

Integration Process of Welding Engineers Within Labour Market

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Abstract

Nowadays when AI topic is everywhere and technology is evolving faster than a teenager mind, this paper is launching the challenge to take a pause and analyse the role of the human in this evolution. More precisely the integration of the welding engineer graduate among tech progress and increasing demands of the labour market. This paper is analysing main standards which can guide the junior engineer after graduation through the organisational systems and demands until he reaches the maturity in order to be capable to choose and supervise processes autonomously. The roles and responsibilities of the young engineer are briefly presented and correlated with the organisation need in order to evolve together human and organisation in a time of tech and digital transformation. Within industrial field the standards have a defining role in establishing the best practice or benchmark regarding processes and products. Following this idea and specifically for welded products this paper is referring to EN ISO 14731, EN ISO 3834, EN1090 and EN ISO 9001. The focus of this paper is on the role of the welding engineer newly graduated and his development within the manufacturing organization.

Keywords

welding engineer, EQ, standard, organisation, development

1. Introduction

Although the organizational change it brings limited discomfort for operators and managers in the same time, at the same time it brings progress.

Many organizations are struggling to implement new values for their team members, but this process is a real operational transaction:

- The customer and not the boss, it is the salary payer, so your objective must be to satisfy his needs;
- All the jobs are depending on the value which are creating, in such a way that if new ideas and skills are appearing, it is important to evaluate if they are influencing the final value;
- Acceptance of personal responsibilities in problem solving, and not the renouncement and to farm out something to the next hierarchical level;
- Each worker is a team member: a good manager is building a collaborative team and not a great empire;
- Due to the fact that the future is uncertain, continuously learning it is the key to success.

The organizations are passing thru different development phases. It is the real fact to meet the probability that all the industries and all the regions to rely on this and to follow similar patterns, in the end predictable ones.

Within Table 1 is presented the typical model of an organization. It is possible that all the economy areas to pass similar development cycles of appreciation and decrease. Which is the main objective of the organizations? It is obvious that these have multiple objectives. All have to present, and all have economic objectives which are targeting the finish goods production and services offer. During this, these organizations have social and cultural objectives which are characterizing a specific type of company.

The organizations have general and specific scope. Many are focused on satisfying all the interests of the employees, shareholders, customers, owners. Companies are concern about with the result and implicit efficiency and profitability. These objectives are regarding the development, increase and investment in feasibility on long term. Although these targets have specific objectives, and more important with focus on production, inventory level, sales, profit and other operational.

Companies are doing everything to exist. In order to do so, these structures have to monitor carefully and to adapt continuously to market labour changes, consumers habits, and products requirements. Most organizations are focused not only on existing, changing and adapting for survival, but also to influence the future through innovation. For innovation are required strategical plans for establishment and management of the organization.

Table 1. Simplified model of organizational life cycles [1]

Entrepreneurial phase	Collectivity phase	Formalization and control phase	Structural elaboration phase
Resources management	Communication and informal structure	Rules formalization	Structural elaboration
Large number of ideas	Sense of community	Stable structure	Decentralization
Entrepreneurial activities	Spending a lot of time	Underline efficiency and structural	Branches expansion
Lack of planning and coordination	Sense of mission	Conservatism	Readjustment
New runs emerging	Continuous improvement	Institutional procedures	Renewal
Initial reason has the priority		High commitment	

Obviously, some changes can be plan ahead and anticipated, but others are imposed on the company from outside or inside. The scheduled internal change can be implemented within the company structure, dimension and boundaries. The changes will affect the company products and the services. The external change scheduled for the company can be brought by the new technology introduction or new communication models, but it is a consequence of new products and the competitors behaviour. Internal change unplan can refer to demographics' characteristics change of the employee (e.g. old labour personnel, uneven proportion of women or/and ethnic minorities than before. In the end the companies have to face unplan external change, e.g. Governmental rules or external increased competition pressure of the foreign countries.

The motive for the errors analyses is the effort to reduce them. Significant effort was expended for equipment, processes and security systems design. The main hypothesis is that errors are appearing due to mismatch between system properties as a whole and the human characteristics of information processing.

Business centre, defined by fast changes and increasing pressure from the competitors between the organizations within local, regional and global market. To develop these entities have to look for adjusting ways more efficient and to implement methods which will lead to increasing performances.

Recently, different ways were analysed to define organizational development emerged along the past years and identified ten possible results as result of this action [1]:

- Promote organizational innovation;
- Start organizational culture change;
- Increase profitability and organization competitiveness;
- Employees health and well been assurance;
- Facilitate learning and development;
- Process improvement for problem solving;
- Increase employee's efficiency;
- Initiation and/or change management;
- Internal processes improvement;
- Organization adaptation to change.

2. Personal Development

Furthermore, below are specified key feature on which a young professional should reflect upon:

2.1. Emotional intelligence/quotient (EQ) versus IQ (Intelligence quotient)

High EQ can be contributed to success more than a high rated IQ.

EQ was used to describe emotional features which are arising as more important in order to be a successful professional.

Among them could be mentioned:

- Temperament control;
- Independence;
- Adaptability;
- Interpersonal problem solving;
- Assertiveness;
- Assiduity;
- Respect.

2.2. Feelings

Many negative feelings within junior welding engineers' soul and mind are playing the role of major motivating factors in the same way as in the childhood.

These are helping them to learn and manifest proactive behaviours among which are mentioned:

- Fear of punishment;
- Induced anxiety by social disapprobation;
- Guilt caused by not being at his own level of expectations;
- Shame and embarrassment due to the fact that the others caught him doing something unacceptable from the group perspective.

The two major positive feelings which are moulding the moral development of a young professional are empathy and conservation instinct.

2.3. Social

- Social skills can be taught.
- Presentation skills are helping the young professionals to establish social contacts with other persons or groups.

2.4. Humour

- To have a sense of humour is an important social skill.
- Humour is one of the most appreciated characteristics.
- It is an ability to say jokes and make everybody laugh but we are born with the ability to appreciate humour.
- Humour is playing different roles at different edges, but during your life can contribute to good understanding with the other or to get over problems.

2.5. Team

- Establishing good relations within the group it is a task of great importance in our personal development. This could influence the future relations of the young professional.
- The young engineer cannot be forced regarding the way how will work within a team of specialists. The newly graduate can be influenced through the mentor behaviour within the group and in this way, he can witness the importance of collaboration between the team members for fulfilling a common goal.
- Inside the group the mentor can initiate opportunities in order to stimulate the junior engineer integration.

2.6. Social

- Social manners impact in daily business.
- Social manners are part of EQ skills, easy to learn with huge impact in the future challenges which the professional will incur.

2.7. Work

- The company has and will have high expectations from the individuals. This should force the individual to expect more from his professional performance also.
- Companies are asking for working hard, dedication, problem solving, curiosity.

- Individuals should receive also tasks for which they can control the output.
- Individuals should practice time management when are performing different jobs.
- They should be able to evaluate the outcome of their assignments.
- Coaching is also a method to help the newly graduated engineers to fulfil their true potential.
- Use the existing resources online, digital, practical to enhance the technical learning skills and the technical knowhow.

2.8. Time

- Perception over thigs is altered in time. Young professional should not give up the optimism from the beginning of the professional development path by comparing their skills with the senior engineers. They should learn to appreciate the effort itself. [2]
- Time management itself is an important constituent of EQ and will affect the entire life performance.

2.9. Motivation

- Finding motivation for the professional activities could be a challenge.
- They should understand the meaning of the effort.
- They react to the colleague's perception in different situations and are affected by the failure.
- Accept that failure is part of the learning path.
- Find happiness in solving problems working as a team and less as an individual.

2.10. Conflict

- Conflict management through negotiation and mediation should be taught in organization in order to avoid major conflicts and unnecessary escalation [2].

2.11. Technology

- Use technology evolution as a tool for becoming a better professional overcoming distance and bias [2].

Technological change, geoeconomic fragmentation, economic uncertainty, demographic shifts and the green transition – individually and in combination are among the major drivers expected to shape and transform the global labour market by 2030. The Future of Jobs Report 2025 brings together the perspective of over 1,000 leading global employers - collectively representing more than 14 million workers across 22 industry clusters and 55 economies from around the world - to examine how these macrotrends impact jobs and skills, and the workforce transformation strategies employers plan to embark on in response, across the 2025 to 2030 timeframe.

Analytical thinking remains the most sought - after core skill among employers, with seven out of ten companies considering it as essential in 2025. This is followed by resilience, flexibility and agility, along with leadership and social influence [3].

3. The Standard Way

Welding coordinator is a job function. This mean that the manufacturer establishes if a specific person has the level of knowledge, skills and experience to fulfil the requirements of a job profile.

ISO 9001 is a system standard concerned with quality systems. They define welding as a special process that must be properly controlled in order to ensure that the necessary quality requirements are fulfilled [4], Figure 1.

The tasks of welding coordination personnel shall be selected from Annex B [5], of the standard ISO14731, ISO3834, EN1090 etc and customer specification.

The comprehensive level implies highly specialized problem-solving skills. This mean that the expectation to acquire advanced knowledge and critical understanding of welding technology application, Figure 2.

ISO 3834 consists of the following parts, under the general title “Quality requirements for fusion welding of metallic materials”, as per Table 2.

According EN ISO 3834-2, welding coordinator can be involved in, or responsible for [8]:

- Customer requirements analyse
- Technical analysis
- Subcontracting process management
- Welding personnel management on behalf of the company owner or administrator

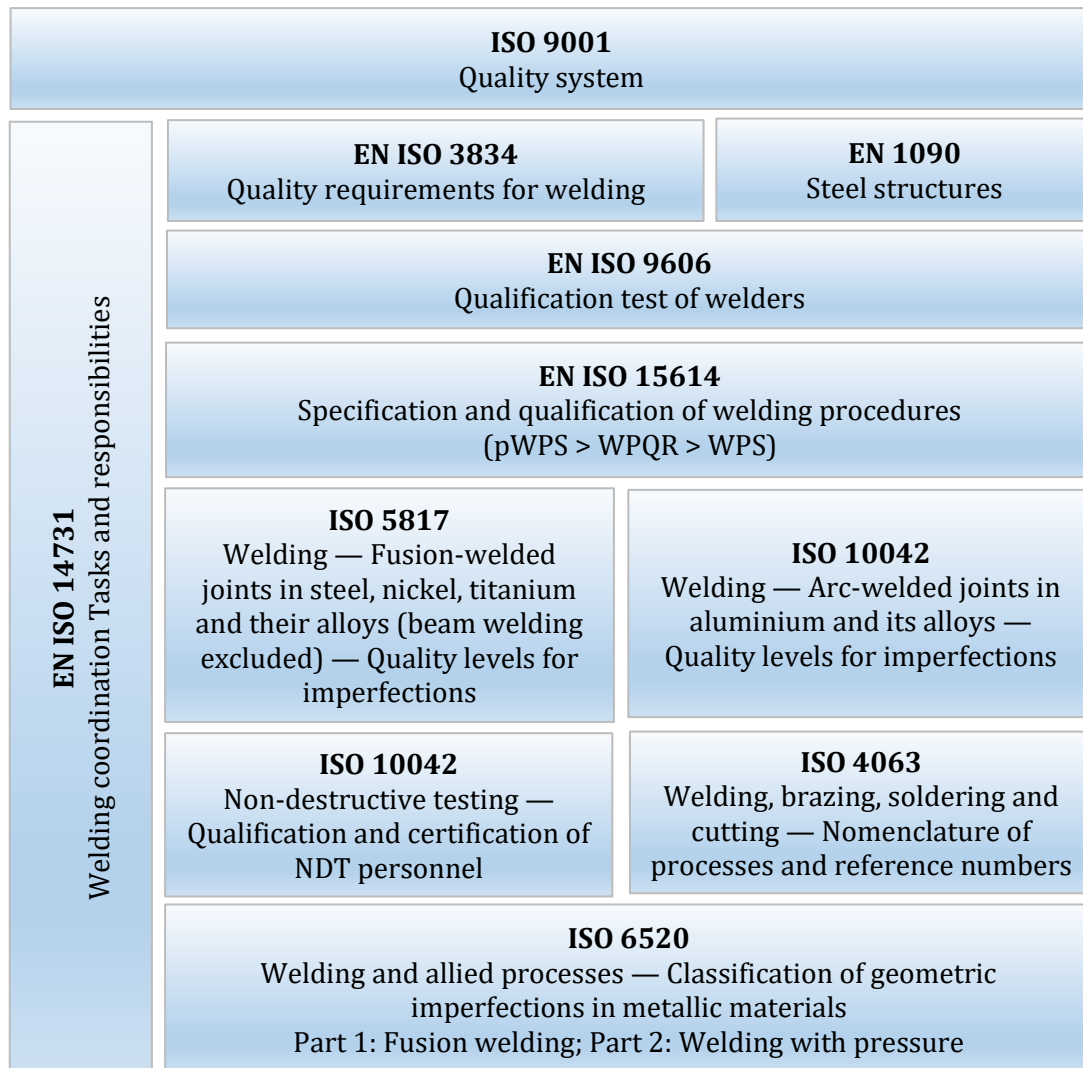


Fig. 1. Standards applied for welded products [6, 7]

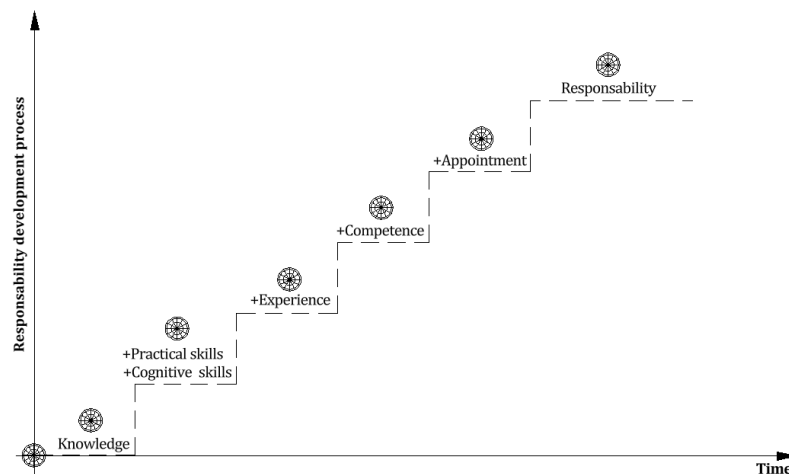


Fig. 2. Responsibility development process

Table 2. EN ISO 3834 series [6, 7]

Standard	Definition	Part	Details
EN ISO 3834-1	Quality requirements for fusion welding of metallic materials	Part 1	Criteria for the selection of the appropriate level of quality requirements
EN ISO 3834-2		Part 2	Comprehensive quality requirements
EN ISO 3834-3		Part 3	Standard quality requirements
EN ISO 3834-4		Part 4	Elementary quality requirements
EN ISO 3834-5		Part 5	Documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3 or ISO 3834-4
EN ISO 3834-6		Part 6	Guidelines on implementing the ISO 3834 series

- Inspection and testing personnel allocation and/or coordination
- Equipment functionality and calibration supervision
- Welding and related processes coordination
- Welding filler material supervision
- Base materials storage supervision
- Post weld heat treatment supervision and coordination
- Inspection and testing supervision and coordination
- Nonconformities and corrective actions
- Calibration and validation of equipment for measurements, inspections and testing

Manufacturer has to have competent personnel for welding coordination. These kinds of employees which have responsibilities for quality assurance have to possess enough authority in order to take whatever measure are necessary. Tasks and responsibilities of these individuals must be clearly defined.

If critical changes occur, conformity assessment body shall initiate suitable activities to verify continuing conformity with the EN ISO 3834:

- changes in welding coordinators or their authority,
- changes in organisation and its management to control welding activities performance in relation to achievement of delivery schedules, performance in relation to extent and type of nonconformity changes in regulatory requirements.

Welding coordination according EN1090-2 it is required for EXC2, EXC3 and EXC4, during welding process execution. Welding personnel must be qualified accordingly for this. Proven experience in welding activities for which was nominated to assure supervision according to product, project or process specification (see EN ISO 14731). Depending on welding processes that are supervised welding personnel has to hold technical knowledge according EN1090-2 specification [9].

For knowledge regarding steel grouping, newly graduates are advised to explore ISO15608 and for correspondence between steel grade and specific standards can be reached within ISO/TR 20172.

Pay attention to B, S, C which are corresponding to the basic, specific and comprehensive levels from EN ISO 14731. According to EN1090-2 good practice for welding coordination depending on material and thickness (levels B, S and C). For more details regarding EN1090 series see Table 3.

Table 3. EN 1090 series

Standard	Name	Part	Details
EN 1090	Execution of steel structures and aluminium structures	1	Requirements for conformity assessment for structural components
EN 1090		2	Technical requirements for the execution of steel structures
EN 1090		3	Technical requirements for the execution of aluminium structures

According third party TUV SUD organization experts, EN 1090 can be presented more explicitly as follows in Table 4.

Table 4. EN 1090 classifications [10]

EN 1090 classifications
EN 1090-1 – refers to CE-conformity assessment
EN 1090-1 – refers to welding certificate
EN 1090-2 – replaces DIN 18800-7
EN 1090-2 – refers to EXC 1 – 4
EN 1090-2 – refers to IWS / IWT / IWE (including limits)
EN 1090-2 – includes NDT specification
EN 1090-2 – includes test piece welding specification
EN 1090-3 - replaces DIN 4113-3

An IWE / Welding engineer professional profile must cover the following skills:

- original thinking, theoretical knowledge, technologies, applicability
- problem solving skills,
- looking for the best technical and economical solution,
- optimal reaction to unforeseen technical.
- responsibility for personnel tasks definition and allocation
- act professional and safe

As presented within EWF-652 Guideline for IWE path a candidate should have an engineering diploma and 4 years' experience in the welding field. During the modules practical training it is allowed to perform virtual weld training 50%, demonstration and video presentation of welding processes [11, 12].

Supplementary, NDT is presented for welding evaluation to increase the awareness regarding welding quality not to become specialists in NDT.

It is agreed that entry to the program should be on a postgraduate level. Participants should have a primary degree in an engineering discipline or its equivalent recognised by the national government and assessed by the ANB (Authorised Nominated Body part of IIW).

In case of co-operation arrangements, e.g. with universities, according to which the IWE Part 1 (IWE 1) of the syllabus with scope, objectives, and learning outcomes is presented under careful control of the ANB, the participant is allowed to enter the IWE course through the Path 2.

The following additional conditions shall be observed for the different routes through the IWE course:

- Students who have authenticated evidence that they have passed the examinations in all subjects of their Bachelor engineering degree studies but still have to complete a thesis are allowed to attend Part 2 (IWE 2) and Part 3 (IWE 3) of the IWE course and the corresponding written parts of the final examination;
- Students shall present their degree diploma to the Board of Examiners before being allowed to take the final oral examination for IWE.

Candidates may be exempted by the ATB from the practical training, on a process-by-process basis, if they can demonstrate practical experience and/or training in the process concerned [11, 12].

No matter the professional path chosen by the young professional, self-education should be considered as part of his continuous development process. First and second path can be followed by the newly graduate depending on the labour market offers. Most of the organisation offers are not demanding IWE diploma but the rest of them are underlining this requirement (Figure 3).

4. Conclusions

Analysing the existing standards and underlining the abilities required for the welding personnel with focus on coordination of welding activities.

Identify and recommend for young professionals an EQ development in order to prepare themselves for industrial challenges and social relations.

University studies after graduation must be followed by 3 or 4 years of industrial practice in order to be eligible for IWE course.

This paper is marking out a development layout for the young engineers based on author experience within industrial field.

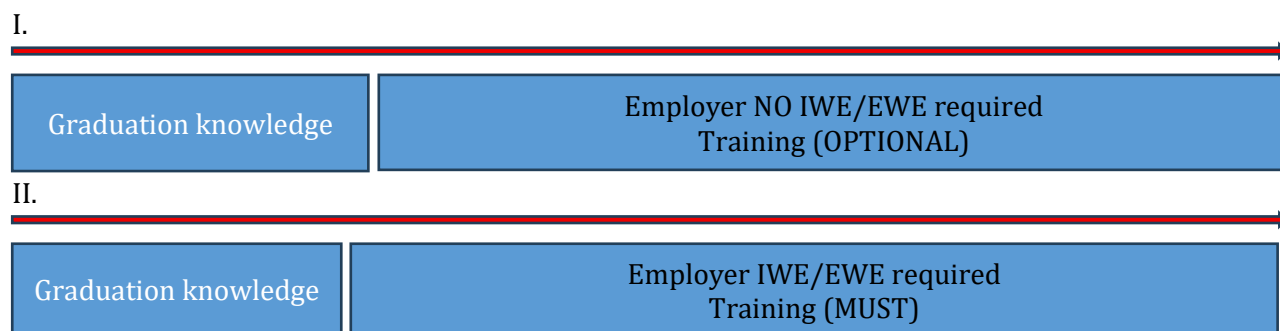


Fig. 3. Graduate development path

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