

The Model of Universal Competences of a Qualified Engineer

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At the end of the 1970's there was an approach in employers' estimation that found wide application, based on diagnostics of knowledge, skills, and competences. In the 1990's the research on such aspects as motivation, personal qualities, result-orientation and others has been started. As a result there appeared a wider notion allowing for determination of readiness of a man for efficient job performance- a notion of competence [1]. In this work we will observe the following concepts [2]:

- **competence** is an integral qualities of a man combining knowledge, skills, competences, and motivation described in terms of behavior. This or that level of competences is different in a more efficient employee at a definite position from less efficient one. Competences are related to behavior influencing the result of work.
- **competence model** - is a set of competences necessary for an employee at a definite position for a company to achieve its business goals.

In most of works competences are divided into professional (technical

knowledge and skills) and universal (personal, cultural) [3]. Different companies assess the rate of validity for such competencies (in Joint Stock Company "The Russian Railway Roads", for instance, 1 and 0,6 correspondency) [4].

Usually professional competences are divided into managing-organizational, design-engineering and project designing ones. Let us consider in detail the most frequently occurring universal competences, the model of which permits for unification of requirements for employees and development of joint standards - a basis for selection, estimation, development and career of employees [5]:

1. Problem solution.
2. Self-development.
3. Result orientation.
4. Communication and team-work.

RULES OF ASSESSMENT

Every competence is broken into 5 levels: advanced level (corresponds to 5), intermediate level (corresponds to 4), basic level (corresponds to 3), introductory level (corresponds to 2), and non-competence level (corresponds to 1).

The characteristics of development levels and indicators of universal engineering competences are considered in the article.

In process of assessment each competence is rated on a scale of 9. The grades from 1 to 5 are possible, in this case the intermediate grades are also appropriate, for instance, 1,5.

1 - is given when behavior described in this level is predominated. 1,5 - is given when behavior described in Level 1 as well some features of behavior described at higher levels are predominated.

2 - is given when behavior described in this level is predominated and there is no features of behavior described in 1 Level as well as features of behavior described in Levels 3, 4 or 5.

2,5 - is given when features of behavior described in Level 2 and higher (3,4 or 5) are present equally, but in this case there is no behavior described in Level 1.

3 - is given when behavior described in this level is predominated, but there is no behavior described in Levels 1 and 2 as well as 4 or 5. 3, 5 - is given when the features of behavior described in Level 3 and higher (4 or 5) are present, but there is no behavior described in Levels 1 or 2.

4 - is given when features of behavior described in this level are predominated, but there are not features described in Levels 1,2 or 3, as well as those of Level 5.

4,5 - is given when all features of behavior described in Level 4 and some features described in Level 5. There are not any features of behavior described in Level 1,2 or 3.

5 - is given when all features of behavior described in Level 4 and 5, but there are no features of behavior described on Level 1, 2 or 3.

CONTENT CHARACTERISTICS OF COMPETENCE DEVELOPMENT LEVELS

<p>5. Advanced level</p> <p>In addition to Level 4 It means that an employee shows a particularly high degree of the competence. He (she) is able to apply competence efficiently in complex or (and) non-routine) situations, advances the initiative related to the given competence.</p>
<p>4. Intermediate level It means that an employee is completely familiar with the given competence. He(she) doesn't make mistakes in routine situations and shows his skill automatically.</p>
<p>3. Basic level It means that an employee is aware of significance of the given competence and is in process of its mastering. However, he (she) makes mistakes in routine situations. The skill is shown in not all situations, its demonstrations requires conscious efforts.</p>
<p>2. Introductory level It means that an employee accepts the importance of the given competence. However, trying to apply the given competence he (she) makes a lot of mistakes. The skill is absent.</p>
<p>1. Non-competence level It means that an employee does not possess the competence and is not aware of its importance. Employee does not try to apply and develop it. He (she) can act in complete controversy with the given competence.</p>

PROBLEM SOLUTION

The list of indicators related to the given competence:

1. Awareness of the problem stated and striving to solve it.
2. Arranging the work to do the task; self- organization.
3. Collection and analysis of initial information.

4. Selection of techniques for problem solution.
5. Quality of solution, correction of mistakes.
6. Forecast of solution consequences.
7. Solutions in the conditions of high complexity.

5. Advanced level
In addition to Level 4
1. Able to formulate a draft proposal independently and correctly, on the basis of clearly stated problem.
4. Always (even under time pressure) chooses and puts into action the best way of problem solution. Can invent new (highly efficient) methods of problem solution and introduce those methods at the level of his (her) department or/and company.
6. Accepts the responsibility for consequences of solutions developed by the team.
7. Solves the most complicated, extraordinary problems. In case of highly complicated problems, under time pressure gets priorities right (for instance, determines what problems are necessary to solve in the first place, what can be postponed).
4. Intermediate level
1. Aware of problem stated correctly. Considers it as a whole (sees it as a part of product; understands its place in other products). When necessary, is able to specify/work out in detail the problem correctly.
2. Plans the job according to problem - predicts the deadline and results in problem solution accurately. Tries to observe the schedule. In case of possible failure to meet a date and/ or essential troubles in work informs the administrative authority promptly. Possesses the tools of project planning.
3. Collects the information necessary for problem solution. Able to use different sources of information (including addressing to colleagues). Able to search for those sources if necessary. Analyses the collected information thoroughly, makes conclusions correctly.
4. Analyses various ways of problem solutions. Chooses the appropriate way of solution. If necessary invents the new solution methods. In this case able to avoid stereotypes, offer a non-standard way of solution.
5. Performs the stated problem solution with the proper quality. Impatient to the mistakes (his and others'), tries not to make mistakes; Identifying the mistake tries to eliminate it. Checks his (her) job independently. If corrected the mistakes, identifies and eliminates its causes. Prevents the situation of new mistakes (in his/her) job or related department, decrease in quality of the product.
6. In development of solution predicts its influence on the function of related departments, the entire product (provides the proper compatibility). Takes into account the possibility of further product development, creates the conditions for such development. Predicts the consequences if his (her) solution. Accepts the responsibility for the consequences.
3. Basic level
1. Aware of the problem correctly, but not as a whole. Solves a concrete problem, but not aimed at the goal of the whole project.
2. May make a significant mistake in predicting the problem solution deadline. Does not informs the authority in case of possible failure to meet a date and/ or in case of significant troubles in job: authorities learn about the trouble too late. Familiar with the tools of project planning, but does not use it in practice and find some difficulty or does not try to use it.
3. In one variant tries to find information necessary for solution, but uses a limited set of sources. If they do not assist, may be at a loss. In other variant analyses the collected information superficially and/ or makes wrong, unreliable conclusions.
4. In one variant does not consider different ways of problem solution (for instance, follows common standards). Finds difficulty in invention and application of a new method of problem solution. In other variant chooses inefficient way of problem solution (for instance, not optimal way of task solution (for example too complicated or too simple).

5. Does not always perform his (her) job qualitatively - makes mistakes regularly; solves problem in such a way that it needs to be re-done / optimized. Does not try to reveal the mistakes in his (her) job independently. In one variant when correcting mistakes does not take into account the consequence for the colleagues' job, the entire project (for example, as a result of error correction new errors can appear, deterioration of product quality). In other variant corrects the concrete mistake, but not its cause.
6. Does not always predict the consequence of his (her) solution. Does not take into account its influence on the work of related department, the project result. Does not predict the possibility for the product to be developed in his (her) proposal. Accepts the responsibility for the consequences of problem solution only partly. Shifts the responsibility to the circumstances and other people (authority, colleagues) partly.
2. Introductory level
1. Tries to solve the problem stated. But in one variant may understand it inaccurately (for example, neglects the elements of problem, understands its objectives and quality criteria incorrectly) In other variant treats the problem pro forma: does not try to specify and improve it, understand its goal (having stated the unclear problem, starts to solve it at once).
2. Disregards the deadline of problem solution regularly and significantly. Does not possess the tools of project planning.
3. Does not try to collect information necessary for problem solution: relies on his (her) knowledge even if it is not enough.
5. When solving the problem makes numerous mistakes (as a variant often does not manage to solve the problem in time with the appropriate quality).
6. Does not predict the consequence of his (her) solution. Accepts the responsibility for the consequences of problem solution only partly. Mainly shifts the responsibility for circumstances on other people (authority, colleagues and others).
1. Non-competence level
1. Does not try to solve the problems stated: deviates from the goals stated.
5. Does not try to perform the work qualitatively: ignores mistakes.
6. Avoids the responsibility for the consequences of his actions / solutions completely.

STRIVING FOR DEVELOPMENT

The list of indicators related to the given competence:

1. Interest in profession.
2. Study of new tendencies, innovations.
3. Initiative, ambitions.
4. Adequate self-assessment.
5. Learning ability, striving for self-development.
6. Readiness for feedback.

5. Advanced level
In addition to level 4
2. Arranges the work of collecting information on latest tendencies and innovations.
5. Systematically develops himself (herself). The goals of self-development correlates with those of company, perspectives in its product development. Helps colleagues in leaning new trends, in development of their professional level.
4. Intermediate level
1. Shows interest in his (her) job, is dedicated to it.
2. Follows the tendencies in branch development. Studies new achievements (product innovations, methods, techniques etc.).
3. Shows ambitions in career and professional growth. Shows the initiative in working situations and out work. Has an active stand.
4. Assesses his (her) professional level realistically. Sees his (her) strengths and weaknesses as a specialist.

5. Accepts the responsibility of his (her) professional self-development, takes effort for self-development. Uses different ways of self-development (reviews the literature, shares experience with colleagues etc.). Acquires innovations quickly and tries to apply theoretical knowledge in practice.
6. Open for feedback (from clients, colleagues, authorities): collects it independently, reacts to the critics constructively. Taking feedback into account changes his (her) behavior to achieve better job results.
3. Basic level
1. Shows interest in his (her) job and given company. But is motivated mostly by money reward, stability or other factors.
2. Interested in new trends and innovation in his (her) professional field, study new techniques but only when necessary, yielding to circumstances.
3. Does not show ambitions in career. Seldom takes initiative, mainly taking a backseat.
4. Makes mistakes in assessment of his (her) strengths and weaknesses. Admits importance of his (her) further development, but develops only yielding to circumstances or under authority's instructions.
5. Does not show consistency in development. Uses too limited methods of development. Shifts the responsibility for his (her) development partly to the authority. Learning new methods and techniques can require sufficient effort and time from him (her). Applies new information in practice with difficulty.
6. Open for feedback from clients and colleagues insufficiently; does not collect it at his (her) own initiative, not always uses this information to correct his (her) actions.
2. Introductory level
1. Shows low interest in his (her) profession, job in the given company.
2. Does not search for information on new trends and techniques in his (her) professional field, does not study innovations.
3. Does not show initiative in job and outwork: does only things that are said.
4. Has some troubles in assessment of his (her) strengths and weaknesses (makes sufficient mistakes in their assessment).
5. Does not deny importance of his (her) further development, but does not take his (her) own efforts for this. Shifts responsibility for his (her) development to the authority Does not strive to use new information in practice.
6. Is poorly open for feedback: accepts it only from authority and other authority figures. As an exception (for example, under pressure) uses this information to correct his (her) actions.
1. Non-competence level
1. Does not show interest in job in the given field and/or given company.
4. Denies the necessity of his (her) development (for example, believes that he (she) has reached the potential in his (her) profession. Is satisfied with the current level of his (her) professional development completely.
5. Negatively accepts new ideas and experience. Insists on impossibility to use innovations in his (her) job.
6. Does not accept feedback (can react to it indifferently or aggressively). Resists to colleagues' or authority's efforts to correct his (her) behavior.

RESULT ORIENTATION

The list of indicators related to the given competence:

1. Goal-orientation, ability to set goals.
2. Activity, persistency and flexibility in reaching goal.
3. Assessment of success in results.
4. Acceptance responsibility for result.

5. Advanced level
In addition to Level 4
1. Able to set clear, ambitious goals both for himself (herself) and for others.
2. Shows persistence in reaching results despite resistance and doubts of others. Suggests and takes measures for reaching outstanding result not only for him (her) but also for colleagues. Searches for the ways of improving the result.
4. Intermediate level
1. Understands the goals set by authorities clearly. Geared to these goals in the course of the works. Sets clear, achievable goals independently.
2. Makes/ expends great efforts to obtain the result. Facing the troubles shows persistence and insistency. Does not give up the task without having performed it. Ready for hard and extraordinary problem realization. Believes in the possibility of their realization. Considers job problems to be "the challenge" for his/ her abilities. Stress-resistant and can stand long, monotonous loads (does not decrease rate and quality of work). In case of time pressure finds forces to increase the efficiency. Flexible in reaching the result: does not get stuck on the only (or planned) version of reaching the set goal.
3. Assesses the success in performed work according to the achieved results. Believes that an important criterion in result assessment is company profit.
4. Makes him/herself responsible for the educt/ results obtained (aware of the direct dependence of the obtained result on his (her) abilities.
3. Basic level
1. Does not always understand the goals set by authorities clearly. Set not clear enough or not real enough goals.
2. Does not make/ expend great efforts to obtain good results. Can decrease rate and/ or quality of work in stress situation, long loads. Facing job problems can feel at a loss and delay the task performance. Not flexible enough: facing obstacles finds it difficult to invent the new way of reaching a goal. Change of approach takes him much time and great efforts. Expresses discontent in case of changing requirements for the result or the way of its obtainment.
3. Assesses success in performed work both by the result obtained and by the amount of expended efforts, by the working process characteristics etc. Does not believe that company profit is an important criterion in the result assessment.
4. Makes him/herself responsible for the educt/ results obtained partly (or not always). Shifts the part of responsibility to circumstances and other people.
2. Introductory level
1. Can not set the goals in work independently – needs friendly instructions. Can be insufficiently geared to the goals set (for example, deviates from them in the course of the works).
2. Makes few efforts to obtain the result (initially works in low rate with poor results). Inflexible in work: recognizes the only way of the goal realization. Committed to it strictly even if it is absolutely insufficient. Facing the obstacles can give up the work begun. Sets to perform only easy tasks (avoids difficult tasks, initially doubts in their performance).
3. Assesses success in performed work not by the obtained result but by the amount of expended efforts mainly, by the working process characteristics.Satisfied with low results..
4. Shifts responsibility for obtaining the result to circumstances and other people mainly.
1. Incompetence level
1. Not geared to the set goals. Geared to the process performance but not to the result obtainment. Enthusiastic about avoiding punishment for low efficiency but not about obtaining success.
2. Needs constant regulations and «cheering». Can give up the work begun even without facing the obstacles.
3. Assesses success of the work done by the amount of expended efforts but not the result obtained. Relucts against authority efforts in introduction of measurable criteria to assess his work.
4. Shirks responsibility for the results: shifts it to circumstances and other people completely.

COMMUNICATION AND TEAM-WORK

The list of indicators related to the given competence:

1. Attitude to team-work. Ability to cope with colleagues.
2. Participation / role in group discussion.
3. Presentation / assertion of ideas.
4. Perception of an interlocutor's point of view.
5. Meaningful position in discussion. Conflict behavior.

5. Advanced level
In addition to Level 4
1. Makes contacts with other people easily. Can find an individual approach to troublesome interlocutors.
2. Manages the course of group interaction.
5. Relieves stress even in complex situations and shifts the discussion to the constructive course/ way.
4. Intermediate level
1. Understands significance of team work. Tries to solve problems by means of group discussion. Feels comfortable in making contact with colleagues and authorities...
2. Able to arrange group discussion, involve colleagues, distribute the roles and tasks among them. Forges constructive relationships in the team.
3. Expresses his (her) ideas clearly and structurally. Able to present strong arguments to support them. Answers questions confidently, does not feel at a loss in this case. Tries to maintain his/ her attitude in the discussion. In doing so can change his (her) opinion under the pressure of interlocutor's arguments.
4. Listens to his (her) interlocutor attentively, understands the arguments properly. If necessary, asks clarifying questions.
5. In the discussion course takes up friendly constructive station towards an interlocutor. Shows respect to the other's opinion. Tolerant to the opposite opinion. Does not conflict with other members of the discussion. Tries to free up conflicts in team. Stays calm in the discussion course.
3. Basic level
1. Admits the importance of team work, but seldom interacts with colleagues on his/ her own initiative. For example, cannot find common language with all colleagues: contacts with some of them easily, but finds it difficult to communicate with others.
2. If necessary tries to arrange a group discussion, but does it inefficiently. Can not involve (alternatively) related people into the discussion.
3. Does not always express his / her ideas clearly (for example, can lose the narration neatness in the course of argument). Uses insufficiently solid/ satisfactory arguments to support his (her) position/ viewpoint. Can either be at a loss and find it difficult to prove his (her) ideas facing critics, or can support his/her ideas/ viewpoint too obstinately and does not want to change it despite solid arguments.
4. Can listen to an interlocutor carelessly (for example, interrupts him, misses part of statement). Does not ask clarifying questions. Tries to understand his point of view insufficiently, does not try to reveal the cause for objections. As a variant does not defer to some colleagues' opinions, but defers to the others'.
5. In the course of the discussion takes up initially a constructive station towards an interlocutor. But in disputes can behave a bit unconstructive, lose emotional well-being (but is not aggressive towards an interlocutor). Does not conflict with other members of the team, but when conflicts does not try to free it up.
2. Introductory level
1. Does not deny the importance of team work, but does not interact with colleagues on his / her own initiative. Finds it difficult to make contact with colleagues.

2. Does not try to arrange team discussions, but does not resist being involved in team work.
3. Finds it difficult to express his/her viewpoint clearly. As a rule does not give reasons for it. Facing critics can either retreat immediately, or can get into an unreasoned argument, can bring pressure on the opponent.
4. Sensible to colleagues' opinions only if they correspond to his / her own ideas.
5. In the course of the discussion takes up a bit unconstructive station towards an interlocutor. Does not provoke conflicts, but conflicts if it is initiated by others.
1. Incompetence level
1. Opposes himself / herself to other team members. Denies the importance of team work. Prefers to work on his / her own.
2. Can back out of team interaction.
3. In the course of the discussion can take up absolutely passive station, does not try to express his / her viewpoint.
5. Initially can take up unconstructive station in team work (being aggressive, provoking conflicts, showing disrespect to others).

Defining an employee's recommended activity type, you should assess it in 3 stages: 1st stage is concerned with managerial and universal competences, 2nd stage is concerned with engineering and manufacturing and universal competences, 3rd stage - with design-and-engineering and universal competences. Then you should take a decision on his/her preferable activity type or his/her being sent to competences training assessed at the lowest grade (4).

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