be to aim at “adaptive qualification” alone, which is sure to be rejected by those who view vocational education as more than just preparation for jobs, and insist on its formative role.

Whereas vocationalism is connoted with the development of an occupational identity that aims at the mastering of the professional domain and the integration of specific competences into a holistic professional acting competence (technical competence, methodological competence, learning competence etc.), the principle of employability<sup>14</sup> is associated with rather general dispositions and attitudes that correspond to the market based and competitive features of a dynamic and globalised economy, especially the “disappearance of long-term contracts” (Priddat 2002: 65-89): Flexibility, mobility, autonomy, competitiveness and self-responsibility characterise the

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<sup>13</sup> SQF = Scottish Qualifications Framework.

<sup>14</sup> The model of employability is focusing only on the functional work requirements of the market (the enterprise) and is in line with a new concept of performance. “Unlike the traditional methods of evaluation, performance is not defined in terms of behaviour, that is, as a particular way of employing one’s labour. What counts as performance is not the intensive and purposive efforts – these are presupposed, as it were – but the degree to which tasks are fulfilled that were defined in the negotiations for the target agreement. This is a recursive concept of performance; it is not the labour itself that is observed (evaluated) but the approximation of a state of affairs that has been specified as a target before” (Bender 1998: 35).

“flexible man” (Sennett 1998) and the “labour entrepreneur” (cf. Voss/Pongratz 1998)<sup>15</sup> as prototypes that represent these market oriented dispositions and orientations.

From the perspective of a critical vocational education the model of employability has become a purely market oriented principle of economic gain, abandoning any normative concept of work. Educational and vocational-pedagogical principles of a humane organisation of work and learning processes in accordance with the educational ideals of humanism or the enlightenment are left out. Instead, the model confirms the submission of the employees to the rules of the market (cf. Greinert 2008: 10), the justification being: “Anyone who doesn’t do this, or not enough, will be eliminated from the market without mercy” (Miegel 2005: 79 and Sennett 2006 quoted in Greinert 2008: 10).

From the perspective of vocationalism it seems to be especially problematic that the model of employability does not take into account *subject oriented* dimensions of education and work such as representation, participation, personality development, deployment of potentials, identity development as well as ethical and moral aspects (cf. DGfE 2011) and that professional and social competence play only a minor role (cf. Kraus 2006: 64 and Gazier 2001 quoted in Greinert 2008: 9).

In contrast to the opinion that employability and vocationalism are two incompatible paradigms of qualification for the world of work, and against the pessimistic thesis of an “erosion of the concept of occupations” (cf. Greinert 2008), the position maintained here is that vocationalism is the very key to safeguarding a sustainable employability. Examples are the development of new occupational concepts and work process oriented occupational profiles (e.g. hybrid occupations, orientation towards occupational fields and concentration on core occupations, strategic aspects of repositioning VET, training plans covering all learning venues etc., cf. Spöttl 2000 and Spöttl/Blings 2011). They guarantee broader qualification profiles and a more comprehensive qualification process, which ultimately improve the opportunities for professional employment, even across economic sectors. The attitudinal dispositions emphasised in the employability model, e.g. mobility, flexibility, performance orientation, competitiveness and autonomy, are viewed by that model as de-contextualised key qualifications ready to be mobilised ad hoc. From the perspective of vocationalism, on the other hand, they must instead be regarded as the *result* of a broad professional acting competence which is based on vocational disciplines and encompasses knowledge and skills.

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<sup>15</sup> Voss and Pongratz view the “entreploee” (Arbeitskraftunternehmer) as a new type of strategic actor who needs to market his or her work capacity actively, “which means that besides the forced productive economy of labour there needs to be an individual market economy related to the capacity for work” (Voss & Pongratz 1998: 142).

#### **4 Convergence of education, learning and work in the post-Taylorist era: learning in the work process and the subjectification of work**

The humanist ideal of education (Wilhelm von Humboldt) and the anthropology of the Enlightenment (Immanuel Kant) are both linked with the aspiration to the “liberation of man from heteronomous submission claims of work” (Georg 1996: 637) and not consistent with alienated routine work in industrial mass production (Fordism, Taylorism). Whereas education aimed at the development of human potentials, industrial work on the assembly line reduced man to a small cog in a big machine. This type of work offered no room for the unfolding of personality and creative potentials but was arduous and burdensome instead, the opposite of dignity, self-determination, happiness and well-being. Education, in the sense of enrichment and condition of “becoming truly human”, therefore seemed incompatible with the deforming effects of a labour that was characterised by alienation, instrumentalisation and fragmentation of humans (cf. Georg 1996: 638).

It was only with the “realistic turn” in vocational pedagogy that the separation of education, learning and work could be overcome at least to some extent. New concepts of production (cellular manufacturing, teamwork and the like) and manufacturing processes replaced the Taylorist principle of mass production. The focus shifted to human skills that had been largely ignored in the industrial mass production: aspects of personality development in the work process and questions of the possibilities for a work organisation that would be pedagogically sound, match the workers’ qualification and support learning (cf. Georg 1996: 639). The emphasis on action also drew attention to issues like the capacity for rational, structured and situatively flexible thought and action, the capacity for continued education (learning), creativity, problem solving, autonomy, communication, cooperation etc.

An initial thesis is that the experience gained in work processes in an enterprise is the “most important medium” of personality development and identity formation (cf. Georg 1996: 639). According to this normative understanding of work, the acquisition of professional acting competence takes place as a process of work-immanent qualification and socialisation in the work activity itself (ibid.). The crucial point is the way of interacting with the requirements and conditions of the corporate work process and the extent to which the worker can influence this process (ibid.). Attention is thus drawn to the optionality and contingency of work process and work organisation as well as the question of opportunities for participation in the shaping of the former (aspect of shaping).

“The reference to the importance of work structures for the development of personality and to the importance of individual learning for the development of work structures and organisation qualifies the traditional overestimation of plans as components of rational and effective agency” (Georg 1996: 654). This is accompanied by a “rejection of the illusion of a technocratic ‘feasibility’ of teaching and learning processes as well as work processes” (ibid. 655).

While the Taylorist, hierarchical organisation with its strong division of labour offered few opportunities for the autonomous organisation of work, the new organisations – which are characterised by “deflating” (i.e. a reduction of hierarchies), decentralisation and a reduction of the horizontal division of tasks – brought about project-based and cooperative forms of work (structures), which support the

development of professional acting competence, e.g. by comprehensive and holistic tasks (cf. Blasius 2007).

The “completeness of the work task” (Georg 1996: 640), together with the extension of the scope of professional activity and the need to have alternative courses of action available, thus becomes the alternative to the Taylorist disintegration of work into narrow, repetitive routine tasks.

Decentralisation, project organisation, concepts of group work and holistic tasks are changes in the organisation of enterprises and the organisation of work that make autonomy and responsibility necessary already at the lower and middle hierarchy levels (shop floor). Therefore autonomy and responsibility (competences) do not show a positive and linear correlation with the position in a hierarchy, as it might have been the case in the old bureaucratic model of organisation (Max Weber) where knowledge, power, autonomy and responsibility were monopolised at the top of the hierarchy. The conceptual flaw of the above-mentioned Employability Grid by Thiel (2011) is its vertical structure: the idea of vertical linearity that integrates the classic line organisation and the vertical linearity of the EQF. Both concepts have to be criticised (in the sense of the only empirical reality). The model of vertical linearity in the classic line organisation ignores the variety of work contexts, the decentralisation of enterprises, the diversity of organisational structures and cultures as well as work processes, all of which influence the opportunities for autonomous, self-directed or self-responsible activity. Therefore the EQF and the related Employability Grid by Thiel are limited in their applicability – even though it cannot be the mission of the Grid to repair the shortcomings of the EQF. Apart from the criticism that the Employability Grid as well as the EQF are exclusively focusing on employability, there is another problem: In order to reduce referencing problems, the Grid would have to see that the EQF is “better” linked with reality, and that would mean to increase complexity. But if all possible variants of enterprises and work organisations were to be included that influence (extend or restrict) the opportunities for autonomous and responsible activity, the instrument would no longer be workable. So the result remains that the EQF and the Employability Grid are models of reality that extremely reduce complexity and that cannot be applied in practice just because of the very complexity they ignore.<sup>16</sup> Accordingly the assessment of the instrument is not a matter of validity and reliability. Instead, the formulation of a “correct” hermeneutic on the basis of the implicit logic of the EQF had the intention to mitigate the problem of “arbitrary” referencing.

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<sup>16</sup> Even if competences are identified with reference to functions and not on the basis of the position in the hierarchy, the functional descriptions need to be brought into a hierarchy in order to reference them to the EQF. But a functional understanding of organisations (matrix organisation or project management) or a functional understanding of activity (or even competence) is not compatible with the concept of hierarchy (linearity model or instrumental rationalist model of organisation, hierarchy model of the EQF). Especially autonomy and responsibility cannot be hierarchised. Moreover, there is a discontinuity in the heteronomous context of the organisation. An example is the simultaneity of autonomy requirements in teams, projects etc. and the subordination within the hierarchy. These role conflicts are typical for modern (hybrid, fractal) enterprises that feature hierarchic as well as heterarchic elements (hierarchy and project organisation). In other words: Autonomy can in principle be undermined by the (often counter-productive) supervisory attitudes of superiors (principals). What is at stake then is not the question whether specific tasks are fulfilled autonomously or under direct supervision, but the competence to deal with role conflicts that result from the simultaneity of subordination in the hierarchy and autonomy in projects or communities. The capacity to manage conflict is an important personal or social competence but is not really considered in the literature.

Today the form of enterprises (e.g. size and organisational structure) and the organisation of work have changed in a way that largely seems to integrate the aspirations for a humanisation of work. But this begs the question why it is necessary at all to advocate educational objectives that go beyond the immediate requirements of work (market and company perspectives). To put it differently: Why is it that the complete work task is defined as a *benchmark* for work processes as a basis for learning processes when it is already realised in virtue of the organisational structure? And if so why is a company oriented or market oriented perspective not enough to identify qualifications that are needed in the work process (and described in the occupational profiles)? These would be questions that the advocacies of employability might (have to ask themselves) ask.

One answer is that it was not normative positions towards work, humanitarian or educational considerations that led to the decline of Taylorism and hierarchies in work and work processes, but efficiency arguments and economic reasons<sup>17</sup> (cf. Heintel/Krainz 1994: 95; Spöttl 2000; Georg 1996).

A second answer is that the interpretation of work that underpins the principle of vocationalism views work processes as areas of “bottom up” design, which are based on educational and vocational-pedagogical principles. The employees are then regarded as participants of a rationalisation programme in the triangle of technology, organisation and man (TOM model) (cf. Georg 1996: 645).

In contrast to a purely market oriented perspective, what is at stake here is that the aspirations, interests and perspectives of the actors and their experiential knowledge (tacit knowledge and skills), that is, the phenomena that are discussed under the headings of subject orientation and experience-based subjectified learning and work (Böhle 2005: 11, 12), are taken into account in the shaping of work processes.

Subject orientation means that work processes need also to consider the needs and requirements of the employees or learners. Subjective factors like emotions, experiences, needs and ties come into focus as important elements of professional activity (cf. Georg 1996: 655).

The participation in the shaping of work processes, however, is possible only when the learners wish it and regard it as an opportunity for development. According to Georg, this is all the more possible when previous stages of socialisation have already led to the ability to identify, formulate and assert these subjective aspirations (cf. *ibid.*: 655). Therefore he proposes not to relocate learning completely and exclusively to the work process, but to strengthen inter-company vocational education as a type of learning in which subjectivity – and thus claims to the realisation of subjectivity – are developed first (*ibid.*).

The participation in the shaping of work processes requires qualifications which are generally ignored in the market model of employability, the reason being that they are regarded as irrelevant from a functional perspective. Work contexts and work processes are understood as facts (exogenous factors) that the actors *just* have to adapt to (adaptive learning!). Accordingly it is no surprise that the employability model

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<sup>17</sup> Post-Taylorist, holistic tasks and new, flexible concepts of production as well as the reduction of hierarchies (introduction of project organisations) succeeded ultimately for economic reasons (e.g. the so-called crisis of hierarchy), even though the Human Relations movement and the concepts of a humanisation of work were important sources of inspiration.

excludes the shaping aspect of work, and that the EQF does not include descriptors that would capture the relevant competences. The ability to participate in the shaping of work processes, the capacity for problem solving, the identification of alternative courses of action, communication, cooperation, teamwork, the ability to be critical, reflexivity etc. do not play a role.<sup>18</sup> Neither are ethical and moral aspects, e.g. solidarity (cf. Georg 1996: 643), taken into account in a purely functionalist conception of “employability”.

What are the implications of the previous considerations for the design of frameworks and instruments to support the implementation of the EQF?

If work processes (and the organisation of work) are conceptualised as areas of creative activity, then the relationship between the work objective and the work process is *contingent* (variable or optional) in principle. This insight refutes the basic assumption of Thiel’s Employability Grid, according to which it is only a superior work objective defined by the enterprise that determines the work process.

This assumption needs to be firmly criticised because it is backed by an “imperialist” mechanism of derivation. In contrast to this, we take the aspiration to shape work processes as the starting point, following empirical research findings on the shapability and formative aspects of work and organisation.

The possibilities for shaping work processes and the included scope of autonomy as well as the opportunities for participation are therefore not determined by an exogenous work objective, but by the “cultures of participation” that are implemented to a greater or lesser extent.

The underpinning conception of work processes has effects on the way competences are defined and measured. In the logic of derivation, inferences are made from the work objective to the work process and from the work process to the required qualifications or competences. In the model of shapeability and optionality of work processes, on the other hand, the expectations towards work and education (normative concept of work, principle of holistic tasks) and desirable competences to be developed (like autonomy) lead to conclusions with regard to the outline of the work process. With regard to frameworks this means that autonomy is a requirement that is relevant already at the lower levels. Moreover, work objectives and educational objectives are not exogenous factors but a matter of definition. The debates on the humanisation of work or the Human Relations approach (cf. Roethlisberger/ Dickson 1939) gave impressive evidence of this fact.

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<sup>18</sup> In the *employability grid* the criterion of autonomy is proposed as the central criterion for allocating qualifications to levels. The analysis of sectoral frameworks examines whether opportunities for planning and autonomy really exist only from level 5 or 6 onwards. It has to be expected that several areas of activity cover the levels below as well, especially when problem solving, planning and thus autonomous agency are required.

## 5 Structural and design principles of selected sectoral frameworks and the empirical backing of competences (learning outcomes)

### 5.1 Demands of markets and enterprises in the focus

Sectoral partnerships and sectoral approaches in Vocational Education and Training (VET) were highlighted already in the Copenhagen Declaration of 2002 (cf. Fahle/Thiele quoted in Hess/Spöttl/Tutschner 2005: 15). The sectoral approach, which was favoured in the calls for pilot studies and projects in the Leonardo da Vinci programme of the European Commission, was meant to be a “testing ground” for the development of qualifications and competences (cf. Hess/Spöttl/Tutschner 2005: 15).

Starting from the work-process-analysis that was developed at the ITB (cf. Spöttl 2000; Becker/ Spöttl 2008), the problem is to describe the added value of a work process oriented design of sectoral frameworks – in comparison to other approaches – and to investigate implications for the referencing, or rather the connectivity, to the EQF.

In contrast to the economic or sociological sector definition according to Fourastie (1954)<sup>19</sup> the LEONARDO Committee (12/2002) agreed on the NACE<sup>20</sup> standards as the basis for all sector related activities in VET (cf. Hess/Spöttl/Tutschner 2005: 16)

At the end of 2008 the European Commission finally established a subgroup within the “EQF Advisory Group” with a view to discussing sectoral issues that would be relevant for the implementation of the EQF. A recommendation on the EQF stated that the European Commission had a special responsibility to enable international sector organisations to reference their qualifications systems to the EQF in order to make the relationship between international qualifications and national qualifications systems transparent (cf. Skjerve/ Zahilas/ Le Mouillour 2009: 2). The focus on European and international sectoral bodies aims to recognise the diversification and internationalisation of qualifications. The emphasis is put on qualifications that are tailored to meet the specific demands of sectors or enterprises. The European Commission thus addresses the perspective of markets and enterprises in accordance with the employability model. Given this orientation it is no surprise that sectoral frameworks are developed from a market and business perspective that leaves out more general objectives and standards of education as well as vocational-pedagogical principles like those addressed in the principle of vocationalism.

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<sup>19</sup> The familiar distinction of primary sector (agriculture, forestry and fishery), secondary sector (industry, manufacturing) and tertiary sector (commerce, banking, services) – that is to say, classification by economic branches – was introduced by the French economist Fourastie.

<sup>20</sup> The acronym NACE means “Nomenclature statistique des Activités économiques dans la Communauté européenne” – Statistical Classification of Economic Activities in the European Community. The organisation according to “sectional rules and definitions” in the NACE groups together economic areas like sale, maintenance and repair of cars and appliances (cf. NACE Rev. 1, 2004) that are just right for sectoral analyses from the perspective of vocational education (cf. Hess/ Spöttl/ Tutschner 2005: 16).

### 5.1.1 Sectoral frameworks I: The European e-Competence Framework

A first example is the *e-Competence Framework*<sup>21</sup> (eCF), which was developed even before the EQF by the *CEN Workshop on ICT Skills*<sup>22</sup>. The formal basis of the framework is a *CEN Workshop Agreement (CWA)* which is not a formal European standard, but a de-facto standard: It refers to agreements of main stakeholders in the field, assembled in the above mentioned CEN workshop that has regular meetings 2 to 3 times a year. The workshop is supported by the *EU Commission, DG Enterprise* that funds projects leading to CWAs, developed by experts participating in the workshop. Unlike the EQF this framework is not defined as a qualification framework, but a *competence framework*, which means that the relationship between education and work is considered exclusively from the *demand side*; reflections on the ways how competences are acquired lie beyond the issues of the e-Competence Framework. Reference to training and education, from the perspective of the demand side, was made by a separate initiative, also launched by the CEN workshop and offering software for identifying training courses according to specific competences: *ICT Lane*<sup>23</sup>

The e-Competence Framework consists of five levels that correspond to the EQF levels 3-8 (for the attentive reader: the EQF levels 3-8 are 6 levels. One may ask, why does the e-Competence Framework consist of only five levels? Explanation see Table 2, page 18, 19: level 2 of the e-Competence Framework is referenced to the EQF levels 4 and 5). The relevant dimensions of description are described in CWA Part III<sup>24</sup>. As the referencing does not take into account formal qualifications, the reservation of the EQF levels 3-5 for vocational qualifications and levels 6-8 for academic degrees becomes obsolete.

The understanding of *competence* is at first described in general, referring to historical developments as “authority” and/or “capability”, for which the following quotation is delivered. “Authority” refers to “possessing the responsibility, licence or right to decide, produce, serve, act, perform or claim” and “capability” refers to “having the knowledge, skills and experience to perform” (cf. Mulder 2007). This shows again the double structure of the concept of competence: the individual ability to apply knowledge and skills, and the room for manoeuvre and powers granted by the enterprise (autonomy). But the same double structure is ignored when competence is specified for the e-Competence Framework where it shall be in line with the EQF definition: *Competence* and *competences* are the “demonstrated ability to apply knowledge, skills and attitudes for achieving observable results” (CWA Part III, 12: 12). This modified definition is now consistent with the EQF definition of “Competence as the proven *ability* to use knowledge, skills and personal and/or methodological abilities, in work or study situations and in professional and personal development” (ibid.).<sup>25</sup>

<sup>21</sup> See <http://www.ecompetence.eu>. Meanwhile the 3<sup>rd</sup> version of this framework has been accepted. However, up to now it has not been published, neither on the mentioned website, nor on the CEN website (see below). In our description of this framework, we only refer to the second version.

<sup>22</sup> CEN is the European Committee for Standardization. For more information on the workshop, see <http://www.cen.eu/CEN/sectors/sectors/liss/activity/Pages/msict-skills.aspx>

<sup>23</sup> See [http://vm0087.cs01.seeweb.it/ictlane/select\\_competences.php?competence\\_areaOrder=Sorter\\_description\\_competence&competence\\_areaDir=ASC](http://vm0087.cs01.seeweb.it/ictlane/select_competences.php?competence_areaOrder=Sorter_description_competence&competence_areaDir=ASC).

<sup>24</sup> European e-Competence Framework, CWA Part III, Building the e-CF – a combination of sound methodology and expert contribution

<sup>25</sup> The reader will notice that this passage speaks of the ability to use specific abilities!

And also: “...competences articulate abilities, where an individual is able to do something within a specific context...” (ibid: 19).

The *ability* to apply knowledge, skills and attitudes refers only to those abilities that are relevant, from the perspective of the enterprise, for the fulfilment of specific job requirements and tasks, but not to existing individual abilities or potentials that might go beyond these requirements (ibid.: 20).<sup>26</sup> This discrepancy between actual individual abilities and required abilities (“job requirements”) might imply, under certain conditions, differences with regard to the level assignment in the EQF or the NQF.

The basis for the definition of competences and competence levels consists of business processes (the so-called e-Competence Areas: Enable, Plan, Build, Run, Manage) and “ICT Knowledge Areas”. The cross-tabulation of these two dimensions makes it possible to define the necessary competences in terms of job requirements or tasks.

Business Processes	Plan	Build	Run	Enable	Manage
ICT-Knowledge areas	Conceiving, designing	Developing, integrating, testing	Controlling and exploiting operations, maintaining, supporting, training, documenting, transitioning	Security, QM, marketing and selling, distributing/supplying, procuring, acquisition (incl. outsourcing), disposing	Managing and operating, defining strategies and applying, risk management, improving, innovating
Microelectronics; Components; Semiconductors					
Computer HW					
Industrial Control systems					
Networks					
System Software					
Applications Software					
Systems Integration					

Build business Applications  
(e. g.) develop, integrate...

Table 1: Matrix – a functional definition of competences/abilities via the combination of Business Processes and ICT-Knowledge areas

(Source: Gerald Thiel (2012): Methodological approach for a holistic and functional description of work processes, [http://www.project-nqf-sqf.eu/fileadmin/Dateien/WP2/NQF-SQF\\_WP2\\_del04\\_synopsis\\_v1.pdf](http://www.project-nqf-sqf.eu/fileadmin/Dateien/WP2/NQF-SQF_WP2_del04_synopsis_v1.pdf))

In this context business processes are not areas of autonomous activity but predetermined work contexts from which the competence needs for the “knowledge area” in question can be derived. The relationship between business process and work

<sup>26</sup> Interviews with engineers conducted in the context of my current doctoral thesis show that the individual competence level, i.e. the things a person would actually be able to do in virtue of qualification or professional experience, is more than competence in the sense of powers (note by Hupfer).

process remains unclear, as does the distinction between the two. Given the previous thoughts about the shapeability and optionality of work processes, it seems impossible that the work process could simply be derived from the business process or the work objective. The description of tasks makes it possible to establish a reference to the work process, but the relationship remains an implicit one (cf. Thiel 2011).

Here, too, work means only the fulfilment of operational functions. It is defined in purely functional terms. Further vocational-pedagogical claims or considerations of desirable objectives of work and learning are left out. Therefore competences that are necessary for the shaping of work contexts, e.g. work processes or business processes, are not taken into account. It is only in a footnote that one finds the information that knowledge and skills are formulated, in the context of e-competences, from the employer's perspective, but serve only as a basis for curriculum development in educational institutions. This means that curricula and training programmes may go beyond purely functional requirements. To give an example: Competences "are constructed from an employer's perspective, education and training institutions will be able to work with these short but precise e-competence components to revise or build curricula, syllabi, or learning programmes. However, it is not intended to restrict educational style or content solely to these descriptors, on the contrary, education providers are encouraged to produce materials complementary to their culture..." (e-CF 2.0 CWA Part III June 2010).

The possible conflicts, contradictions or incompatibilities of educational claims and functional requirements of the enterprises are not mentioned. It is obviously presumed that "educational claims" and "corporate claims" are compatible in principle or supplement each other functionally.

However, the functional identification of competences (see matrix) does not deliver any information about the hierarchical arrangement of competences by levels, nor criteria for the referencing of e-competences to the EQF because of the very different perspective in the design of the frameworks.

Therefore there is a logical gap between the e-Competence Framework, which consists of the levels three to eight, and the identification of competences in terms of knowledge areas and business processes. The competence levels of the e-Competence Framework were referenced to the corresponding EQF levels according to the pattern of a possible career path and the positions in job hierarchy (cf. Table 2).

<b>EQF level</b>	<b>e-Competence level</b>	<b>Generic job description</b>	<b>Typical tasks</b>
8: knowledge at the most advanced frontier, most advanced and specialised skills and techniques to solve critical problems in research and/or innovation .....	5	Principal  Overall accountability and responsibility recognized inside and outside the organization for innovative solutions and for shaping the future using solutions and for shaping the future using outstanding leading edge thinking and knowledge	IS strategy or programme management

EQF level	e-Competence level	Generic job description	Typical tasks
7: Highly specialized knowledge,...critical awareness of knowledge issues in a field and at the interface between different fields, specializes problem solving skills in research and/or innovation to develop new knowledge..., managing and transforming work or study contexts that are complex, unpredictable and require new strategic approaches, taking responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	4	LEAD Professional or Senior Manager  Extensive scope of responsibilities deploying specialized integration capability in complex environments; full responsibility for strategic development of staff working in unfamiliar and unpredictable situations	IS strategy / holistic solutions
6: Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles, advanced skills, demonstrating mastery and innovation in solving complex and unpredictable problems in a specialized field of work or study, management of complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts, for continuing personal and group professional development	3	Senior Professional or Manager  Respected for innovative methods and use of initiative in specific technical or business areas; providing leadership and taking responsibility for team performance and development in unpredictable environments	Consulting
5: Comprehensive, specialized, factual and theoretical knowledge within a fields of work or study and an awareness of the boundaries of that knowledge, expertise in a comprehensive range of cognitive and practical skills in developing creative solutions to abstract problems, management and supervision in contexts where there is unpredictable change, reviewing and developing performance of self and others  ----- 4: Factual and theoretical knowledge in broad contexts within a field of work or study, expertise in a range of cognitive and practical skills in generating solutions to specific problems in a field of work and study, self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change, supervising the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities	2	Professional  Operates with capability and independence in specified boundaries and may supervise others in this environment; conceptual and abstract model building using creative thinking; uses theoretical knowledge and practical skills to solve complex problems within a predictable and sometimes unpredictable context	Concepts / Basic principles
3: Knowledge of facts, principles, processes and general concepts, in a field of work or study, a range of cognitive and practical skills in accomplishing tasks. Problem solving with basic methods, tools, materials and information, responsibility for completion of tasks in work or study, adapting own behaviour to circumstances in solving problems	1	Associate  Able to apply knowledge and skills to solve straight forward problems; responsible for own actions; operating in a stable environment	Support / Service

Table 2: Correspondence of EQF levels with hierarchical levels in the e-Competence Framework  
(Source: Thiel, Gerald (2011): Draft Employability Grid, 25.11. 2011, I.c.: 15f)

When the “job descriptions” of the e-Competence levels are compared with the descriptions of the corresponding EQF levels, one finds them to be incompatible. The referencing is instead based on a normative judgement or at least on an interpretation. For it is questionable whether the strategic tasks of management or, respectively, the strategic competence of the principal (e-Competence Framework level 5) actually correspond to the description of EQF level 8: “knowledge at the most advanced frontier, the most advanced and specialised skills and techniques to solve critical problems in research and/ or innovation, demonstrating ...scholarly or professional integrity” (EQF level 8). This description might also (and above all) refer to the professional expertise e.g. of developers, who are often situated at the middle management level of the corporate hierarchy. The strategic competence and tasks of the management represent a different knowledge and different skills, but it would be wrong to say that these are the most advanced knowledge or skills. To put it another way: As the referencing of the e-Competence Framework levels is based on the *normative decision* to value technical expertise and skills lower than entrepreneurial skills (management and leadership), the question is whether the position in the hierarchy really corresponds to the qualification or competence level. This also puts the inclusion principle of the EQF into question. For this principle presupposes that knowledge and skills can be accumulated and transferred in a vertical direction, which means that the available knowledge and skills are monopolised at the top of the hierarchy (classical model of hierarchy). This has to be distinguished from *different forms* of knowledge and skills in the various functional areas at the same hierarchy and competence levels (e.g. the equalisation of strategic management tasks with engineering competences like development). Hoffmann et al. (2008: 12) also criticise the “linear structure” of the EQF from the perspective of the 4ING sectoral framework (see below). This structure implies “that a lower qualification level can be followed only by one qualification from the next higher level”. In reality, however, quite diverse qualifications and ramifications may come into play, which cannot be represented or provided for in the linear structure of the EQF. This is a drastic limitation of the practical applicability and use of the EQF (ibid.).

The genesis of the e-Competence Framework is based on a “top-down” approach, which describes competences from the perspective of organisation and management. This approach is different from a “bottom-up” approach, which identifies existing individual competences. The latter include not only the learning outcomes achieved in general or vocational education, but may also comprise desirable competences in the sense of vocationalism, which can be taken into account in the construction of sectoral frameworks. These two different views of competence are correlated with two opposing methodologies of competence diagnostics: “To identify an individual’s competence, requires a ‘bottom up’ approach based on methods such as interviews with identified ‘best performers’...whereas the organisational competence viewpoint requires a ‘top down’ approach, based on either business or work-process-analysis methods.” (Appendix 1 of the e-CF 2.0, p. 25).

### **5.1.2 Sectoral frameworks II: Work process based framework “Car Service and Repair”**

The automotive sector framework Service & Repair, which is based on the CarEasyVet project, is closely connected with vocationalism and professional aptitude in the sense

of acquiring domain-specific competences. One becomes an expert through reflected practice in a domain, e.g. an occupation. This is a fundamental difference from general and higher education.

The identification of competences is based on the method of work-process-analysis, which was developed at the Institut Technik und Bildung (ITB) of the University of Bremen. This instrument is compatible with the learning outcome orientation of the EQF. The claim of the work-process-analysis is that the categories for the description of learning outcomes (competences) reflect exactly what a person is actually able to do. This means that the method is about identifying factual, individual competences (learning outcomes). This distinguishes the work-process-analysis from the “job analysis” in the logistics framework ([www.novalog-project.org](http://www.novalog-project.org)), which was focusing on learning outcome in the sense of requirements from the perspective of the enterprises (job descriptions etc.).

In our understanding the work-process-analysis is not a top-down approach but a scientifically tested and validated method for the empirical identification of core work processes and the required competences at the shop floor level. It captures several aspects in a bottom-up as well as a top-down perspective: the challenges of the work objective, the options and consequences of different forms of the organisation of work, the application of appropriate tools, and the needs of the enterprise, the individual and the society. All of these aspects are included in the work-process-analyses (cf. Spöttl/ Loose 2013).

In order to carry out a work-process-analysis a *company-specific questionnaire* has to be used because the analysis has to start at the place where concrete work is done. The questionnaire is designed as a guide that aims to make the structure and the work and business processes in an enterprise transparent and understandable. It helps to find out how a company produces its services and products, and which knowledge, abilities, theoretical understanding, skills, which social and normative requirements and which competences are necessary to put this into reality. The most important dimensions of these requirements are identified, and it is investigated which knowledge and abilities can be linked to which skills, capabilities and other capacities.

It is important to draw all conclusions on the basis of first-hand evidence, insights and experiences at the workplaces of the respondents, and to reflect these conclusions carefully. The work-process-analysis, in which the management of the company is involved as well, takes place in the shape of an intensive communication process and by means of observations. The process takes place between the staff in the enterprise and the expert team, which afterwards defines the standards for an occupation or an occupational cluster.

The main goal of the work-process-analysis is the identification and definition of core work processes, which are then operationalised by several key terms. The process includes three levels of differentiation (see Figure 1):

1. A brief description of *core work processes* in a report, a detailed account.
2. A definition of *core competences* that are required for the performance of the core work process. These competences are identified in the course of the work-process-analysis and serve also as the basis for the referencing to qualifications frameworks (EQF, NQF) at a later stage.

3. A detailed outline of *reference objectives* of the occupation, which aims to illustrate the context of the core work process. This includes a detailed description of the subject matter of skilled work, e.g. tools, methods and organisation of work.

### Flowchart: Development of Occupational Standards

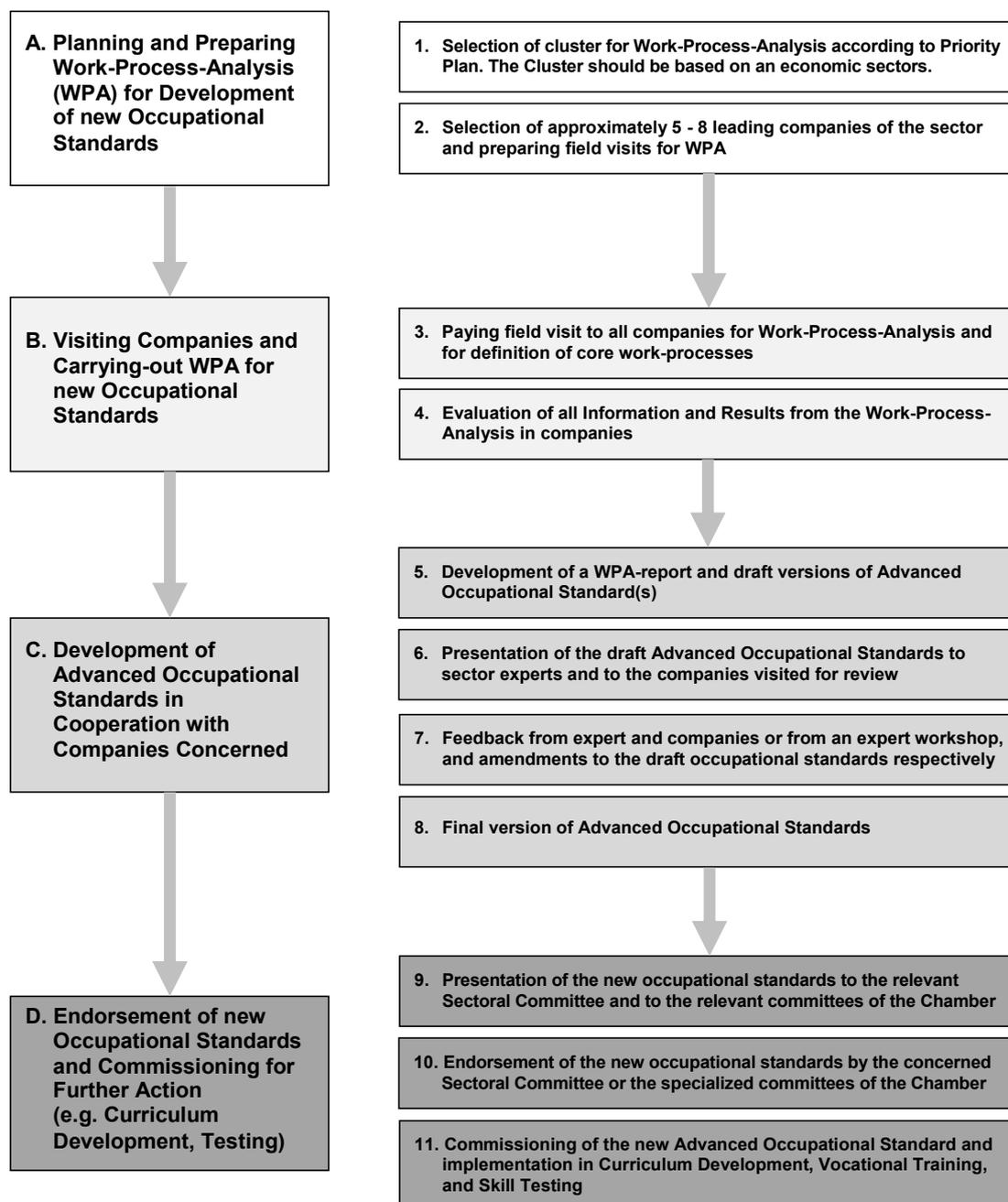


Figure 1: Flowchart – development of occupational standards on the basis of work-process-analyses (own source)

The core work processes are the basis for the definition of standards, which are assigned to the different qualification levels in the sectoral framework. The identification of all relevant core work processes in a sector and the definition of the corresponding standards are the basis for the development of work process oriented

sectoral frameworks (cf. Spöttl/Ruth 2011). An example of referencing is given in the following Table 3.<sup>27</sup>

<p><b>Level 3 to 4: Skilled Worker</b></p> <p>(Standards 1 to 7)</p>	<p><b>Demonstrates mastery of:</b></p> <p><i>Standard 1: Standard service</i></p> <p><i>Standard 2: Wear and tear repair</i></p> <p><i>Standard 3: Standard diagnosis, diagnostic procedures, trouble shooting, minor repair</i></p> <p><i>Standard 4: General inspection</i></p> <p><i>Standard 5: Undercarriage and suspension repair</i></p> <p><i>Standard 6: Electrical and electronic repair</i></p> <p><i>Standard 7: Advanced diagnosis and repair of aggregates, component groups and elements</i></p>
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*Table 3: Excerpt from a work process oriented sectoral framework*

In contrast to the structure of the concept of qualification in the EQF, the categories of the sectoral framework that are used to describe learning outcomes are designed to reflect the unity of skills, especially with regard to their relevance for the work process (cf. Spöttl/Ruth 2011). An aggregation of isolated and de-contextualised competence descriptions as suggested by the concept of qualification in the EQF is rejected. The reason is that the criteria for assigning acquired abilities and skills to specific qualification levels are the result of the reflection of this context.

It was one of the main questions of the project whether the EQF can actually fulfil its function as a meta-framework. The EQF descriptors are abstract quantities to which specific and concrete sector related competences have to be referenced. Due to the abstraction and the hermeneutic quality of its descriptors it is impossible in principle to *derive* sector related competences from the EQF. To put it differently: It is undisputed that the EQF does not help to define sector related competences. The formulation of concrete descriptors requires other sources of information. But the *referencing* of sector related competences to the EQF is likely to be problematic as well if the former are not compatible with the EQF descriptors.

In order to be able to identify and describe contextualised competences, one has to consult, as a source of information, the concrete work context that has been surveyed by the work-process-analysis in the course of the project. The description of the work processes makes transparent all capacities and skills, all knowledge and abilities required for the performance of the work. These work processes are embedded in various contexts of work, which are taken into consideration in the existing occupational profiles only in part. If the abilities and skills acquired in the process of vocational education and training (learning in the work process and school-based learning) are to be situated in the EQF with reference to occupational profiles, one must examine not only these profiles but also the material that might give information about the skills in question: requirements for further education, curricula, training methods, learning venues, examination regulations. In accordance with the structure of dual vocational education, competence levels can be viewed from two methodological

<sup>27</sup> The publication by Spöttl/Ruth (2011) describes the entire development of a work process oriented sectoral framework at the example of car service and repair.

perspectives, namely the “training supply perspective” and the “workplace demand perspective”. Both have to be taken into account when it comes to identifying the emergence of new occupational profiles or the modification of existing ones. This is a process of mutual observation: New “workplace demands” give information about the need to change curricula, and conversely vocational-pedagogical and educational principles that have been formulated in the VET system deliver normative criteria for the shaping of work processes (countries that do not have an elaborate VET system do not follow these principles either.)

Competences are therefore not just representations of workplace demands or corporate demands (market and enterprise perspective) as in the employability model, but the result of the interplay of workplace demands and the potentials of the qualifications supplied by the “feeder” system.

Under the heading of qualification we summarise the skills that are necessary for mastering the tasks that are inherent in the work processes. Therefore there is also the notion of qualification requirements. A reminder: In the terminology of the VET system, qualification means a bundle of competences (professional competence and personal competence). These denote the subjective performance requirements necessary to fulfil the objective qualification requirements.

The basis for the identification of the sector-relevant competences is work-process-analyses, which identify the requirements that the work processes pose in terms of abilities and skills. The crucial point, in the sense of an intervening variable, is the organisation of work, i.e. the content and distribution of tasks. The development of occupations in many countries has shown that the changes of corporate structures, i.e. the introduction of new concepts for organisation and management (e.g. matrix organisation or project management), are leading not only to a deflating of hierarchies and a reduction of the horizontal division of work, but also to a reduction of occupational profiles. This is perfectly in line with the Lisbon Strategy of “more and better (sic!) jobs” (cf. European Council 2000). With regard to the EQF this suggests the introduction of broad core occupations that are open for development (ibid., p. 15, 16). This development has also to be taken into account in the generation of sectoral frameworks, which is not the case when the perspective of a purely market oriented employability is applied.

Therefore it is necessary for the development of a sectoral framework to find, with the help of the work-process-analysis, categories that establish the link to the context of work and describe competences that are developed in the schools and training enterprises.

The work-process-analysis starts with the identification and exact description of the *core work processes*. It is also assumed that the planning of these work processes is an important step and that it is not the aim just to depict existing work processes and patterns of work organisation. On this basis, core competences are identified and learning venues are determined that are appropriate for the acquisition of these competences (VET school and/or training enterprise).

The model of vocationalism makes it possible to develop a qualifications framework in which the qualification levels refer to each other. The concept of professional aptitude corresponds to the findings of expertise and qualification research, according to which professional skills are the result of a process of

competence development that presupposes domain-specific work experience (cf. Spöttl/ Ruth 2011: 17).

Work-process-analyses are the basis for the definition of up-to-date work process oriented standards, core work processes and occupational profiles (Spöttl/ Loose 2013). Standards are not a substitute for curricula but the basis on which curricula as well as tests to check the qualification are developed. The order of core work processes follows the developmental model by Dreyfus and Dreyfus (1987), which describes the tasks from the novice to the expert level (cf. Spöttl/ Ruth 2011: 44-45 and Spöttl/ Windelband 2011).

In Table 4 the work process oriented occupational standards are referenced to the levels 1 to 5+ and 6 at the example of the demands in a car service shop. This classification is based on the professional competences that are described in the standards. Sector experts referenced these standards to the different levels according to the following criteria:

- knowledge about the structure of the core work process,
- estimated requirements of the core work processes,
- safeguarding of a coherent performance of the tasks that result from the core work processes,
- consideration of “sub-tasks” necessary to fulfil the core work processes;
- expected demands of customers,
- safety regulations;
- technical equipment at the workplaces,
- necessary exchange of information,
- technical complexity of the core work processes,
- diagnostic skills to be acquired.

For the purpose of referencing the experts defined three levels (levels 3 to 6 according to the above description) that correspond to the levels 3 to 5/6 of the EQF.

Levels 1 and 2 were considered irrelevant for car service shops like the ones in the present case<sup>28</sup>, the reason being that there was not enough need for simple tasks per job. The experts did not agree with this view because in their opinion there might well be enough simple tasks to be fulfilled separately. However, they do not occur frequently enough to justify a separate organisational unit for the fulfilment of these tasks. The tasks according to standards 8 and 9 were regarded as particularly challenging and assigned to the EQF levels 4 and 5.

The standards 10, 11 and 12 correspond to the management level in, for instance, a car service shop and include the responsibility for an enterprise or a company department. Sector experts and social partners assigned these standards to level 5+ and 6, the same level as the academic Bachelor’s degree. Level 6 is addressed whenever the task involves a high degree of responsibility and autonomy. Level 6 can thus apply to academic (B.A. degree) and vocational careers (e.g. master craftsman) alike.

The classification levels of the sector experts were coordinated with the definitions and the eight EQF levels (see Table 4, right column). This preliminary

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<sup>28</sup> The same is true of other workplaces in which skilled work is carried out.

coordination did not lead to significant divergences with regard to the level definitions concerned. However, a closer coordination is still pending.

This means that a referencing to the EQF is possible, but a more detailed comparison of the EQF (and DQR) descriptors shows that “functional competences”, which are an important aspect of skilled work, are missing in the EQF (cf. Spöttl/ Ruth, Table 2: 47).

	No.	Mastery of Occupational Standards	Recognized by EQR terms
Level 1 to 2 Semi-skilled level	1	Standard Service	C: Basic skills required for simple tasks and work under supervision K/S: Basic knowledge/ skills; solve routine problems; basic factual knowledge
	2	Wear and tear repair	
Level 3/4 Skilled worker	1	Standard Service	C: responsibility for completion of tasks; adapt own behaviour K/S: Knowledge of facts, principles, processes in a field of work; range of cognitive/ practical skills required to accomplish tasks and solve problems by applying basic methods, tools, materials
	2	Wear and tear repair	
	3	Standard diagnosis, diagnostic procedure, trouble shooting and minor repair	
	4	General inspection	
	5	Undercarriage and suspension repair	
	6	Electrical and electronic repair	
	7	Advanced diagnosis and repair of aggregates, component groups and elements	
Level 4/5 Technician	8	Repair and overhauling of aggregates: engine, gearbox and automatic transmission	C: Responsibility for supervision of work; self-responsibility for service and repair; following work guidelines K/S: factual and theoretical knowledge of aggregates; generate solutions for efficient repair.
	9	Standard extensions and accessory installation	
Level 5+/6 Assistant Engineer, Master Craftsman, BA Technology	10	Personnel affairs	C: Taking over management and supervision tasks in the context of work K/S: Specialised and theoretical knowledge for management and practical skills
	11	Qualification for accountancy	
	12	Entrepreneurial qualification	

Table 4: Structure of the automotive sector framework service and repair

### 5.1.3 Sectoral frameworks III: Developing a logistics sector framework in the NOVALOG project

The development of a sectoral framework for “jobs” in the logistics sector took place in the Leonardo da Vinci project NOVALOG ([www.NOVALOG-project.org](http://www.NOVALOG-project.org))<sup>29</sup>. This one, too, is a competence framework and not a qualifications framework. What is special about the logistics sector is that activities and jobs cut across other sectors that also have the potential to develop their own sectoral frameworks: transport and communication, commerce, chemical industry (NOVALOG Handbook, n.d.: 26; [www.novalog-project.org](http://www.novalog-project.org)).

<sup>29</sup> NOVALOG: Employment and Qualifications in Logistics: from national realities to a European approach.

An interdisciplinary study identified relevant “jobs” in logistics, their nomenclature and their descriptions in 16 partner countries (excluding transport jobs). It became clear that the national nomenclatures are quite different and that the available data are not comparable. Some countries follow the “International Standard Classification of Occupations” (ISCO 88), which does not take into account newly emerging tasks and requirements in the logistics sector and which includes only rudimentary job descriptions. A much more differentiated and elaborate basis and guideline is the NOVALOG nomenclature, which classifies logistics jobs in four groups (cf. Table 5).

<p><b>Group 1</b></p> <p>Supply chain manager Logistics manager Logistics Analyst Logistics Controller Logistics IT Specialist</p>	<p><b>Supply and distribution managers</b></p>
<p><b>Group 2</b></p> <p>Materials Manager Packing Manager Purchasing Procurement Manager Purchasing Officer Purchasing Clerk Stock/inventory Controller</p>	<p><b>Supply and distributions managers</b></p>
<p><b>Group 3</b></p> <p>Production Planner and Controller</p>	<p><b>Production clerks</b></p>
<p><b>Group 4</b></p> <p>Warehouse Management Administrative Operations Warehouse Operations Warehouse supporting Activity</p>	

Table 5: NOVALOG nomenclature based on ISCO-88

When group 4 is compared with the other groups one can see that groups 1-3 describe positions while group 4 includes corporate functions or areas of responsibility. However, both can serve as a basis for the identification of competences.

Due to the inadequate supply of data and the shortcomings of the ISCO nomenclature, which does not deliver a complete picture of the all relevant logistics jobs and their descriptions, an analysis of the “production of logistics jobs titles” and “job descriptions” was carried out. Apart from the national statistics offices, the following stakeholders were involved:

- VET experts and VET institutions,
- social partners,
- job centres.

The result of this analysis is that the definition of logistics jobs is based on different items. The most important of these are: “Competencies, Qualification, Activity,

Knowledge/Know-how, Tasks, Career Development, Levels of Responsibility” (NOVALOG Handbook, n.d.: 28: [www.novalog-project.org](http://www.novalog-project.org))

Another outcome is that “the most clearly identified and/or defined jobs in Europe are forklift drivers, warehouse operators, and order pickers, in accordance with their statistical relevance” (NOVALOG Handbook, n.d.: 26). Strategic tasks and management activities (Logistics Manager), by contrast, receive less attention but come into focus with the help of the NOVALOG nomenclature (especially group 1).

The NOVALOG project distinguishes between “jobs” in two areas of activity.

1. Warehouse function: forklift driver, order picker und warehouse operator und
2. Professions working in the field of logistics strategy and supply management.

The analysis of the formal qualifications that give access to logistics jobs made clear that the formal qualification level of “Warehouse Workers” (1) is quite low in comparison with employees with management responsibilities (2). Some “Warehouse Operators” even do not have any formal qualification at all and there are only few opportunities for advancement (NOVALOG Handbook, n.d.: 54). The analysis of training programmes shows that one-week courses are enough to be employed in this low-skilled area. The competence descriptions for the lowest hierarchy level, the level of “Warehouse Workers”, include only technical competences but no social or methodological competences (ibid.: 55) as these competences are considered relevant only for the “middle level”. Additional personal competences (“behavioral skills, development potential, team leading abilities, high level of relational abilities, high level of respect”) are even mentioned for at the highest level only. In the second area of activity, on the other hand, which includes “jobs” with management responsibilities (as well as “Logistical Assistance Jobs”), one finds an increasing number of employees with university degrees and a high-quality vocational education.

Due to the shortcomings of the data and the nomenclatures as a basis for establishing a European logistics framework it was necessary to identify the competences that are required for the performance of work tasks and the corresponding training needs. To this end “job analyses” were carried out in three steps:

1. The first step consists in the formulation of job descriptions on the basis of empirical observations in combination with the professional logic of logistics.
2. The second step includes the job analysis in terms of competences with the influence of contextual factors being taken into account.
3. Third step: After the competences have been defined that are necessary to fulfil a job, the training needs become visible. These have to be translated into the corresponding knowledge and skills that can be taught and assessed.
4. The “job analysis” takes place on the basis of observation, interviews and explicit task descriptions (NOVALOG Handbook, n.d.: 36). It starts either with a specific job (position) or a function in logistics that includes a number of duties or areas of activity. Concrete competencies are derived and performance standards are established.

## Job analysis

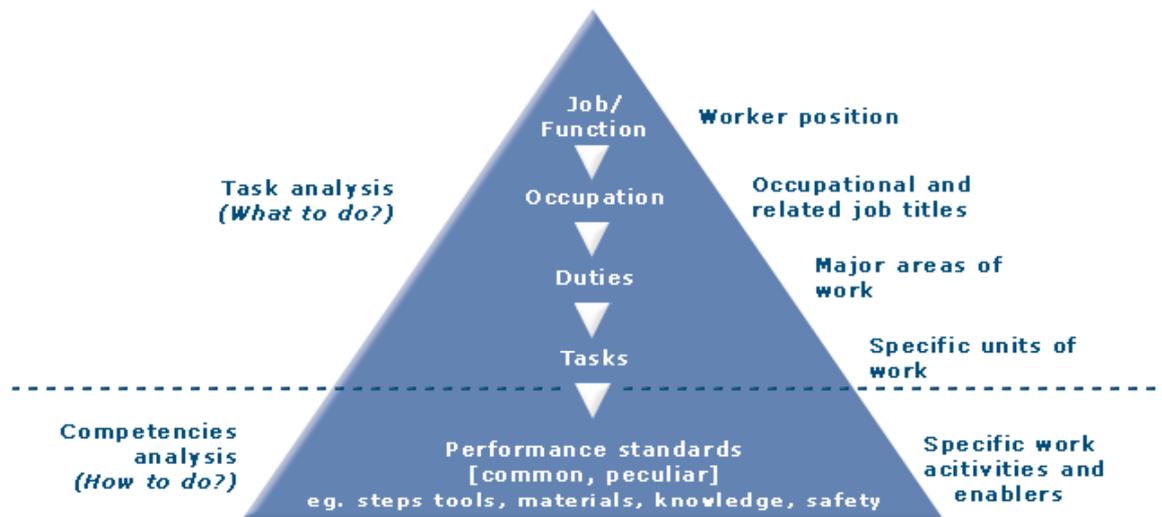


Figure 2: Structure of the job analysis (Source: NOVALOG Handbook: 36)

It is emphasised that the formal qualification (diplomas and certificates) is necessary but not sufficient to perform concrete tasks. (“A formal qualification related to the diplomas and training certificates is necessary, but not sufficient to perform a concrete task. Applying the qualification successfully on a specific job situation, which means meeting the performance standards – that is the characteristic element of a competency” (NOVALOG Handbook, n.d.: 36).

In respect of the guiding question as to what concepts of work and education are underpinning the development of sectoral frameworks one has to observe again that competences merely reflect job requirements from the perspective of the enterprises and the market. Further claims of educational science or vocational pedagogy that are implied in the model of vocationalism were not taken into account in the generation of the framework. This might lead to the conclusion that the identified “training requirements” are defined in the sense of a mere adaptation to new work requirements, i.e. requirements that are mostly determined by technological innovation and the internationalisation of the sector.

Whether the qualifications framework for logistics follows the employability model or the model of vocationalism is a question that cannot be answered on the basis of the material alone. There are no concrete statements as to whether and to what extent the “job analysis” also does justice to a normative claim to education and work as included in the concept of vocationalism, especially in the case of dual vocational education and training. All that is being said is that the recruitment and training programmes of the enterprises need to be developed further in the light of changes in the market and the increasing significance of the logistics sector as a whole (cf. NOVALOG Handbook, n.d.: 85). This is an indicator of the employability model in the sense of only adaptive qualification.

#### **5.1.4 Sectoral frameworks IV: Sectoral framework construction<sup>30</sup>**

The basic idea is that the development of a sectoral framework in the course of the Leonardo da Vinci project “SQF-Con” supports the European lifelong learning policy in this important sector. In addition, the possibility of a transnational, European application of the framework is supposed to increase transparency. A further claim formulated in the project refers to the availability of a sectoral framework in all European countries. Therefore it is supposed that the framework is to operate with generic descriptors.

The main definitional feature for the structure of the sectoral framework consists in the “job positions” that exist in the construction sector. This means the profiles that exist for various positions in the company and which are determined by the organisation and challenges of work.

These considerations lead to five levels with level 3 being subdivided into 3a and 3b:

##### **Level 5**

This level includes planning and the implementation of plans. Persons at this level need to be able to implement detailed schedules and to comply with safety and health regulations.

##### **Level 4**

Persons who work at this level must be able to implement parts of the schedules and assist the persons in charge in their planning activities.

##### **Level 3a**

Persons at this level must be able to coordinate teams.

##### **Level 3b**

Persons at this level must be able to perform all productive tasks such as bricklaying, plastering, concreting etc.

##### **Level 2**

Persons at this level must be able to perform all tasks from level 3 under detailed guidance.

##### **Level 1**

Persons at this level must be able to perform simple tasks under guidance.

To this vertical structure a lateral one is added which consists of the EQF descriptors.

However, the descriptors

- Knowledge,
- Skills and
- Competence

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<sup>30</sup> Source: SQF-Con (2009): Sectoral Qualifications Framework for the Construction Industry in Europe. Final Report. Bremen: BAQ.

are supplemented with “sub-descriptors” from the construction sector in order to safeguard the context reference in the descriptions. These are listed in the following table (cf. Table 6)

Knowledge	Skills	Competence
tools, equipment, material, rules, norms, procedures, frame of action, actors	<ul style="list-style-type: none"> <li>- execute practical operations</li> <li>- execute logical operations</li> <li>- planning, organisation</li> <li>- communication</li> </ul>	<ul style="list-style-type: none"> <li>- manage control</li> <li>- achieve results</li> <li>- take responsibility</li> </ul>

Table 6: *Sub-descriptors from the construction sector to extend the EQF descriptors*

These sub-descriptors were used for the description of the levels. It is supposed that they are also capable of describing the developments in the construction sector. On the whole this qualifications framework has to be understood as a framework that represents real job requirements and can therefore be used as a basis for collective bargaining. Further claims with regard to structuring and contents are not associated with the framework.

### 5.1.5 Sectoral frameworks V: The 4ING sectoral framework of Bachelor and Master programmes in engineering and computer science

The 4ING sectoral framework, unlike the previous examples, is a qualifications framework and not a competence framework. The starting point for the definition of descriptors is not the work processes, work-process-analyses or company-specific job titles or workplace descriptions, but the academic degrees (qualifications) Bachelor and Master for graduates of research-oriented and application-oriented degree programmes in engineering or computer science. Accordingly the levels in question are 6 (Bachelor) and 7 (Master), which are undisputed unlike the level assignment of competences below the academic level, especially when vocationally acquired expertise and leadership have to be taken into consideration on top of the formal qualification. The establishment of discipline-specific sectoral framework aims to make the diversity of qualifications visible in spite of the formal equivalence of the formal degrees. The reason is that recruitment takes place not on the basis of NQF levels but on the basis of concrete knowledge, specific skills and competences.

Learning outcomes in the 4ING qualifications framework refer to the achievements of graduates, i.e. job starters. These learning outcomes can be established with the help of the course-specific learning objectives, curricula and examination rules and on the basis of assessments. Competences that are acquired in the work process on the way from novice to expert do not seem to have any influence on the level assignment. But these competences are of crucial importance for sectoral frameworks that refer to occupations and occupational profiles below the academic level (see the CarEasyVET project).

The qualifications framework for research oriented Bachelor and Master programmes was developed by a working group of 4ING, the network of faculties of engineering and computer science at universities (see [www.4ing.net](http://www.4ing.net)). The examples taken into consideration were the formulations and recommendations of the “VDI-Gesellschaft Verfahrenstechnik-Chemieingenieurwesen” (GVC), the Association of Faculties of Computer Science and the 4ING position paper on the doctorate (cf.

ASIIN Newsletter 2008: 11). Experts familiar with the professional practice were also involved in the consultations. Therefore it can be assumed that learning outcomes that are relevant and desirable from the enterprises' point of view were also taken into account.

One fundamental decision with regard to the design of the 4ING sectoral framework was to adapt the EQF terminology of knowledge, skills and competences and not the four-pillar model of professional acting competence (professional competence: knowledge and skills; personal competence: social competence and independence) that has been implemented in the DQR. The reason given was that the consistent usage of the EQF terminology was a necessary condition for the implementation of the 4ING framework.

This consistency requirement, however, is undermined because the concepts of knowledge, skills and competences are defined in a different way than in the EQF (see box below).

**The 4ING definition of knowledge categories  
(simplified definitions on the basis of a learning model)**

**Knowledge**

is retrievable information that is memorised by the learner.

**Skills**

are abilities that enable a person to apply routine procedures that are learned through the exercise of process knowledge.

**Competences**

are abilities that enable a person to adapt ideas and procedures, by analogy or comparison with familiar situations, to new problems or situations in such a way that problems are solved and facts are changed with a view to a specific target.

*(Source: Hoffmann 2011)*

It is obvious that this interpretation of knowledge, skills and competences is based on a radically behavioristic model of learning. This is not compatible with the learning model and the anthropology of a critical sociology and educational science. The equalisation of knowledge with retrievable technical knowledge or accumulated information corresponds to a traditional view of knowledge as an inventory. This interpretation is inadequate because especially engineers often face problems and tasks whose solution generates new knowledge. The definition of knowledge as an inventory needs to be confronted with more elaborate conceptions which interpret knowledge as “intangible asset” or “capacity to act” (Stehr 2001: 62, 2003: 31) or as a process operation and a “complex testing operation” that determines the handling of information (Baecker 2003: 164). The reduction to reproducible and retrievable factual knowledge also fails to recognise the fact that knowledge is disputable and interpretive. Moreover, the reduction to explicable factual knowledge ignores the “tacit dimension” (Polanyi 1985), which is crucial for experts: the implicit knowledge and professional experience that novices (graduates) lack.

The behavioristic understanding of *skills* as routines or automatic patterns of activity “without a mental focus” (Hoffmann 2009) has to be criticised, too. This interpretation is not compatible with the EQF definition of skills, which includes also the capacity to solve problems: “Skills mean the ability to apply knowledge and use

know-how to complete tasks and to solve problems ...: Skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments)” ([www.ecompetences.eu](http://www.ecompetences.eu)). How should all this be possible “without a mental focus”?

It is only in the category “Competences” that the capacity to solve problems independently (with a “mental focus”) is mentioned. The distinction between automated behaviour and routines on the one hand and problem solving capacity on the other seems to serve the purpose, above all, of drawing a precise distinction between skills and competences. This precision is missing in the EQF (see chapter 1)

To summarise: Even though the EQF structure of knowledge, skills and competences has been adopted, the description of competences does not follow the logic of the EQF. Especially the term “competences” does not comply with the EQF understanding of competence as a meta-category that comprises autonomy and responsibility.

In the following we present an excerpt from the qualifications framework for graduates of “research oriented” Bachelor programmes in engineering or computer science:

**Knowledge:**

The graduates are equipped with the scientific fundamentals in the areas of mathematics, natural sciences and the specific disciplines in engineering or computer science.

The graduates understand the phenomena and problems as well as the fundamental principles of modelling in the various disciplines of engineering and computer science, and to apply this knowledge in practice.

**Skills** (methods of engineering or, respectively, computer science):

The graduates are able

- to identify professional problems with the help of fundamental knowledge,
- to abstract, formulate and holistically solve these problems,
- to grasp systematically, analyse and evaluate components, processes and methods of their discipline,
- to select and apply appropriate methods of analysis, modelling, simulation and optioning,
- to specify requirements for practical solutions of simple problems,
- to work out practical solutions on the basis of specified requirements, and to realise these solutions,
- to understand design methods in depth and to apply them,
- to carry out literature searches and to use subject-specific sources of information for their work,
- to plan and carry out experiments or systems implementations and to evaluate the results.

### Competences:

The graduates have<sup>31</sup>

- the competence to combine theory and practice with a view to analyse and solve research questions in engineering and computer science in a methodical way and with the help of fundamental knowledge,
- an understanding of applicable techniques and methods as well as their limits,
- the competence to use their knowledge in different areas responsibly and in consideration of safety-related, economic, legal, social and ecological requirements, and to deepen their knowledge independently,
- the competence to organise and implement projects,
- the competence to cooperate with experts from other disciplines,
- the competence to present the results of their work clearly in writing and orally,
- an awareness of the non-technical effects of working as an engineer or computer scientist,
- acquired, in their studies, general competences like time management, learning and work techniques, ability to cooperate, team orientation, and communication,
- the competence to communicate with laymen and experts in German and English about contents and problems of their discipline,
- the competence to work on their own as well as in international teams,
- a good preparation for lifelong learning and for employment in different occupational areas thanks to the orientation to fundamentals in the study programme,
- an awareness of the impact of their work as engineers or computer scientists on the society and
- an awareness of the ethical principles of working as an engineer or computer scientist.

It is quite obvious that the descriptors do not follow the logic of knowledge, skills and competences.

### Conclusion:

1. While the short definition views *knowledge* as retrievable information (factual knowledge), the framework also mentions the capacity of problem solving as a characteristic. But only familiar problems can be solved through the retrieval of stored knowledge. New problems or applications require new solutions and thus generate new knowledge.
2. The descriptors in the category *skills* go far beyond routine procedures (“without a mental focus”) like those formulated in the short definition. Problem solving competence is the crucial requirement also in this case.
3. It is also striking that the category of *competences* includes a multitude of descriptors that imply, to a greater or lesser extent, autonomy and responsibility

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<sup>31</sup> Source: ASIIN Newsletter No. 2, May 2008

(the competence categories of the EQF) in one's own activity and in the interaction with others. If the list of competences is compared with the description of EQF level 6, one finds that the 4ING framework additionally mentions the observation of ethical principles and the ability to cooperate. What is important – since this is a qualifications framework with competence profiles of university graduates – is that competences are included which can be developed only in the course of some years of professional experience. These include interdisciplinary cooperation with experts, project management competence, competence to collaborate in international teams, knowledge about the societal, legal etc. effects of one's own activities.

4. To summarise: The compatibility with EQF level 6 is deficient because the 4ING framework mentions relevant extra-functional competences (reflexivity, awareness of societal effects of one's activities, consideration of ethical principles in the area of activity, cooperation) as well as functional competences relevant for the discipline that are missing in the EQF.
5. So on the one hand the 4ING framework and its definitions reach beyond the EQF, the declared reference framework, and on the other hand the framework concentrates on the university education without taking into account the professional practice of engineers.

## **6 Conclusions: Implications for the generation of frameworks**

The discussion shows that there are no agreed theoretical principles, no standard procedures and no comparable descriptors for the construction of sectoral qualifications frameworks. Therefore the different sectoral frameworks can neither be compared nor clustered. Each of the presented sectoral frameworks exists on its own. The same is probably true of other existing sectoral frameworks. Accordingly sectoral frameworks are no advantage when the aim is to compare the training quality and the qualifications of different sectors. This disadvantage turns into an asset when it comes to transnational comparisons within one sector. The sectoral frameworks presented are appropriate for comparing the training quality and the qualifications in a sector across national borders. Due to clear references to the world of work they offer considerable advantages because they deliver sound information for the sector concerned, which is why they are met with much higher acceptance than meta-frameworks. The inevitable question is whether national frameworks are needed at all when sectoral frameworks are used. Sectoral frameworks can be directly referenced to the EQF without taking the detour via a national framework.

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