Beiträge aus der Praxis der beruflichen Bildung

Nr. 13

Activity Analysis and Identification of Qualification Needs

Internationale Weiterbildung und Entwicklung gGmbH
Capacity Building International, Germany

Impressum

Editor:	InWEnt – Capacity Building International, Germany Technological Cooperation, System Development and Management in Vocational Training Division 4.01 Käthe-Kollwitz-Straße 15 68169 Mannheim
Authors:	Prof. Dr. Ekkehart Frieling, Dr. Markus Buch
ISBN:	3-937235-47-7
Text editing:	Melany Martin, Heidelberg
Translation:	Melany Martin, Heidelberg
Layout:	Rendel Freude, Köln
Graphics:	Prof. Dr. Ekkehart Frieling, Dr. Markus Buch
Pictures:	Rendel Freude
Date of Publication:	December 2005

Activity Analysis and Identification of Qualification Needs

Index

InWEnt in Brief

InWEnt – Capacity Building International stands for human resource and organizational development within the framework of international cooperation. InWEnt's services cater to new managers, skilled and executive personnel as well as to decision makers from businesses, politics, administrations and civil societies worldwide.

Programs and measures at InWEnt aim to foster the capacity for change on three levels: They strengthen the capacity of individuals to act, increase the performance of businesses, organisations and administrations, and improve the capacity for action and decision-making at the political level. InWEnt's methodological tools are drawn up in modular form, so that they can be used for customized services development, according to needs and demand. In addition to face-to-face training situations, to exchange and policy dialogue, emphasis is also given to networking with the help of e-learning. InWEnt's partners are equally from developing, transition and industrialized countries.

InWEnt shareholders are the German Federal Government, represented by the Federal Ministry for Economic Cooperation and Development, as well as the German industry and the German federal states (Länder).

InWEnt was established in 2002 through the merger of Carl Duisberg Gesellschaft (CDG) and the German Foundation for International Development (DSE).

Division 4.01 of InWEnt is seated in Mannheim and conducts on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) advanced training programs. Under the banner of "sustainable development", its work focuses on questions of technology cooperation, system development and management in the field of technical and vocational education and training. Its dialog and training programs are targeted at decision-makers from the public and private sectors, junior managers and multipliers from vocational training systems.

Introduction

From 2003 onwards, InWEnt´s Division "Technological Cooperation, System Development and Management in Vocational Training" is to present a series on everyday practice in vocational training.

The intention of this series is described in the title itself ("Beiträge aus der Praxis der beruflichen Bildung" = series on everyday practice in vocational training). The division aims to support its programs of international personnel development in the above-mentioned areas with technical documentation in both printed and electronic form.

These reports

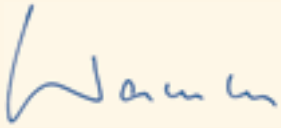
- originate in the partner countries, taking into account specific situational demand
- will be tested with and for experts in vocational training in the partner countries in conjunction with respective practice-oriented training programs on offer, and
- with a view to global learning, will be improved and adapted prior to publication according to the recommendations of the partners or the results of the pilot events.

Thus, the Division "Technological Cooperation, System Development and Management in Vocational Training" is applying the requirements of InWEnt´s training program to its own products in the above faculties: i.e. these can only be as good as their practical relevance for the experts of vocational training systems in the partner countries.

To this effect, we look forward to critical and constructive feedback from all readers and users of these special series.

Our thanks go to Prof Dr. Ekkehart Frieling and Dr. Markus Buch of Kassel University who both made invaluable contributions to these activities.

Division "Technological Cooperation, System Development and Management in Vocational Training", InWEnt, Mannheim, Germany



Dr. Manfred Wallenborn
Head of Division
tvet@inwent.org

1 Changing Scenarios and Qualification Demand

The political and economic changes often described with buzz words like globalization, decentralization and stockholder society have been affecting gainful employment since the 80ies of the last century. This is true for highly industrialized countries in the same way as for transformation and developing countries. Beck's so-called "Brasilianization of the West"(1999) describing the deregulation of the basic standards evolve from a paradigmatic switch from the "job security offered by the companies" to the "employability of the employee". Simultaneously, the industrial production in transformation and developing countries is increasing. This development generates risks and opportunities. As a result, organisations have initiated extensive restructuring processes to affront the challenges of globalisation encountering new competitors and exploring new markets which in many cases results in a strategic centralisation in combination with an operational decentralisation. At the same time, rapid changes of technology are taking place. As a consequence, we are observing a growing speed of technical innovations with reduced productive lifecycles. The described basic structures, which can only be drafted here, correspond to the rapidly changing working conditions. Also qualification and competency requirements constitute an integral part of this. The sketched trend shows that present qualifications become obsolete, if they are not constantly expanded. Such qualification adjustments require a lifelong learning which needs to be supported through the creation of appropriate organisational measures. Therefore, the structure of the working environment should facilitate learning within the job and plan a personal development strategy for each employee. This dynamic of increasing changes in the field of qualification and competency requirements is causing a crisis of uncertainty not only towards the initial vocational training, but also towards further training within the company.

Under circumstances as this, the identification of the qualification demands for crafts as well as for industrial professions gains a key function. The relevant questions to be asked are: Which are the qualifications offered by (potential) employees? Which qualifications are currently imperative? Which technological and organisational changes can be anticipated? How do they alter the structure of tasks within the profession? Will the tasks change with regard to their qualification requirements? And therefore: Which qualifications will gain importance in the future?

The starting point of this examination is the work task. Its order and performance criteria determine the regulation and the structuring of the task. Therefore, the work task is to be considered the main analyse unit to determine "the qualificational content of work tasks with the objective to use the requirements for occupational action competencies for work relevant curricula (and) to design learning tasks and environments in order to initiate work orientated integrated learning processes".

On the other hand, the analysis of work tasks represents the target of the job and activity analysis. The job and the activity analysis, on the other hand, constitute a precondition to define the demand of qualification. In everday practise job analysis is often done adhoc based on years of practical experience or extensive expert reports in the respective field. Although, there are work analytic procedures capable to generate databases which are able to solve these questions systematically. This will be clarified in chapter "2 Job analyses" before discussing the different aspects of qualification and qualification demand in chapter 3. Furthermore, we will sketch the application of the analysis strategy the "duty list" as an example in chapter 4, which can be used universally.

2 Activity Analyses

Activity analyses are a precondition to determine the demand of qualification in a systematic approach.

Furthermore, they constitute the basic structure to create more humane and economically efficient work. In this chapter we will start by defining the concept, the fields of application, the objectives/intended application as well as their respective application areas. Finally, the theoretical and methodological fundaments will be discussed.

Definition

By activity analyses we understand all methods, procedures and instruments with the purpose of collecting, processing and interpreting information about work activities, technical and organizational working conditions, working methods and tools as well as the impact on the staff. The job analysis aims on defining the interaction between the objective working conditions, working processes and the persons involved (employees). As work is always linked to a specific social environment, social conditions (wage settlements, standards, rules, laws) need to be taken into consideration. Apart from this context, also the personal characteristics of the employee, like physical condition, knowledge or capabilities and skills, but also the perception and the interpretation of the working situation play a determinant role in the job analysis process. The different aspects of the work activity (working conditions and behaviour which can be recorded objectively as well as individual characteristics and subjective perception) are differentiated according to the aim of the respective job analysis. Usually, the working activity (meaning a typical combination of tasks) of a person is focused on a job analysis, as the work to be analysed manifests itself while it is done.

As there is no established general delimitation between job analysis and activity analysis, both concepts are often used as synonyms.

Application Areas

The application fields of the job analysis vary due to the changing allocations of tasks in company practices, the current research assignments and the different scientists involved in the analysing process. The potential application areas of the job analysis are defined through the combination of the respective targets of the different methods depending on the area of application.

Additionally, there is a growing need in Human Resources of compiling all the results coming from all the job analyses which have been conducted with several purposes and trying to give them a multifunctional utility. The companies need to gather the data coming from the workplace analysis in order to determine their auditing procedures (standard specification groups ISO 9000: 2000, VDA 6,3, auditing for environment protection, risk assessment).

Even for the work structuring effort, business process reengineering, optimisation of working processes, the implementation of subject specific careers or the design of innovative qualification measures job analysis data is imperative.

Target / Intended Application

The relevant specialised literature cites the following on the purpose of classic application fields of job analysis:

> Improvement of existing working procedures and processes, workplaces and working activities from a technical-organisational, ergonomic and creative point of view.

- Assessment of risks, identification of workplace safety issues, specific health and work related aspects

- Determination of work requirements and of the relevant qualification for the selection, positioning and qualification or the training of staff members.

- Comparison of working activities on a vertical and a horizontal level to detect differences and similarities. The targets can be scientific comparison, determination of remuneration, development of technical vocational and further training measures as well as career guidance. Furthermore, alternations according to technical impact estimations can be evaluated after technical and organizational restructuring measures.

- Determination of work related strain and effort.

Application Field / Branch / Profession / Occupational Groups

All available tools cover a specific application field. The application field can be related to the operational groups of an organisation (for example to production, manufacturing, administration, nursing area in a hospital) or to particular occupational goups (for example operating CNC machines or computerized workplaces). The job evaluation criteria for the analysis of avtivities in manufacturing were used to determine a procedure group able to cover a much broader application field. The same is true for the so-called "*Berliner Arbeitsanalyseverfahren*" (The Berlin job analysis procedures).

On the other hand, there are tools which claim to provide a relatively broad coverage on occupations including different branches and functional areas. The questionnaires for job analysis as well as the inventory of job analysis belong to this set of tools. This particular procedure focuses on the differentiation potential in the areas of production/manufacturing and administration and less on service sector. The differentiation capacity depends on how the analysis criteria are formulated and on their respective abstraction level: The lower the level and the more specific the criteria of the different occupational categories, the more restricted are the application areas. Normally, the specificity of the criteria increases the autonomy of procedures as the analysis comprehends concrete characteristics which can be made accessible for modification depending on the investigation target. The task inventories constitute an extreme example for a low abstraction level.

Theoretical Backup

Depending on the theoretical backup the distinctive aspects of the work activities are delimited through selected analysis criteria. The development of these work analysis procedures radiates from different theories. The range of theories covers stimuliorganism response models of behaviour over strain/demand model, action regulation theories, socio-technological system approaches, job theories up to socio-industrial and organisational model theories. Usually the procedures explicitly make reference to a theory or imbeddes several theoretical concepts (e.g. Task-Analysis Inventory - TAI).

Task versus Personality Oriented Activity Analysis

The differentiation between task versus personality oriented activity analysis techniques according to Oesterreich and Volpert (1987) predominate in the German industrial science. A standardised definition to delimitate the objective from the subjective job analysis could not be established.

The personality oriented job analysis explicitly examines the individual strategies, the attitudes and opinions of the employee as well as his redefinition

of the assignment. On the other hand the task oriented job analysis contains a more general evaluation of the work conditions not related to the employee. Through the introduction of the, hypothetically, ideal employee all individual particularities become abstracted. As the task to be analysed constitutes itself through the interaction between the individual and the environment there can be problemes, with reservations, especially in the case of less institutionalised professions with a high levels of flexibility. In this case the classification of personspecific versus person non-specific job analyse procedures seems more appropriate.

Methodological Backup

In order to conduct job analyses, there is a wide range of statistical methods available. There are, to mention but a few observations, surveys, observational interviews, data analyses, work diaries as well as services performed by job analysts.

The most commonly used method is the survey. Surveys are employed particularly in the case of personality oriented job analyses. Nevertheless, all these questioning methods comprise specific problems: The translation of scientific terms into everyday languages is difficult due to its ambiguity and often the regulation processes can not be verbalised easily as they are psycologically automated. In the case of observations difficulties are more of a methodological nature when it comes to the compilation of rare but relevant events (e. g. disruptions) as well as the compilation of temporal dynamic aspects of the work activities as for example pressure of time. To affront these problemes, observations and questionnaires are normally combined with observational interviews using them as task oriented job analysis tools.

A reliability check concerning the solidity of the tool is necessary when it is used by several researchers, for different research purposes covering several people performing the same working tasks (this aspect is irrelevant for interactional procedures), since the task oriented job analysis procedures do not compile information on the person itself, but on their activities.

For this purpose Oesterreich & Bortz (1994) propose an appropriate statistical design and evaluate further possibilities for validity checks of task oriented procedures. For the evaluation of personality related job analysis procedures the current theoretical testing standards in the area of psychological profile studies constitute an appropriate method.

3 Qualifications and Qualification Analysis

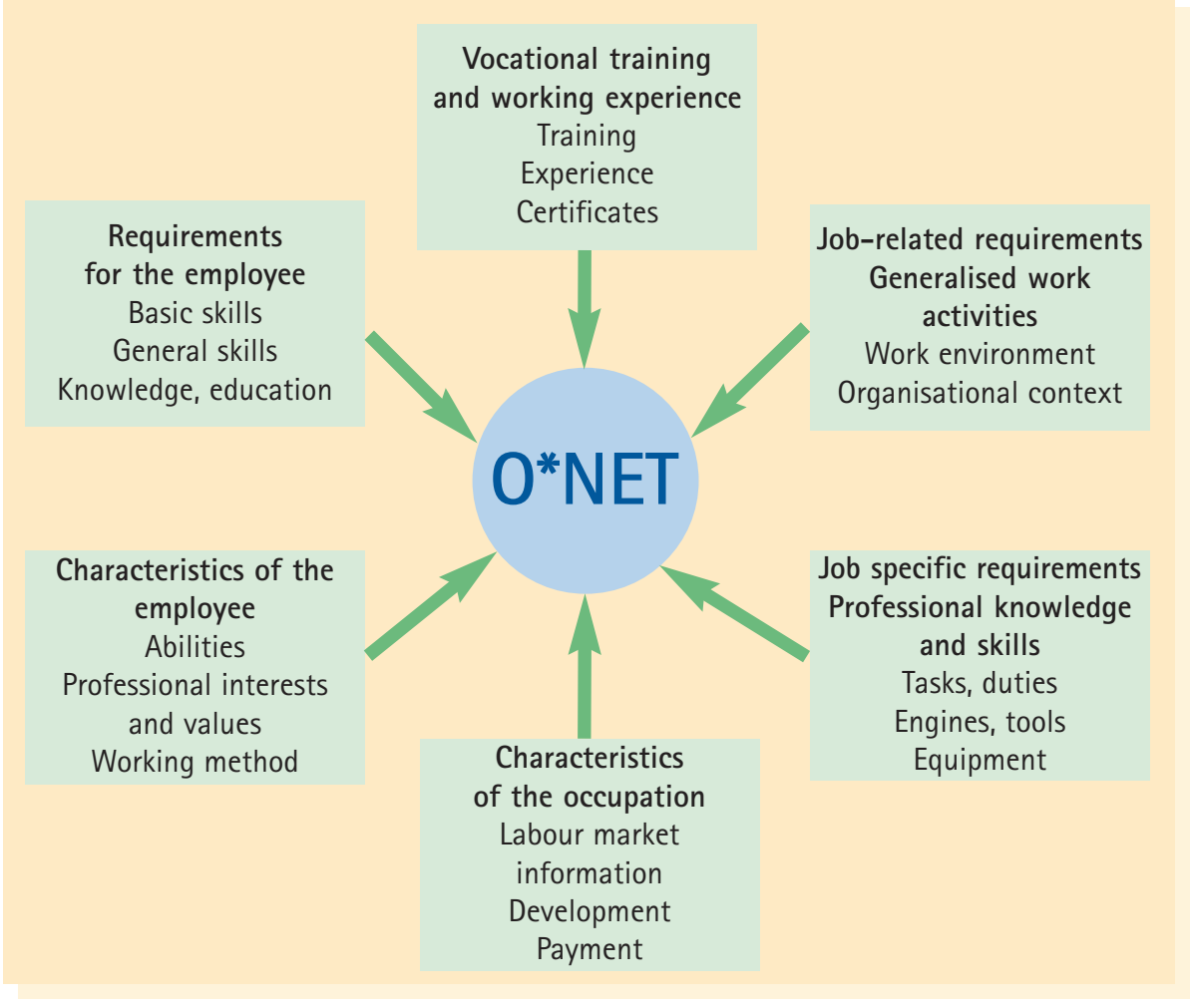
In the following subchapters we will define the concept of qualification, its different aspects, how it is interrelated with the effort and the characteristics of the qualification demand.

Definition

Qualification can be described as follows: "An individual gains action capability by owing the amount of capability to handle, organize and manage a situation. We speak of qualification if this action capacity comprises a degree of maturity and a clearly defined situational context".

In the respective scientific publications the concept of "qualification" was almost superseded by "competency" – therefore you will not find any entries on "qualification" in the "Manual for Human Resources". The controversy about the delimitation between competencies and qualifications will not be consolidated at this point; they will therefore be used as synonyms.

Chart 1: O*NET Content Model



Subsequently, we will introduce the "Content Model"to illustrate the different aspects of qualification as well as to emphasise on the links between the concepts of work activity and work tasks.

The O*NET Content Model

A comprehensive conceptual model to describe activities is the "Content Model", which represents the basis of the Occupational Information Network. This complex approach captures qualification relevant information in a comprehensive way, as it can be appreciated in chart 1.

In order to determine the qualification demand, the requirements that can be swayed are more relevant then the characteristics which normally are invariable. Accordingly, in the following we will discus the aquisition of skills, the knowledge structure, and the job preparation, the generalised work activities as well as work tasks and duties.

Skills. Mumford et al. (1999) have developed a classification scheme for a systematic evaluation of skills. This requires the differentiation between basic skills (e.g. reading comprehension and learning strategies) and average skills which ensure that the knowledge is applied to the work tasks (e.g. solving of complex problems, social skills, and technical skills). The different skills are classified and put into the required category on an established 8 level scale while the evaluation of the skills relevant for the total performance is measured on a 5 level scale. Additionally, it also needs to be determined, if the respective skills constitute a prerequisite to enter the profession.

Knowledge structures. Constanza, Fleishman and Marshall-Mies (1999) elaborated a hierarchically organised scheme of activity relevant knowledge prerequisits and converted it into an instrument for knowledge analysis. This procedure requires the evaluation of 33 disciplines out of 11 knowledge clusters as a first step to determine the essential knowledge. First of all, the necessary extend of knowledge needs to be defined. In case the respective knowledge area is relevant the knowledge area is additionally categorised due to its importance towards the total performance. Furthermore, the specific requirements are determined based on 214 given specialised areas.

Preparation for the job: In order to facilitate the design of the curriculum the preparation considered as necessary for the duty needs to be determined. Anderson (1999) presented a comprehensive module with the objective to systemise this kind of information. This module includes the necessary educational and vocational degrees, the required educational levels in the different specialised areas as well as the necessary vocational certificates and the expected professional experience.

Generalised work activities: The "generalised work activities" represent categories of similar work activities or behaviours considered essential to cope with relevant work tasks. This leads to the Position Analysis Questionnaire as starting point for the development of classification systems. Furthermore, the following procedures and approaches have been taken into consideration: the Job Element Inventory, the Occupational Analysis Inventory, the Generalized Work Inventory as well as management classification systems. The "Generalized Work Activities Questionnaire" which has been developed on this ground requires a definition of the level, the relevance and the frequency of the 42 generalised work activities corresponding to the four dimensions of information input, cognitive processes, work output and interactions with others. The relatively high abstraction level of generalised work activities (examples are explained in chart 2) allows an interdisciplinary comparison. This classification can be performed by employees or by professional raters.

Chart 2:

Description and Definition of Selected Generalised Work Activities (GWA)

Denomination of the GWA	Operationalisation	Basis of criterion
Dimension 1: Information input, e.g.: Search and compilation of job-related information		
Extraction of relavant job-related information	Study, capturing or other forms of information collection of all relevant sources	**High** – Preservation of information of several sources often through active interaction **Low** – Regular use of the same type of information of a single source
Dimesion 2: Cognitive processes, e.g.: Conclusion / Decision Making		
10. Decision making and problem solving	Combination, evaluation and conclusion of/with information and data in order to make decisions and to solve problems. These processes comprise decisions concerning the relevance of the information and the selection of the optimal solutions.	**High** – Draw the consequences after considering a great variety of options which tend to be ambiguous or abstract with opposed approaches and alternatives which need to be considered before a final decision can be made. The chosen solutions have highly significant effects. **Low** – Draw the consequences after considering a few options which tend to be clearly defined limiting the number of possible actions and the effects by the taken decisions or solutions.
Dimension 3: Work output: e.g.: Performing physical and manual work activities		
17. Handling and moving objects	Utilisation of hands and arms for the handling, installation and positioning of material or for the manipulation of objects (including the use of a keyboard)	High – Hands and arms are used almost constantly to perform the same function. Low – Scarce use of hands and arms.

Dimension 4: Interactions with others: e.g.: Communication / Interaction		
30. Aid and care	Provide aid and personal care	High – Provide aid and care in highly straining or challenging situations. Low – Provide only little aid or care.

Generalised work tasks are particularly effective to determine the similarities of occupations. This can be used as a starting point to design interdisciplinary vocational and further training or practical training measures.

Tasks / Duties. In contrast to the description methods presented before, tasks are on an activity specific analysis level. For a variety of psychologically relevant tasks job specific information is indispensable. Task inventories are an adequate method to generate this information. This approach was applied by Christal (1974) in the Comprehensive Occupational Data Analysis Program (CODAP) as a starting point for the curriculum design of vocational training courses for those entering the profession, particularly for the US Air Force. Further application fields of the task inventories are the deduction of qualification programs or aptitude requirements, systematic modification of occupational groups as well as the formulation of job descriptions or performance assessments. Some elements of the tasks inventories have been used already by Taylor (1911), as well as Gilbreth and Gilbreth (1917). The analysis level of this approach is the task which is performed through a link between an object and a verb e.g. "study blueprints". As a result, tasks lists have an extremely low abstraction level.

The approach of task inventories rests on a two level model. Normally, task inventories are developed by external experts in cooperation with the superiors. Apart from being generated, the tasks are categorised by subject areas into the respective duties (or functions) on a higher aggregation level. These are defined as "a broad subdivision of a job composed of a group of tasks that are somewhat related because of the nature of the work of the behaviour involved". The "generalised work activities" can also be considered as a structural frame for the organisation of tasks.

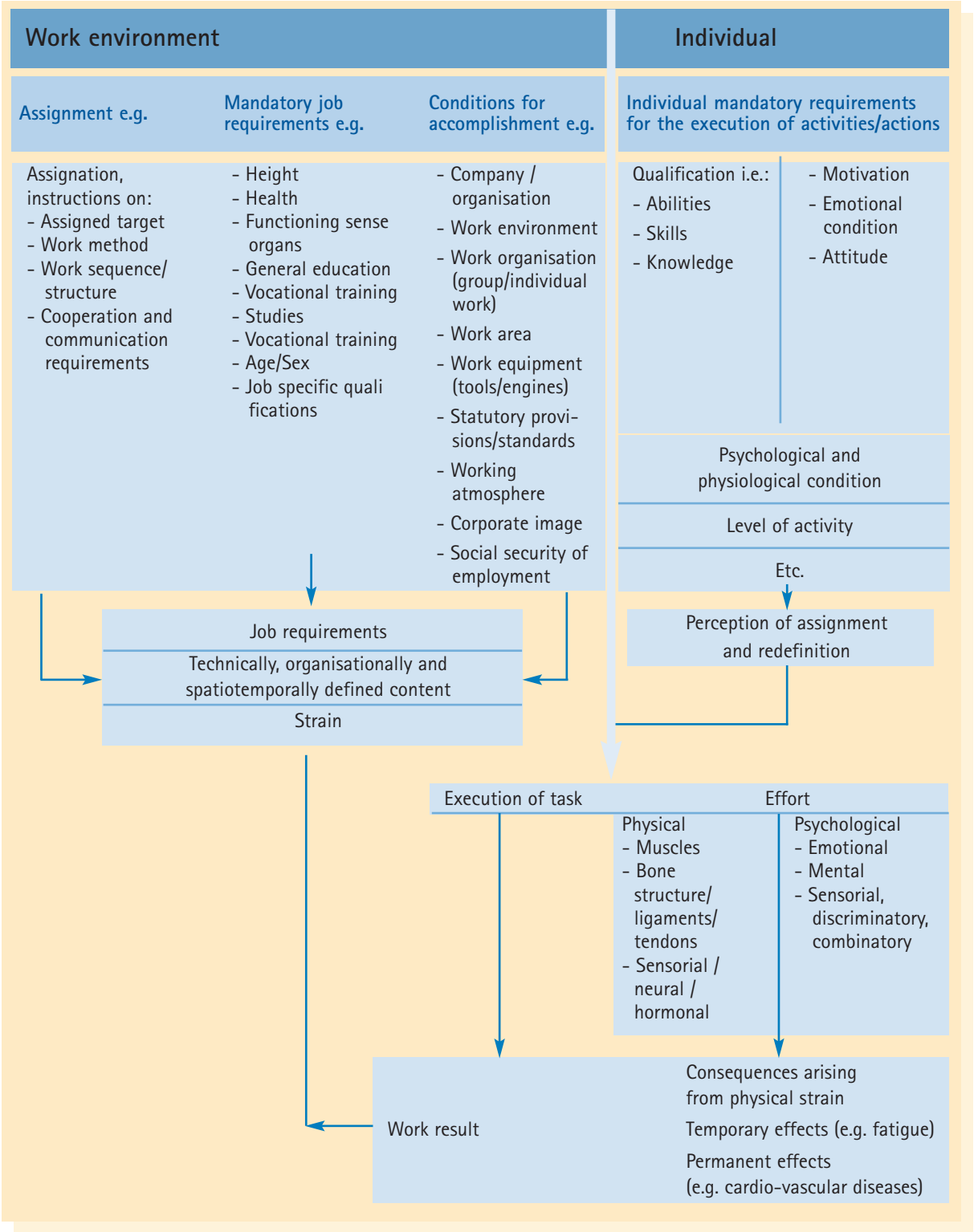
In the next step the tasks of the inventories are classified on different scales e.g. by employees. By this means task relevant statements can be made concerning the importance of the task, its proportional time on the total working hours or its intensity.

Occupational related information is indespensable to define the qualification demand. In order to generate this information task inventories have proven to be an effective method.

Qualification and Effort

The task and duty relevant qualification of an employee are the prerequisite to cope with the work tasks in a successful way and for the obtention of positive working results. In general, the respective researches focus their interests on that particular link. Nevertheless, qualification is also interconnected to the effort. The discrepancies between individual performance requirements and their effort on one hand, and the expectations on the employee resulting from the nature of the assignments and the objective conditions for their execution on the other hand can lead to job strain. A mismatch of qualifications and tasks can lead to psychological exhaustion and stress. The complex relations

Chart 3: Relations between Individual Performance Requirements, Work Environment, Work Requirements, Efforts and Work Results



between qualifications as essential component for the individual performance requirements, the work environment, the work requirements, the effort and the work results can be observed in chart 3.

Qualification Demand

The qualification demand determines the discrepancy between the currently present and the demanded qualification which evokes from the requirements for defined actual or future tasks. This definition of discrepancy therefore comprises an actual value and a potential goal. The wider the discrepancy the higher the qualification demands. Particularly the forecast of future required qualification demands is difficult. It is based on a diversity of assumptions. Nevertheless, we need to take the risk and speculate about the future.

In order to project the qualification demand several application methods can be useful. The different aspects of the Content Model mentioned before are considered to be suitable in order to determine the discrepancy between the actual and the target value. Duty lists constitute one of the approaches with the highest acceptance in business practices. The application of these further developed task inventories will be discussed in the following chapters.

4 Duty Lists – An Approach to Determine the Qualification Demand

The duty list (DL) permits to depict the production processes including main and subordinate processes, to structure the individual steps of each process and to systematically describe the new duties coming up. Besides the specific requirements for the employees, it also shows all other required and existing competences to perform the tasks. The DL offers the possibility of supporting the planning of required training measures and of qualifing the employees for new processes and changing tasks.

This chapter discusses the characteristics of a duty list, how to create a duty list and, finally, we will show an exemple on how it is applied in business practises.

Characteristics of a Duty List

The following criteria of the approach facilitate to adapt the task structure to rapid changes.

- Prospectivity: The description of the current value with respect to the task level is contrasted with the respective goals, which reflect the technological innovations and the strategic reflections.
- Participation: Participation can be achieved when the employees themselves generate the tasks rather then the superiors in cooperation with external experts. This process is moderated by external experts in workshops.
- Flexibility: The necessary flexibility is achieved as the employees get to documentate the job elements on the task level themselves. This process reflects

Chart 4: Step 1 – Definition of the Total Structure

HC Pharma – LIFE	Ecoflac Production (Ecoflac 100, 500, 1000)	Employees 1	
		Actual value	Target value
1	Bottling Ecoflac		
2	Palletisation, sterilisation, depalletisation		
3	Packaging and final storage		
Interdisciplinary competencies, skills and knowledg			
	Technical competencies		
	Methodological competencies		
	Behavioural competencies		
	(social competency and self assessment)		
	IT competency		
	Further training in general		

the core competences given by the companies.

- Rhythmic: Describes the recurrent classification of the task lists performed by the employees after massif technical-organisational changes as well as changes in the structure of the assignment outline, or at least every two years.
- User-friendliness: Is achieved when the task inventories have data processing support. As a result, modifications can be introduced without any effort. Nevertheless, it is indispensable to have at least one person or department within the company responsible for the maintenance and the update of these task inventories.

How to Set up a Duty List

The following chapter describes the six steps to set up a duty list in order to define the qualification demand.

1. Determination of the Total Structure

The first step defines the criteria to structure the duties, for example as a lineal process. The following example represents the production process of saline infusion. The total process has been divided into three main duty categories: "1 Bottling Ecoflac", "2 Palletisation, sterilisation and depalletisation"and "3 Packaging and final storage" (see chart 4). They can be elaborated for the entire process e.g. in group interviews with experts. Consequently, interdisciplinary competences, skills and knowledge are added in a standardised process. Further, they are classified into technical competences, methodological competences, behavioural competences (social competence and self-assessment) as well as IT competences and further training in general.

Chart 5: Step 2 – Capturing of all Duties and Task

HC Pharma – LIFE	Ecoflac Production (Ecoflac 100, 500, 1000)	Employees 1	
		Actual value	Target value
1	**Bottling Ecoflac**		
Bottlepack – Bottling plants 1 – 5			
	In-process-control (IPC)		
	DIP		
	AKM		
	AKU		
	Conveying system cleanroom		
	Recycling granulate		
	PUK bottling system		
	General		

2. Capturing of all Duties and Tasks Inherent to the Respective Total and Subordinated Processes

In the second step the groups of duty categories (or subordinated processes) are divided into duties. They can also be considered as "duties"in accordance with the task inventotries. The following chart shows the different duties for the duty category "1 Bottling Ecoflac" (see chart 5). The first workshop is aimed at the generation of duties. A participative approach ensures that the specifics of the production process are taken into consideration. In addition, the participation of the employees guaranties the acceptance of the procedings.

3. Deduction of Necessary Technical Competences for the Performance of Duties

The articulation of the necessary technical competences for the performance of duties is also conducted in workshop. The inventory of the necessary technical competences elaborated is put at free disposal to the employees in order to obtain additional

Chart 6:

Step 3 – Deduction of the Necessary Technical Competences

HC Pharma – LIFE	Ecoflac Production (Ecoflac 100, 500, 1000)	Employees 1	
		Actual value	Target value
1	**Bottling Ecoflac**		
	Bottlepack – Bottling plants 1 – 5		
	Operation and supervision of plants		
	CIP / SIP		
	Handling system		
	Punch and evacuation systems of chips		
	Bottling sample		
	Configuration		
	Inspection of bottling plant		
	Calibration		
	Cleaning		
	Sterile filtering / particle filtering, filter change and inspection		
	Maintenance		
	Troubleshooting		

remarks. It is imperative to facilitate a contact for the employees to offer support for the participatory elaboration as problems arise e.g. for the identification or classification of a duty. A second competency oriented workshop aims at the comparison and unification of additional remarks
(see chart 6).

4. Deductions of the Interdisciplinary Competences Which can not be Directly Assigned to a Duty or Task, but are, however, Indispensable for the Process as a Whole

Finally, the formulation of a duty list calls for the integration of interdisciplinary competences (see chart 7, left). In this context the ability for teamwork can be considered as one part of social

Chart 7: Step 4 – Deduction of Necessary Competences

HC Pharma – LIFE	Ecoflac Production (Ecoflac 100, 500, 1000)	Employees 1	
		Actual value	Target value
Interdisciplinary competencies, skills and knowledge			
IT competency			
IT basics			
Lotus-Notes			
MS-Office			
IT basics skills			
SAP R/3			
SAP Module x			
SAP Module y			
SAP Module z			
MES			
PLS			
Technical competency			
Workplace safety and environment protection			
Basics of workplace safety and environment protection			
Training for safety resource persons (basics)			
Training for safety resource persons (consolidation)			
Training for environment protection representatives			
First aid			

Chart 8: Competency Criterion for Task Evaluation

Evaluation of Knowledge Abilities

0 = no knowledge
1 = basic knowledge/abilities/basics/overview
(assistance necessary)
2 = general knowledge/abilities
(no assistance necessary,
only in exceptional cases)
3 = qualified knowledge/abilities/experts
(no support necessary)
4a = Method developer
4b = Method implementer

competences when required necessary for several different duties. As a rule, this can be applied to semi autodidact group activities or projects. The work steps three and four are normally analysed subsequently discussed in the workshop sessions.

5. Selection of the Appropriate Criterion

Initial to the classification of the duties and competences a criterion needs to be established. In many cases a dual criterion of"accurate/necessary"and "inaccurate/unnecessary" is applied (see chart 7).

In order to emphasise on the intensity of the particular duties at the moment and which duties will be compulsory for the future more differentiated criteria can be applied. The following chart 8 gives one example on how it can be done.

6. How to Establish an Actual and a Target Value Profile

In general, the criteria for evaluation for the actual value profile are elaborated by the employees, in exceptional cases they can be evaluated by the superiors. The evaluation of the target value profile is elaborated in workshops. The demand for further training measures (groups/teams/staff members) can be identified through the comparison of the target value and the present qualification level (balance settlement).

Exemplary Model for a Duty List – "The Sodium Chloride Production"

The following duty list (chart 9) is a perfect example for the identification of the qualification demand through the comparison of the actual value and the target value profile of the employees. This extract is a reference of a pharmaceutical company for the standardised production of sodium chloride.

The duty cathegories "1 Automated production process", "2 Palletisation" and "3 Optical check and packaging" are complemented with interdisciplinary competences "4 Technical competence", "5 Methodological competence" and "6 Behavioural competence (social competence and self assesment)". The compilation of duty lists used to be very time consuming. Several workshops were conducted with the persons involved in the process to achieve a unanimous solution. The actual value profiles are based on the opinions of the employees, the target value

Chart 9: Duty List "How to Produce a "Sodium Chloride Solution""

Production process A Production	Training / Qualification		Employees 1		Employees 3	
	Priority	Duration(h)	Actual value	Target value	Actual value	Target value
1 Automated production process	1	50				
1.1 Plant and machine operation			x	x		
1.2 Maintenance, cleaning and adjustment			x	x		
1.3 Troubleshooting and repairing				x		
1.4 Equipment of magazines			x	x		
1.5 Cleaning (facilities and plants)			x	x		
1.6 Technical supervision of production process			x	x		
1.7 Operation of recycling plant			x	x		x
2 Palletisation	1	20				
2.1 Palletisation and plant functioning				x	x	x
2.2 Process monitoring				x	x	x
2.3 Maintenance and cleaning				x	x	x
2.4 Transports within the production site				x	x	x
3 Optical check and packaging	2	70				
3.1 Optical check, detecting the sources of defect			x	x	x	x
3.2 Monitoring of total production process and					x	x
operating of: product labelling, carton lid,						
carton labelling, assembly line						
3.3 Recording of error statistics					x	x
3.4 Adjustments, maintenance, cleaning, loading					x	x
3.5 Process monitoring						x
3.6 Sporadic transports with lift trucks in the			x	x		x
work area						
Interdisciplinary competency						
4 Technical competency						
4.1 Workplace safety and environment protection			x	x	x	x
4.2 Quality management			x	x		x
4.3 IT-competences			x	x		x
4.3.1 Data processing (basics)					x	x
4.3.2 SAP					x	x
4.3.3 Office						x
4.4 Machines & engineering			x	x	x	x
4.4.1 Electropneumatics						
4.4.2 SPS						

Production process A Production	Training / Qualification		Employees 1		Employees 3	
	Priority	Duration(h)	Actual value	Target value	Actual value	Target value
4.5 Languages						
4.5.1 English						
4.5.2 Technical English						
4.6 Manufacturing regulations and GMP			x	x	x	x
5 Methodological competency						
5.1 Continuous improvement process			x		x	x
5.2 Project management						
5.3 Group work			x	x	x	x
5.3.1 Group work			x	x		
5.3.2 Functional group leader					x	
5.4 Problem solving and decision making						
5.4.1 Troubleshooting						
5.4.2 Problem solving and decision making						
5.5 Moderation						
5.6 Work organisation and time management						
6 Behavioural Competency (Social competency and self assessment)						
6.1 Communication capacity						
6.2 Conflict capacity						
6.3 Team capacity			x	x	x	x
6.4 Target orientation						

profiles, however, were elaborated by both, the employees and the superiors. The fields marked in orange represent the demand for qualification, while the yellow fields stand for non-used qualifications. Furthermore, the qualification contents have been prioritised and estimates towards their required time consumption have been laid out by a group of experts.

Integration of the Duty List into Human Resources and Organisational Development

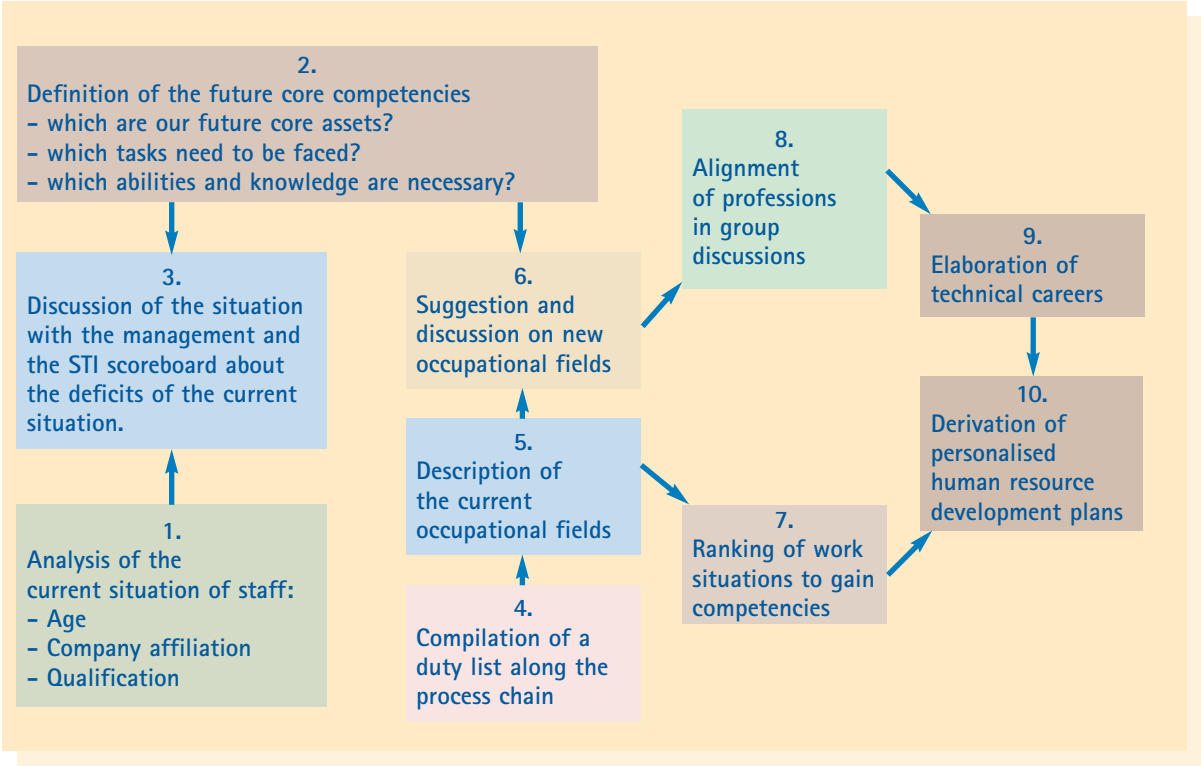
The integration of the duty list into human resources and organisational development is documentated through an example of a project to develop technical careers for engineers in the filed of R&D in the automotive sector. In the course of this research, the duty list was compiled by the employees and the management trying to generate a process chain as accurate as possible. This integrated qualification strategy can be divided into 10 different stages (chart 10).

Phase 1)

Analysis of the Recent Human Resource Data.

Data captured are e.g. the age or the qualification of the employees. This procedure clarifies that the statistical data procured by the Human Resource department is insufficient for the purpose of further training meassures. Therefore, it is advisable for each department to establish its own data base.

Chart 10: The 10 Stages of the Process Integrated Qualification Strategy



Phase 2)
Definition of the Future Core Competences.

In view of the increasing use of development services by product suppliers and engineering offices the question is raised on how to handle the necessary technical and methodological competences for the calculation of charges and the evaluation of external service and product suppliers within the company. This process is based on a top down structure, which means that the emerging core competences are deducted gradually from the company strategy for the different areas.

Phase 3) Problems for Competency Development.

The third phase is used to discuss and to determine problems in competency development from the employee and the management perspective. In the course of this approach also actual problems in the task management are included in order to obtain information about the future demand in competency development.

Phase 4) Set up of a Duty List.

To gain transparency about the different tasks and duties within the company, it is indispensable to structure them. The so-called cross-section functions are applied to obtain a complete picture of the connections between the different processes.

Phase 5) Description of the Current Occupations.

The classification of the different work places by the current occupational and functional categories in the development area creates problems. On one hand there are different denominations for very similar professions and on the other hand very different work activities are subsumed under one profession. In the given example of the company the following professions were unanimously assented: industrial engineers for components, chartered engineers, simultaneous engineering, functional group leaders and module-/component leader.

Chart 11: Exemplary Model of a Duty List

2. Engineering

2.1 Product Design

- > Compilation and alignment of target requirements (product requirement catalogue)
- > Specifications sheet/catalogue of requirements/interface management (components and assemblies)
- > Basic design/creation of a concept car
- > Kinematics design
- > Sufficient clearance testing
- > Definition and construction of component/assemblies
- > Calculation of tolerance margin
- > Design of 3D CAD models
- > Generation of component drawings
- > Creating a bill of materials (release)
- > Consider and define variants/configurations
- > Assessment of vehicle performance capabilities and selection of concept
- > Technical support for externals (suppliers, engineers, institutions)
- > System and component optimisation

(according to Friedling et al., 2000)

Phase 6) Designing and Discussing New Occupations.

At this stage, the core competencies mentioned under 3) are specified, made operational and structured by content. In the given example there are: Specific technological knowledge as e.g. the treatment of magnesium, laser welding, mechatronics, competencies for integrated projects (e.g. joint choice of suppliers, joint decision on the production rate), methodological competency (e.g. FMEA) as well as –competencies in CAx (e.g. overall knowledge of the system, interface management). In contemplation of the core competencies considered as relevant new professions were defined during the workshop in order to anticipate the future requirements. This was the case of the mechatronic engineer, CAx-experts and experts for quality methods.

Phase 7) Enumeration of Work Situations for the Acquisition of Competencies.

The goal is to achieve a consensus between the Management, Human Resources, Controlling and the staff members on the suitable (work) situations which should lead to the acquisition of the targeted competencies. For this purpose a chart is facilitated containing all measures of competency development. This chart clusters competency development in seminars, individual-, autodidactical and computer-based methods, workshops and conventions, as well as work integrated and work related competency development measures.

Phase 8) Alignment of the Professions in Group Discussions.

The suggested job descriptions are defined by the staff members on the basis of duty lists and by applying the competency criterion (see chart 7). The evaluation constitutes the basis for the next stage.

Phase 9) Elaboration of Technical Careers.

This phase is about determining the appropriate professional stages an employee should undergo before entering a profession to ensure a clearly defined degree of expertise within an occupational field. Technical careers have been designed e.g. for experiment engineers and module/component leaders. Each professional stage is characterised by the staff members in terms of 1. Target, 2. Occupational content, 3. Competency development measures, 4. Duration of stage, 5. Organisational integration, 6. Cost measurement of competency development and 7. Monitoring of results.

Phase 10) Deduction of Personalised Human Resources Development Strategies.

Finally, each organisational unit and each staff member gets a human resource development strategy.

The described method is a very flexible one. The *Deutsche Steinkohle AG* (German Coal Mining Inc.) e.g. used a very similar approach to constitute their inventory of relevant competencies in order to compensate the losses of know-how as a result of the drastic down sizing through target oriented planning, controlling and development in human resources.

Other Publications Available from InWEnt – Division 4.01 Technological Cooperation, System Development and Management in Vocational Training

Serial No	Title	Language
1	Competency-based Training	english, arabic
2	Curricular Design and Development	english
3	Innovative and Participative Learning-teaching Approaches within a Project Based Training Framework	english
4	New Forms of Teaching-learning for In-company Training	english
5	The Project Method in Vocational Training	english
6	Training and Work: Tradition and Activity Focused Teaching	english
7	Instrumentos para la Gestión del Conocimiento - Estrategias Organizacionales	spanish
8	Instrumentos para la Gestión del Conocimiento - Estrategias Individuales	spanish
9	Developmental Psychology in Youth	english
10	Theory and Practice of the Project-based Method	english
11	The Labor Market Information System as an Instrument of Active Labor Market Policies	english, arabic
12	Selecting and Structuring Vocational Training Contents	english
13	Activity Analysis and Identification of Qualification Needs	english
14	Structures and Functions of CBET: a Comparative Perspective	english
15	Managing Change and Innovation: A Challenge for Modern Organizations	english
15	Gestión del Cambio y la Innovación: un Reto de las Organizaciones Modernas	spanish
16	Financing Technical and Vocational Education and Training (TVET) (in process)	english

InWEnt – Internationale Weiterbildung und Entwicklung gGmbH

Capacity Building International, Germany

Technological Cooperation, System Development and Management in Vocational Training
Division 4.01

Käthe-Kollwitz-Straße 15
68169 Mannheim

Fon +49 (0) 621 - 30 02 - 0
Fax +49 (0) 621 - 30 02 - 132
tvet@inwent.org
www.inwent.org

InWEnt Mannheim in figures:
Employees: 24 Annual financial budget for international human resource development programs: approx. 5,5 million euros; a further approx. 3,5 million euros per year are made available by federal states cooperating in joint projects Annual number of participants: approx. 950