Vocational Education and Training Reform in the Republic of Serbia

Manual No. 2

METHODOLOGIES AND TOOLS FOR THE IDENTIFICATION OF LABOUR MARKET SKILLS NEEDS AND EMPLOYERS REQUIREMENTS

Vocational Education and Training Reform Programme – Phase II

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Authors preface

There are several major methodologies for developing occupational standards, all of which starts with analysing what people in a certain occupation are doing. In spite of this common basis, methods differ considerably and so do the occupational standards that are a result of the analysis. Occupational standards are much less standardised than the term "standards" suggests. Therefore occupational standards differ from country to country.

In the past 30 years, economies and the organisation of work have fundamentally changed. Occupations have become more complex. Employees have more responsibilities linked with more competencies and less routine. The concept supports flexibility in labour mobility and production and can enhance the innovative capacity of companies by enabling enterprises to assimilate new production technologies rapidly and adapt themselves quickly to new demands of the market. The growth of SMEs, the knowledge economy, and in particular the service sector worldwide has also raised demand for a more flexible work force. These changes have caused an evolution from initial task-based to broader competency-based approach to occupational analysis and standards during the past 20 years.

In response to those changes, new methods for occupational analysis are being developed and attention has shifted from analysing narrow job tasks to analysis of broader occupational competencies. For that purpose, occupational competency is defined as the 'ability to perform activities common to an occupation, within an acceptable range'. As job analysts examined the different tasks that constitute a job, they noticed that a number of the tasks for different parts of the work process require similar, if not identical, abilities. By grouping the tasks, they noticed that only some of the tasks required specialised technical knowledge and skills, whereas others were more generic. Examples of the latter were problem solving, communications skills, the ability to take initiative, and some technical skills (i.e. safety and environmental). These generic functions are called core or key skills to distinguish them from technical skills and basic skills (numeracy and literacy).

Methodologies for development of occupational standards

Three methodologies for defining occupational standards reflect this evolution from initial task-based to competency-based occupational analysis and standards. The methods include job/task analysis, DACUM, and Functional Analysis. Additional detail on the history, application, and current use of each method is described in the following:

Job/Task Analysis

The establishment of occupational skill standards started with job analysis. Frederick Taylor (1911), the originator of "scientific management" is usually credited with conducting the first formal job analysis. This approach has been predominant for a long time in many industrialised countries, since it is especially suited to analyse tasks in a mass production process and in situations where there is little flexibility in the organisation of production processes. The aim of the analysis is to divide and subdivide jobs and tasks into their constituent parts, in order to provide information for training and to develop benchmarks for piece rate wages. In spite of fundamental changes in job and task analysis, the approach is still used for specific purposes and in certain sectors, including some service and administrative occupations.

DACUM

The DACUM approach to occupational analysis is quite different from job analysis (Norton 1997). DACUM is an acronym for Development A CurriculUM, but it actually involves only the first step in a full vocational curriculum development process. Instead of job observation, DACUM uses guided group discussion with expert workers. The DACUM process includes, in addition to occupational specific tasks, the separate identification of work enablers: general knowledge and skills, worker behaviour (personal traits and inter personal skills), and tools and equipment used. These tasks become the focus of curriculum development. DACUM is used in many developed and developing countries.

Functional Analysis

Functional Analysis (FA) is not a method for occupational analysis in strict sense. Rather, the idea is to start with the identification of the key purpose of an occupation in the major sectors where it is found, identifying the main functions, braking these in turn down to sub functions until outcomes for each function are identified following a strictly logical sequence. Functional Analysis, as practiced in the United Kingdom, uses a consultative process that involves practitioners, managers, and in some cases, the users or "consumers" of standards. The modules are analysed one by one to identify the performance requirements. The FA method has been used in several countries in Europe and the Middle East and is being experimented with in South America.

This Handbook

The intention of this handbook is to introduce persons from vocational education and training to the occupational analysis method, DACUM.

This method was used to analyse the occupations chosen for the curriculum development in the CARDS VET II programme 2006- 2007.

This handbook can be seen as the beginning of a row of interlinked handbooks, where the next in the row is the handbook on Curriculum Development.

GLOSSARY

Curriculum:	A description or composite of statements about "what is to be learned" by the student in a particular instructional programme; a product that states the "intended learning outcomes".
Duty:	A cluster of related tasks from a broad work area or general area of responsibility (area of competence)
Educational/Training programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Facilitator:	The person who leads the DACUM occupational analysis workshop to identify the actual job duties and tasks, and related information
Instruction:	The process, the how, or the means by which the intended learning will be achieved.
Occupational area:	This is a broad grouping of related jobs. Example: food service
Occupation/job:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (example: baker)
Occupational analysis (job analysis):	A process used to identify the duties and tasks that are important to employees in any given occupation.
Outcome-based vocational education:	Essentially synonymous with competency-based vocational education. Expected outcomes of student participation in a vocational-technical programme are identified, and measures of competency are utilised in the instructional system
Outcomes:	Statements of what the student must do to master a given task
Performance checklist:	A list of specific criteria, usually based on actual occupational standards, that is used to evaluate the process used and/or product developed by the student/employee when performing an occupational task. These checklists should also include employee behaviour and performance time criteria when appropriate.

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Performance standard:	Criteria which the student/employee must meet when performing a task.
Skill:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Step:	One of a series of procedures or activities that the employee does to complete a task. The completion of steps alone does not result in a meaningful unit of work.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision. Tasks are also frequently referred to as the competencies that students must obtain in order to be successful employees.
Task analysis:	The process of analysing each task to determine the steps, related knowledge, attitudes, performance standards, tools and materials needed, and safety concerns required of employees performing it.
Verification	The process of having experts review and confirm the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.

Introduction to DACUM

What is DACUM?

DACUM (**D**eveloping **A** **C**urricul**um**) is a systematic process with four distinct components that enables its users to design educational curricula that are based on the realities of the workplace. It allows for movement from initial planning and needs assessment through programme design to instructional delivery quickly and cost effective.

The **DACUM** processes have some important advantages over other curriculum and instructional design methods. They provide a real-world base for instruction and learning. They provide an effective forum for the stakeholders in the education and training process to work closely together from design through delivery. They build a collaborative relationship among business, industry, labour, government, and education stakeholders.

The DACUM analysis is usually carried out as a two-day workshop, involving a trained DACUM facilitator and a group of 5-12 expert employees from the occupation/job that is decided to be analysed. The result of the DACUM analysis workshop is a detailed chart describing the duties and tasks performed by the employees involved.
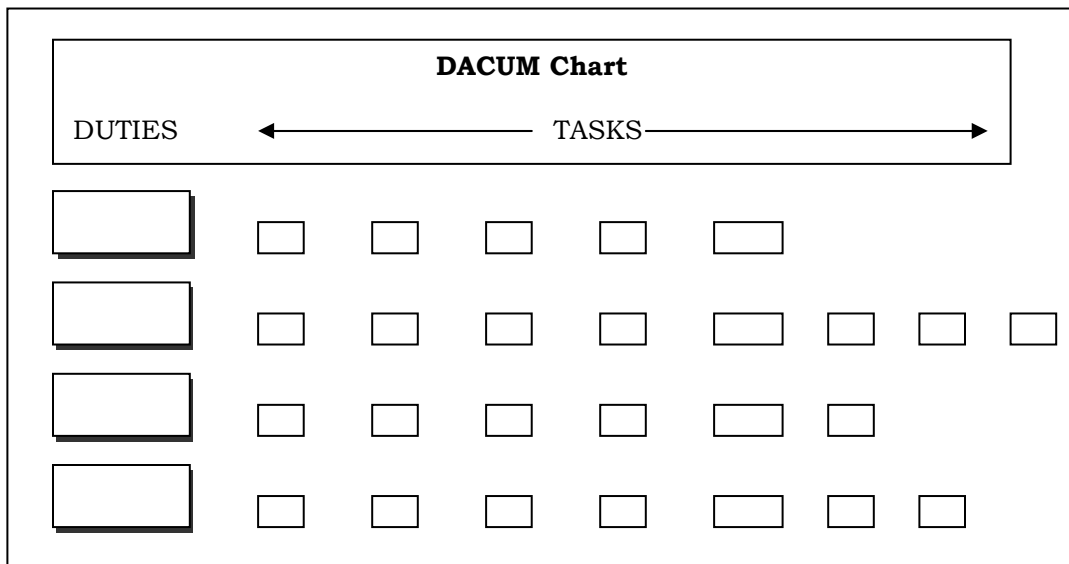
In addition to development of precise duty and task statements, list of general knowledge and skills, - employees' behaviour, tools/materials/supplies, and future job trends/concerns are also identified.

DACUM is based on three logic premises:

1. Experts employees can describe and define their job/occupation more accurately than anyone else. Persons who are working full-time in their positions are the real experts on

that job. Even though supervisors and managers usually know a lot about their subordinates work, they usually lack the expertise needed for high quality analysis.

2. An effective way to define a job/occupation is to precisely describe the tasks that expert employees perform. A successful employee performs a variety of tasks that either the customer or employer wants performed. Possessing positive attitudes and knowledge alone are not enough. Hence, finding out what the expert employees (top performers) do will give us the opportunity to prepare other experts.

3. All tasks, in order to be performed correctly demand the use of knowledge, skills and behaviour. While knowledge, skills and behaviour are not tasks, they are enablers which make it possible for the employee to be successful. Because these three enablers are so important, considerable attention is given during the workshop to identifying lists of each. Because these enablers are different and distinct from the tasks, it is very important to keep them separate if a high quality analysis of job performance requirements is to be obtained.

When can DACUM be used?

DACUM analysis is ideally suited for two particular purposes:

- The development of new vocational education and training. Precondition is that a labour market analysis has been carried out to reveal the need for a new curriculum. DACUM can then quickly identify the competencies needed to perform the job for which new education and training has to be set up.

- The review of existing curricula for education or training. A group of expert employees within the profile in question can be convened to identify the competencies that should be delivered in an existing curriculum, just as it can be convened to identify the competencies for a new curriculum. In this case, once the competencies have been carefully identified by expert employees, the existing curriculum are examined to see if it addresses all required tasks. Modifications of the education or training curriculum are then made, where necessary to ensure current relevance of the curriculum.

Phases in carrying out the DACUM workshop

This handbook is describing the phases that have to be followed to successfully carry out the DACUM workshop.

The phases are outlined below:

⇒ Preparation of the DACUM workshop

⇒ Carrying out the DACUM workshop

⇒ Verification of the results of the DACUM workshop

Preparation of the DACUM workshop

In order to carry out a successful and productive DACUM workshop, you have to do a lot of planning and preparation before the actual workshop.

1. **Selection of the DACUM workshop participants**

One of the most important tasks connected with the DACUM workshop is the selection of the workshop participants. The people chosen to be the DACUM workshop members should have several important characteristics. The proper selection of the participants is probably the most complex aspect of organizing a successful workshop. The quality of the interactions that are going to take place, as well as the quality of the DACUM chart, depend to a large extent on the people chosen. The participants have to be either employed within the agreed occupational area or be the direct supervisors in this occupational area. Decisions, based on the chosen criteria, must be made in relation to the kinds of employees that have to be included or excluded. The following criteria have to be taken into account during the selection process:

a. **Technical skills**. The people chosen have to be highly – qualified for their jobs and they should be aware of the actual development and needs referring to this area. Plenty of years spent in doing the job doesn't necessarily mean that the person has the necessary qualifications to be the competent DACUM member. Generally speaking, indirect supervisors can recommend the most competent employees as far as technical skills are concerned.

b. **Full-time employment.** The chosen people should have a full –time job in the given occupational area. This is how we can be sure that they have the necessary knowledge and information about all the aspects of their jobs. Some of them can be supervisors if they directly supervise the employees whose occupation is being analyzed. Supervisors with the recent practical experience of the job can provide useful information about the job that is being analyzed and they can add "realism" to the process. In any case, supervisors should not comprise more than 20% of the participants.

c. **The presence of the occupational area on the market**. The selected DACUM workshop participants should show the real situation as far as employment is concerned for the job that is being analyzed. If the job which has to be analyzed is different in terms of the employees' fields of specialization, then the DACUM participants must be chosen to show these specializations.

d. **Efficient in communication**. In order to be efficient, the DACUM participants have to be very precise when they give detailed and exact explanations of what they do. Since the DACUM workshop participants are the group of people who work on the further development of ideas and reaching the consensus, the members of the group have to be

able to listen to other people's views carefully and to participate in the group discussion in an effective way.

e. **Team player**. The DACUM participants should influence each other, but they should not be dominant or being dominated by others, they should not be too critical, and they should not try to overanalyze or reorganize their contributions all the time. Ideally, each participant should be willing to participate in the process. It excludes the individuals who were "just sent" with no explanation or who were told by the supervisor to go since there was a "vacant committee position".

f. **Full commitment**. All participants should be fully committed to the DACUM workshop during the required time. They should come to meetings on time, since the participants who are late or are just partly present will miss some part of the orientation or group discussion and this may have the negative impact on the workshop.

g. **Biased** – **free**. DACUM participants have to be open – minded and biased – free. It is the primary reason why teachers should **not** be the members of the group. Teachers may try to influence the contributions of the participants, which can have a negative impact on the process and the ways of sharing information. Teachers should be encouraged to come to the workshop as observers and hosts.

Sometimes certain pressure is made on the facilitator to include people from the top management but in general the best result is obtained by only including actual employees that have the practical daily work experience for that particular selected occupation

Identify the key contact people

The process of identifying the key contact people is very important. The teachers and instructors in the school and/or training centre can usually be helpful in identifying various employers in the community that employ the type of experienced people needed as DACUM workshop participants. Although the teachers and instructors should never serve as participants on the DACUM group itself, they are probably the best single source for identifying potential employers and/or participants. Sometimes a teacher/ instructor or groups of teachers/instructors resist involvement in the planning process. Resistance may arise for many reasons, but usually it disappears quickly once they understand what DACUM is all about and how it can help them do a better job, by getting an updated education/training programme.

The right choice of the participants is one of the key items for the development of the extensive and relevant DACUM chart.

The other tasks that have to be done before the DACUM workshop are: 1) making contacts with the companies that employ this kind of qualified / expert employees and 2) making contacts with potential DACUM participants.

1) Making contacts with the company. The main tendency in making contacts with the employers is to convince the HR (Human Resources) manager, supervisor or any other contact person that the school or the centre needs the help of the company to modernize or establish the relevant education or training programme. The facilitator has to persuade the representative that the results of the DACUM workshop will be used by the institution to develop a curriculum to the benefit of companies.

It is important for the facilitators to make the appointments by phone or even a visit to the employers can be done. Important is to explain them the DACUM process and to ask for further co-operation with them. Written materials about the DACUM process and some of the DACUM charts can be helpful to hand out. If the formal approval is needed, the facilitators have to be ready to write a formal letter on the memorandum of their institution in which they ask for help. The only approach that is not good enough is writing letters. Written requests are usually written to the people in charge of the public relations who want to help, but might not be qualified enough to help. These people may not have the sufficient knowledge about the request and can appoint themselves or other people who are not technically or individually adequate for that job. If the facilitator uses letters, they must be accompanied by phone calls in order to have the request or the people as potential DACUM participants discussed.

2) Contact to potential DACUM participants. Before you start inviting/calling the DACUM participants, you should decide on the size of the DACUM group. In order to have the "ideal" DACUM group, of 8 to 10 participants, it is best to choose first 10 – 12 participants. In this way if one or two members cancel in the last minute, the group will keep the satisfactory size for the proper functioning.

The personal contact of the 'third' party in the company (HR director/supervisor, etc.) can be helpful; the facilitator should send a written copy of the criteria to the 'third' party who will follow these criteria in the selection process. However, personal involvement of the facilitator is of great value. Once the potential participant is appointed it is important, that the facilitator makes a contact personally to the participant.

The people who were sent to the workshop by their "boss" with no previous personal contact with the facilitator can disturb the productive work.

Potential participants might be indecisive in relation to their commitment to a completely new or different experience. The DACUM facilitator has to explain the purpose of the analysis and the role of the DACUM participants in this process. (Tell the participants that they were selected because they are the experts in their area. Tell them that they will be asked, together with other employees from the same occupational area – profession, to talk about different tasks they perform as part of their work).

Since they carry out these tasks every day, they don't need a special preparation for the DACUM workshop. Each participant is regarded as the expert.

While the facilitator is giving explanations, he/she has to emphasize the importance of the full commitment to the workshop. Each workshop participant is expected to start, participate and finish the whole workshop. If the person is not interested in the activity, then the person should not be asked to participate. That person would probably not contribute to the analysis and might even be destructive for the process.

2. Planning of the DACUM workshop

A good schedule (agenda) is important for a successful DACUM workshop. First of all, for most occupational areas it is needed to have the whole two days for the standard (regular) DACUM workshop. It might be needed to have two and a half days for more cognitive and more abstract occupational areas. In most cases it is best to use two work days in a row. However, if it is necessary, the workshops can be carried out during the weekend, or even five days in a row (every day half a work day).

The workshop schedule (agenda) should determine the time at which the workshop starts and ends as well as give the outline of the main activities and the approximate time during which it will take place.

A proposal for the agenda of 2 days workshop (8.00am. – 4.30 pm. With lunch and coffee breaks) could look like:

1st day:

- Welcome and orientation about the DACUM process
- Review the occupation
- Identify duties
- Consensus on duties
- Identify tasks

2nd day:

- Consensus on tasks
- Review of duties and tasks
- Develop a list of general knowledge and skills, employee behaviour, tools, equipment, supplies, materials, and future trends/concerns
- Review, refine, and sequence duties and tasks
- Conclusion of DACUM

3. Workshop facilities

Several days before the workshop it is important to check the equipment (stationery) and materials to see whether all that is necessary is available and in place and that the quantities are

appropriate. We recommend the following equipment (stationery) and materials in the quantities suggested below:

Equipment (Stationery):
- a set of papers for the flip – chart (2)
- paper sellotape (1 packet)
- markers (3 black, 3 red, 3 blue markers)
- 5"x8" blank white cardboard papers for writing down the task statements (200)
- 8 ½ "x11" cardboard papers in any colour for writing down the duties statements (25)
- paper for the participants' notes (25)
- pens for the participants (12)

Materials:
- slides of the workshop
- an example of the high – quality DACUM chart (15)
- workshop schedule handouts (12)
- additional materials with tasks and tasks statements
- the workshop evaluation form (12)
- the participants' name tags
- the list of the participants

In order to facilitate the interaction which has to take place in the DACUM workshop, the participants' seats should be comfortable, they should see and hear each other easily, and they should be able to read everything that is displayed on the wall. The best seating arrangement for the participants is to sit behind the desks that are placed in a semicircle.

4.   The role of the facilitator, DACUM participants, secretary, and observers

Facilitator
If resources are available it is mostly convenient to have <u>one person</u> to make all the necessary pre-workshop arrangements- including the selection of the participants and provides for the verification of the tasks and <u>another person</u> running the workshop (facilitator). But in reality it is often the same person(s) that makes the pre-workshop and post-workshop arrangements/activities and acts as facilitator of the DACUM workshop.
A facilitator must possess the following characteristics:

- Skill in occupational (job) analysis procedures

- The ability to display warmth and establish rapport quickly with the participants

- A high degree of sensibility to both verbal and nonverbal communication

- The ability to motivate and encourage participants

- A willingness to assume and "act out" the role of <u>process</u> expert while according participants the role of <u>content</u> experts

- An appreciation of the value of small-group process so that participants are allowed to work things through by themselves

- Excellent listening skills and memory, since the facilitator must be able to "store" majority of the participants' contribution in his or her memory and be able to retrieve them as needed
- The ability to obtain consensus from the participants

Besides, the facilitator should exhibit the following behaviours:
- A professional image and outlook
- A sensitivity for others
- The ability to establish and maintain enthusiasm
- A sense of humour
- The ability to show empathy
- The ability to display and maintain a positive image
- Patience
- The ability to make decisions

The facilitator also needs to understand the DACUM process itself. As should now be apparent, facilitating a successful DACUM requires a multitude of skills, many of which cannot be quickly acquired. The qualities described are extremely important to successful performance as a facilitator.

The facilitator must establish and maintain the group's pace, balance the group's participation, clarify vague statements by probing for more details, and insist in selection of the most appropriate action verbs, task statement modifiers, and objects (nouns) in composing duty and task statements. The facilitator must motivate and lead the group and control the process, yet never impose content judgements or decisions on the participants.

Each DACUM participants should be motivated to participate actively in the process. The facilitator does not have to be familiar with the profession that is being analyzed; it is usually better if the facilitator is not familiar with that profession. In this way it is less probable that the facilitator will include his / her personal judgments in the process of analysis.

DACUM participants
The DACUM participants in the DACUM process have the task to decide **which** skills should be taught to the students who want to work in their domain. Therefore, their role is crucial in relation to the successful development of the valid DACUM chart.

The role of the DACUM participants is unique. Individually and collectively the participants are asked to define in great details their jobs by identifying all important tasks that they have done so far in their jobs. The participants are the experts for the contents and they are those who have to

lead the discussion, the debate, and from time to time, they have to discuss what is really important in their job.

The secretary and the observers

The secretary is the assistant to the facilitator whose task is to, at the facilitator's request, to write down the contributions of the participants. The tasks of the secretary should be precisely explained to the person in charge of this role before the workshop starts.

The role of the observers is to observe. They are not expected or allowed to participate. If the size and the position of the meeting room enable the observers to observe without disturbing, they can broaden their knowledge about the DACUM process through the observation itself. The teaching staff should be persuaded to take the role of the observers in the DACUM workshops which are organized for their subjects. As observers they can get the precious technical background about the changes of their domain of teaching. During the breaks and meals, they can contact qualified – expert employees and develop their new industrial relationships.

The observation is particularly useful for those teachers that are going to use the DACUM results for the curriculum development that might eventually follow or for development of teaching materials.

The DACUM Process

In order to carry out successfully the DACUM workshop, it is recommended to follow the following stages:

1. **Presentation of the basic principle of the DACUM workshop**

From the very beginning it is important that the participants feel comfortable with the training and with each other. After the facilitator has shortly presented her/himself, the facilitator's background and role in the DACUM workshop, the facilitator starts at one end of the group and asks each participant to tell which company they come from and their position in the company.

Then it is necessary to explain the basic principle of the workshop in 5 to 10 minutes. It is important that there is a general understanding that the occupational area analysis that results from the DACUM will be used to develop new curricula or to revise the existing ones.

The aim of this part of orientation is to give the **overview** of the basic elements of the DACUM. It should focus on what the participants should know in order to get started.

Basically, the DACUM facilitator will during the process of the workshop have to follow the basic principles of the DACUM and at the same time encourage the participants to contribute and to build the group interaction.

The overview of basic elements/procedural steps:

1. Orient the participants
2. Review the job/occupation
   a. conduct initial brainstorming
   b. develop organizational chart
3. Identify duties (general areas of responsibility)
4. Identify specific tasks performed
5. List
   a. General knowledge and skills requirements of the job
   b. Employee behaviour (desirable attitudes and traits)
   c. Tools, equipment, supplies, and materials
   d. Future trends/concerns
6. Review/refine task and duty statements
7. Sequence the task and duty statements
8. Other options as desired

2. Review the job/occupation

a. conduct initial brainstorming

The brainstorming about the whole occupation or job gives the facilitator the opportunity to get valuable information from each participant, which will help to understand their work as well as help to provide the necessary data base for further defining of duties.

The facilitator starts at one end of the group and asks each employee to tell one work activity they do. This will be repeated until each employee has given at least two different work activities. Then a discussion is started, letting everyone give their contributions, until 4-6 sheets of information exist for the chart draft.
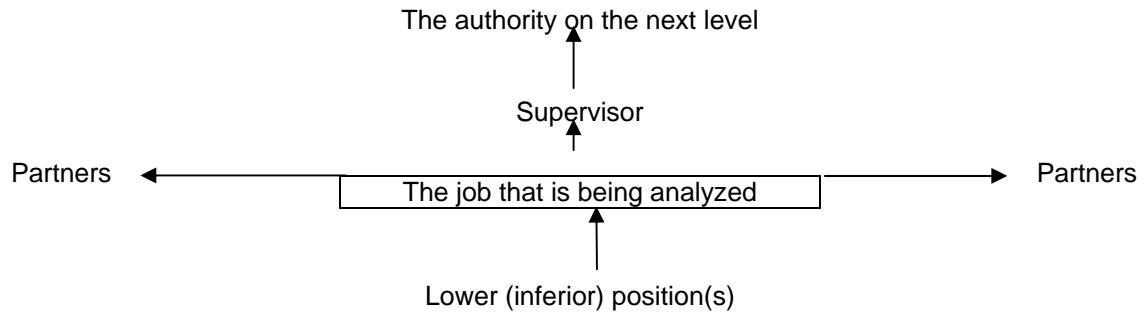
If necessary, the facilitator asks questions for further clarifications. If some of the comments are too long, the facilitator makes a summary of their contents and asks them if the summary is ok. When each chart draft is finished, it should be displayed in front of the participants.

b. develop organizational chart

Immediately after this brainstorming, the facilitator starts a discussion and conducts the review of the occupation/job that is analyzed.

A good way to make this clear is to make the organisation chart on the flip chart. The title of the job that is being analyzed should be placed in the middle of the page. The facilitator tries to determine whether there are different levels of position. E.g. higher level, inferior level, etc. like indicated in the drawing below.

Then, the facilitator can ask the participants to identify the job titles that other companies gave to the people who work in the occupational area that is being analyzed. Different titles are often used to describe jobs that are basically the same.

The authority on the next level

↑

Supervisor

↑

Partners ◄─────────────── | The job that is being analyzed | ───────────────► Partners

↑

Lower (inferior) position(s)

3. Identification of duties

Before the facilitator starts the 3rd part, it is important to define 3 words that will come up very often.

Duty: A cluster of related tasks, usually 6-12 per job

Task: Specific meaningful units of work, usually 6-20 per duty and 75-125 per job

Steps: Specific elements of activities required to perform a task, always 2 or more per task

Example: Job: Secretary

Duty: (one of the duties) organise meetings

Task: (one of the tasks related to that duty) distribute the materials for the meeting

Step: (related to this task) prepare the materials for the meeting,
Make photocopies and arrange all materials for the meeting
prepare respective folders for the meeting

The facilitator first explains that the duty is a huge area of work, that is, a group of minimum 6 and maximum 20 related tasks. Duty statements must begin with the action verb, consist of the object and usually the qualifier. The main difference between the duties and tasks is in the amount of the work. Examples can here be useful.

Then facilitator asks the participants to study carefully the information gathered during the job description process. He/she asks them to identify some of the duties that might already be there and to group smaller, but similar activities.

The participants might find it difficult to differentiate between the tasks statements and the duties statements. Anyway, the aim of the activity is to have in writing some, if not all, contributions of

the members. The proposed duties are put on the wall, even though the wording might be changed and some of the duty statements will end up like task statements and the other way around. When the duties statements are offered, it is necessary to ask for the agreement of all participants. It will require further discussion or checking.

It would be helpful to ask the participants to include one action verb in each duties statement, because it makes the participants think about the performance.

When all the duties are identified and when the participants are satisfied, the facilitator asks them to sequence the duties from top to bottom. The sequence is not based on priorities, but on the natural and logical scheme of the work process. For example, you plan something before you actually carry it out, and you will assess it after planning and carrying it out. This sequencing usually helps the participants to get the overview of the job structure faster than it could be done in some other way.

Some samples of duties statements:

a) perform diagnostic tests

b) maintain the welding equipment

c) perform welding process

d) service the cooling system

e) prepare written documents

One verb (not two or three) should be used to describe the area of duties whenever it is possible.

4.   Identification of specific tasks

This is the biggest and the most important phase of the DACUM process, since defining tasks for each area of duty results in developing the essence (core) of the chart. These tasks (some of which are referred as competencies that should be achieved) will make the basis structure of the curriculum.

The facilitator first identifies one particular duty and asks the participants to work on this duty. The main question that is to be asked is: «What do you do in this area of duties?». This is also a brainstorming activity, where the results are written down on flip chart papers. This activity should be done for each duty.

During this phase the facilitator should emphasize the need for the statement that consists of the action verb and that clearly reflects the obvious actions of the employees, not knowledge, skills or equipment. The statements that cannot be accepted may begin in the following way:

- knows the company procedures
- understands the supply policy
- appreciates quality.

It is important that the secretary writes down the statements that are agreed among the participants. The facilitator should order them as quickly as possible with the minimum of debate and negative comments.

When all the tasks for one duty seem to be used up by the participants, the same goes on for the other duties. The facilitator reminds the participants to avoid using double verbs such as «remove and fix», but to use the more general of the two.

The facilitator ensures that the same verbs are not used to describe both the duty and the task or procedure. The verb that is used to describe the duty should be, by its nature, more general from the verb that is used to describe tasks or procedures.

5. **List**

About 15-20 minutes are needed to finish each of the following lists. When the participants propose the items for all lists, the items should be written on the flip chart. As opposed to the duties and tasks, the lists of knowledge, skills, tools, etc, should not be expressed in the form of action verbs, objects or qualifiers. It is usually quite easy to reach the agreement in relation to the items for all four lists.

a. **General knowledge and skills requirements of the job**

The list of general knowledge and skills should consist of the important knowledge that the employees need in that occupational area. The list should also include the skills such as decision making, problem solving, and interpersonal skills that are crucial to many tasks. General knowledge and skills should be seen as the important support to the employees to perform their tasks precisely and accurately.

b. **Employee behaviour**

Employees' behaviour patterns (the attitudes and characteristics) are important in every job. The behaviour patterns that considerably vary from job to job should be identified by the participants without copying or «borrowing» ideas from other DACUM research charts. Similar to general knowledge and skills, the employees' behaviour patterns should be used as parameters that enable the employee to treat other people (other employees, supervisors and costumers) in a positive manner. They support successful performance of many tasks.

c. **Tools, equipment, supplies, and materials**

The lists of tools and equipment will vary considerably depending on the type of the job that is being analyzed. Try to avoid writing down the brand of the tools and equipment in the list.

d. **Future trends/concerns**

This list should be made before the workshop finishes and it is important because of the items which give the analysis the appropriate futuristic look. While the DACUM participants cannot tell exactly which new tasks will appear in two or three years, they can identify the future trends and concerns (if any) about the future of that occupation.

6. Review the duties and tasks

The facilitator now asks the participants to compare the duty and task lists with the very first list of activities that were made by the participants in order to describe their work; these were the lists that were made before the duties identification.

This check will almost always result in identification of 3-8 new tasks. From time to time, it can result in the identification of one or two new duties.

The duties statements and tasks statements should be checked for clarity and precision. Certain changes may be made and something can be erased in order to improve the quality of the chart. There are several more issues to emphasize. The tasks statement should contain as fewer words as possible (maximum eight) and at the same time it should be fully described. Three words are usually enough. Long statements tend to lose the focus and are not appropriate for the presentations in the chart.

Even though task statements can be shifted from one area of duty to the other during the improvement process for the sake of the best possible fitting, the same task should not be repeated twice. Instead of this, the participants should decide on the best fitting. If there are two similar but still different tasks for which the participants think are important, then different definitions should be used.

 Each area of duty should comprise at least six special tasks statements. If the participants can provide only two or three tasks, the area of duty should be combined with the other related areas. On the other hand, if the particular area of duty results in identification of a huge number of tasks (for example, 20-30), there must be an excuse for the division of this area into two duties.

Once the tasks in all areas of duty are improved the facilitator should ask the participants whether the duty statement still represents the precise description of the general area of responsibility. Sometimes the range of the duties statements should be narrowed or expanded in order to determine the specific tasks more precisely.

7. Review of sequences of duties and tasks

Several ways of sequencing may be used:
  a) the most logical order of work activities or performance;
  b) sequencing according to the relative importance of the tasks, from the most important to the least important;
  c) sequencing according to how difficult the tasks are, from the least difficult to the most difficult.

The facilitator may ask the participants which principle they are going to apply.

Probably the best way of sequencing (and the easiest for most groups) is the first one, the logical sequencing of work activities. The participants should be advised to sequence these tasks as

they like. Sometimes they will find out two or more sub-areas of tasks in one category which logically follow one another.

The facilitator should choose the first area of duty for which the sequence of tasks is to be made. During the phase of sequencing the participants may find out that some task statements are missing or that some task statements overlap or that some of them should be revised. The facilitator should not allow important changes at this stage, but he /she should allow some revisions. When the tasks are sequenced, check from top to bottom (left to right) and make the final agreement before the next duty is checked for tasks.

When the group has sequenced all tasks statements, the facilitator should ask the participants to study all areas of duties. The aim is now to make the whole analysis that will appear in the printed chart.

8. Code the tasks and duties statements

Before anything is removed from the wall, the facilitator should monitor numbering and marking the DACUM chart in order to keep its final structure. A simple, yet productive method is to mark from top to bottom each area of duty with capital letters: A, B, C, etc. Then each individual task in each area of duty should be marked from left to right in the sequence: A-1, A-2, A-3; B-1, B-2, B-3, etc. At the end the facilitator should remove each area of duty and the related tasks and leave them in the proper (right) sequence to be typed later. The original work should be kept in a safe place at least until the typed sample of the DACUM chart is ready and the copy carefully checked through reading.

The lists of the general knowledge and skills, the behaviour of the workers, future trends, tools, equipment, supply and materials that the DACUM analysis developed are usually written down on the chart. Keep these lists for further transcript and keep them as evidence of the DACUM analysis.

Verification of the DACUM results

1. Development of verification instruments

The process of the tasks «verification « confirms that the listed tasks are the actual tasks that the students / employees should be able to carry out when they start work in the occupation or when they are promoted within that occupation. The task should be given to the people who are active in the occupation at the moment so that they could examine it. Those who conduct the verification process should be asked to take each item into consideration and to determine whether that particular item is really the part of the occupation or not. They can also suggest additional tasks which are, in their opinion, left out (omitted).

The reason that verification is needed is that the DACUM participants represent a small number of companies and that it should not necessarily represent the whole occupation. So if a huge

<u>number of expert employees and supervisors re-examine (verify) the analysis, the value of the DACUM results will be much higher</u>. This is particularly important if the results are used for the development of the state or national curriculum or for the teaching process.

In order to structure the process of verification, the following questions must be asked:

a) Who is going to carry out the verification?
b) Which questions will be asked?
c) Which instruments will be used?
d) How will the people in charge of verification be selected?
e) How will the data be gathered and analyzed?
f) How will the tasks statements be changed?

The DACUM facilitator (or some other person that carries out the process of verification) should have the skills for developing the questionnaire and processing the gathered/collected data. The facilitator is usually experienced in making contacts with the industry staff and therefore he/she is in a good position to identify the people who are qualified enough to be verifiers.

It is better to know in advance why the information is necessary and what should be done with it than to ask a lot of questions just to get some information. Two questions for each task statement are probably the best, but certainly not more than three questions. It is a good idea to develop a high – quality verification instrument, and if possible, do the pilot testing with two or three interviewees in order to check whether the instructions are clear. The format of the instrument should be attractive, and the reproduction should be of high quality.

2. Selection of the interviewees for the verification

Verifiers should be selected from a group of expert employees in the occupation and / or indirect supervisors of the employees who have the direct responsibility for the job to be done. Again, directors at high levels, staff managers or the theoreticians should not be selected. The criteria for the selection of the verifiers are basically the same as the criteria for the selection of the DACUM participants. Verifiers are the people who can be regarded as experts for that area. Contrary to the participants, verifiers do not have to verbalize the skills.

An important group that can help in the selection of the qualified interviewees is the DACUM participants. During the workshop, the facilitator should ask each member to give the names and the addresses of other experts.

The list of tasks might be verified by the expert employees all over the country or only in several neighbouring regions.

3. Collection of the data for verification

From a verification group. One approach that is used for collecting the necessary data is to establish a special group for verification with the only aim to verify the tasks statements. Select the group members (10 -15 people make a good group to work with) on the references from the well-informed people in the occupation. A two – hour group meeting should be enough for the verification of the temporary list of tasks and for the desired verification of the tasks.
The facilitator should structure the verification process by verifying the lists for each competencies area. Verify each tasks statement separately and move the focus of the group to some other things if there are no questions or problems. If the original list of tasks is developed in great details, there should be relatively few items that require considerable change, but the things that are recommended by verifiers should be taken into account and certain changes should be made.

By sent questionnaires. This is probably the most efficient and the most frequently used procedure for gathering the data. Send a well – made questionnaire together with the appropriate cover letter to 25 workers and 25 supervisors.

Interview / observation. If the verification is done by the interview techniques/observation techniques, the facilitator must prepare the interviewees, write the introductions to the employers and provide enough free time for the staff to carry out the interviews.

4. Analysis of the verification data

When the tasks data are collected, they have to be presented in the chart and organized into a usable format.
Put the data into the chart by counting the answers to every statement (these are called are frequency numbers). If there is a small number of interviewee, the chart can be filled in manually in the blank form similar to the one that is used during the data collecting, or if there is a huge number of answers in each category a specially designed form can be used. The form should be organized in such a way that the results are clear and the information usable.
If the interviewees add some statements during the verification process, the best way to process these statements data is to fit them into the separate form of the summarized chart. The number of individuals that will add statements will be probably very small.
When the frequency numbers are fitted, then the data should be analyzed and placed into the form that makes them easier for interpretation. It can be done with the help of the charts of tables or columns or frequency results. However, the easiest way, perhaps, is to turn the data into the percentage or average terms. The data can be represented as percentage for each statement, and as numbers and percentages of answers for each statement, or the average answers.

Whichever format is used, make the final list of tasks that reflects the choices

5. Refinement of DACUM chart based on the verification data

When the data are summarized, they should be carefully interpreted in order to see which changes are necessary in the temporary listing of tasks. Sometimes the interviewees will point out to one or two tasks that the DACUM committee somehow left out. The comments given by several verifiers may suggest that some statements should be changed to a certain extent in order to clarify their meaning.

In order to add tasks statements the DACUM participants have to be contacted again to carefully study the proposed changes in order to see whether these are the real tasks that are compatible with the accepted criteria and that they have not been already described in some other words in the given tasks. All the answers have to be summarized and the opinion of the majority will give the result.

Task analysis

Once an occupational analysis is completed, the next action is to analyse the tasks to determine exactly what must be taught in order for the students to perform those tasks successfully on the job. Through a systematic task analysis process, each task is examined separately to identify its instructional elements. The major benefit of task analysis is to provide an organised database for the later development or revision of the curricula and the training materials. If the analysis is well done, it will give specific information about what needs to be taught, what specific tools and equipment are needed, what point need to be emphasised during the education, the standards of performance the student must achieve

The major types of information that may be identified about each task include:

- performance standards= steps= performance criteria
- tools, equipment
- required/related knowledge
- safety concerns
- attitudes (related to work performance)
- decisions to make
- data necessary for decisions
- errors

Performance standard:

The elements of a task are those observable/measurable actions or activities required to perform an occupation. These elements of a task (=steps) are called performance standards, which are specific criteria that define successful task performance. The criteria should be both observable and measurable. The criteria may describe an acceptable type of output (product), an important sequence of steps (process) or a combination of both process and product standard. Although there may not be a separate criterion associated with every step, it is helpful to look at each step of a task to see if a criterion can be specified.

Product standards are usually described in terms of quantity (e.g. number of units produced) or quality (e.g. appearance, precision, accuracy, shape, test strength). Process standards refer to the acceptable sequence of steps an employee must follow when performing a task.

Any criteria should be stated in specific terms. It is not merely to state "according to the supervisor's expectations" such expectations must be spelled out.

Tools, equipment

The tools and equipment of the occupation consist of any physical items required to perform the task successfully. Protective clothing, hand tools, vehicles, and consumable supplies would fall in this category. Identification of this information allows a teacher to know exactly what items the learner must be able to manipulate or use. The goal is to create a list of tools and equipment that will be an aid in designing instruction. With this goal in mind, it is important to limit identification of tools and equipment to those that are *unique* to performing the specific task. Otherwise, it can be an overwhelming list of everything from screwdrivers and hammers to nails and bolts. Instead one should list only unique tools and equipment and then refer to other generally used tools.

Required/related knowledge:

Knowledge statements describe what the employee must know to be able to perform each task correctly. By listing knowledge requirements in the task analysis, the relationship of knowledge to application becomes clear. The areas of job-related knowledge to be identified include theory and concepts underlying the technical area, as well as content in science, math, and language, or communications.

Listing that student must know general science principles, for instance, is too ambiguous; or does not identify the specific knowledge that training must provide. Using as an example the health physical technician position and the task *Calibrate portable survey instruments*, some knowledge statements might be as follows:

- Radiation units
- Dose limits
- Radiological practices

- Biological effects of ionising radiation on humans

Safety concerns:

Each step of the task must be carefully studied to identify (1) potential hazards that could cause injury to personnel or damage to equipment or facilities and (2) safety-related knowledge practices, and procedures that support the safe performance of tasks.

Safety statements may be written as verb phrases (e.g. *Handle toxic chemicals in accordance with set procedure* or *Use proper ventilation*

Attitudes:

Attitudes refer to a person's system of beliefs, values, and tendencies to act in certain ways. Networks of related attitudes, beliefs, and feelings form a person's values – ideas of what is "good" and "bad". Since an employee's attitudes can affect job performance - for good or ill – task analysis should include information about what attitudes are most beneficial to performing a task effectively.

Since the purpose of task analysis is to provide objective data from which to design curricula, attitudes need to be stated in observable, measurable terms. Therefore to state the *indicators* that represent the observable characteristics of a person possessing the desired attitude is needed.

If learners need to appreciate the need for accuracy on the job, for example, the indicators could include *Assigns the parameters accurately* and *Forwards additional materials concisely.*

Decisions to make:

Employees commonly have to make a number of decisions when they are performing certain tasks, A decision occurs whenever the employee has to make a choice or decide on a specific course of action. Making the correct decision can be very important in terms of successful task completion. Thus, task analysis may include listing any decision(s) that are necessary in performing individual steps.

Data necessary for decisions:

Related to these decisions are the data needed for the employee to make a decision or which provide the employee with information for making the correct decision. A data might be a red warning light, an unusual sound, or a pressure gauge reading that provides information to the employee.

Errors:

Another item included in the decision-making category is a listing of errors or problems likely to result if an incorrect decision is made; in other words, the consequences of inadequate performance.

A number of action verbs used to specify steps, such as select, choose, determine, identify, and differentiate, imply that the employee will have to make a decision.

The product of task analysis

The end result of a task analysis is usually a several page form, with the actual length dependent primarily upon the number of steps involved in performing the task. The following example is only a short cut of the whole form, in order to give a visual impression of how the result could look like.

An example of steps from the analysis of the occupation 'carpenter':

B. Processes wooden materials manually (=one of the duties)

B.1. Picks tools (=one of the tasks of the duty)

	Steps / Criteria of Accomplishment	Tools	Knowledge Needed	Safety	Attitudes / Features	Decisions to make	Data necessary for making decision	Mistakes as consequences of wrong decisions
1.1.	Assigned technical documentation is analyzed	For cleaning	To know to interpret (read) technical documentation	Personal, as well as of machines and tools	tidiness, pedantry, creativity	On the basis of tech. documentation, checks and chooses equipment and tools	Technical documentation	Impossibility to realize work
1.2.	Tools and additional means for processing are picked							
1.3.	Working place is prepared for work							

B.2.   Sharpens the tools

	Steps / Criteria of Accomplishment	Tools	Knowledge Needed	Safety	Attitudes / Features	Decisions to make	Data necessary for making decision	Mistakes as consequences of wrong decisions
2.1.	Tools which need to be sharpened are chosen by testing	Set for manually sharpening of manual tools	To know to apply tools for manually sharpening	personal	tidiness, pedantry personal affinity	In accordance with instructions and personal judgment	personal judgment and technical instruction with given parameters	Impossibility to realize work and no quality processing
2.2.	Chosen tools are sharpened manually							