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CURRICULUM FRAMEWORK FOR VET COURSES FOR WORKERS

in the Chemical, Pharmaceutical, Rubber and Plastics Sectors

FECCIA CEC EUROPEAN MANAGERS

ECEG European Chemical Employers Group

ledarna SVERIGES CHEFSORGANISATION

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1 Introduction

This document provides a framework of digital skills, supporting transversal and social skills to make sure that professionals are prepared for the digital transformation of the chemical, pharmaceutical, rubber, and plastics sector. This framework can be used at vocational education and training (VET) and university institutes to make sure that the new generation of young people who are preparing for a career in these sectors possess the required advanced digital skills and qualifications. This will enable future employees to adapt to the digital innovations the industry goes through. This framework has been derived from desk research and a number of workshops with employers, workers and managers during spring 2022. With a representation from the various sectors.

The project partners Ledarna, ECEG and FECCIA, in association with industriAll European Trade Union, representing the chemical, pharmaceutical, rubber, and plastics industry within the EU, have worked together to identify and anticipate the digital skills needed in the sector. We present a framework as digital skills for curricula- and final-qualifications for students that must be acquired during the education besides the general program. Some of these qualifications are new for most education institutes and are highlighted in the framework. For lifelong learning courses the content and learning path depends on the skills gap of the individual trainee. The digital technology that is associated with each skill is changing continuously: e.g., new social media platforms keep emerging and new sensors are entering the market, this framework is therefore at a more generic level and does not describe specific digital technologies.

We present the Digital Skills framework for the sector specific jobs and tasks, the differences across the sectors are not large, however in pharma the usage of digital technologies seems already more advanced of which the in-silico research is an illustrative example. A process must be implemented to keep aligning courses to the needs of the industry, since the current digital skills framework due to the continuous emerging of new technologies must be updated soon. We advise to align the curriculum framework with the European Chemistry Thematic Network (ECTN) frameworks.

Building an eco-system with industry (cases, expressed needs, hybrid teachers) is a best practice to align industrial needs with curricula to upskill both trainers and professionals. The learning community model integrates learning, innovation and work at one location is a promising concept.

2 Impact of digital transformation on the workplace

The digitization of manufacturing is gradually transforming the maintenance function from analogue and paper based towards digital and sensor based. This offers on the one hand many opportunities for e.g., predictive maintenance, but on the other hand it requires many new skills. Partly, this digitization helps to improve registrations of failures, asset condition and usage by making the registration less dependent on human input. However, expert knowledge and knowledge management remain key: more specialists are required for collecting and analysing specific data (Tiddens, 2018).

Smart Maintenance relies on the comprehensive collection of data, and the capacity for remote monitoring to enable a constantly updated information stream, available at any time and in any place. This leads to guided predictive maintenance and optimized repair strategies. Machines with deep learning capacity not only analyze past and present performance but can also offer valuable insights and diagnostics for machines and their components.

Digital platform in logistics creates visibility of inventory positions, movement of goods, delivery performance and compliancy with respect to safety processes (Gmür, 2018). In pharmaceutical logistics, digitalization initiatives are currently mainly focused on tracking & tracing practices. New shipment regulations (GDP) are forcing companies to place greater emphasis not only on how they track and trace their shipments, but also on temperature control during shipment. Smart technologies and centralized cloud platforms provide better and more comprehensive means to comply with these requirements. In addition to track & trace, pharmaceutical logistics is also showing a strong interest in serialization.

Moreover, many pharmaceutical companies are looking into opportunities to implement central supply chain control towers and the underlying IT solutions as a means not only to gain more visibility into their supply chain, but above all to give them better proactive control over their shipments and supply chain execution.

Internet of Things (IoT) leads to new system architectures where open standards play a significant role. Through better connectivity, information will be better available, which could result in integration of previously isolated functions and more closely integrated. Here modelling at the right level of fidelity will be key. It can be expected that the importance of optimization will increase. Another trend is the fact that handheld sensors and wearable devices will enter the shopfloor.

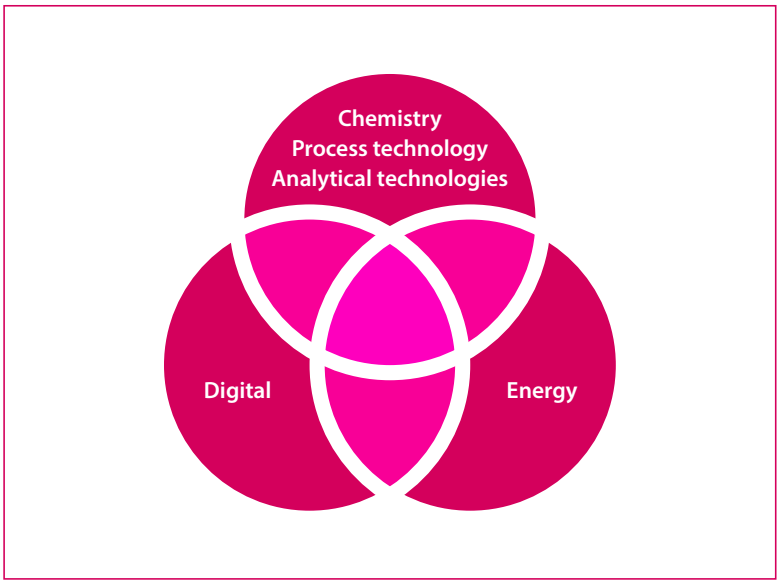
Digital technologies are changing the way research and innovation is being performed: examples are in silico research for items like drug candidate screening, cell simulations, as well as the use of digital twinning to predict impact of new technologies and the usage of technology scouting using artificial intelligence.

New ways of data driven chemistry and research are emerging. Part of data driven research and innovation strategy is to collect, aggregate and analyse all available research data and provide it to all relevant workers (internal knowledge management system).

3 Skills sets

The skills domain of the professional in chemistry can be considered to deal with the traditional skill domain areas for chemistry, process technology and analytical technologies, extended with knowledge on Digital technologies and Energy or Sustainability skills. IT professionals will cover the green lower left part, energy specialist the green lower right part. This framework deals with the blue left upper part and the black part that describes which skills a professional in industry much has about the digital technologies.

During their degree programme students should develop a realisation of the importance of chemistry in the world around us and of its possibilities for helping to solve problems for which mankind needs to develop solutions if it is to survive. It is thus vital that teachers do not stress only the academic side of the subject, but also present material relevant to topics such as: chemistry and industry, chemistry and the environment, The economic importance of chemistry, chemistry and energy, climate change and food production, chemistry and biology, chemistry and medicine, social aspects of chemistry



4 Curriculum framework

We propose the following expected learnings for curriculum framework for vocational and practical learning institutes with a course for blue collar workers working in maintenance, operations or logistics. A number of skills are aligned with the Edison Data Science Framework (EDSF) release 3[1] concerning domain knowledge and expertise (DSDM) and data management and governance and the skills at a beginner's level for data science analytics.

1 Y.Demchenko e.a. 2018 EDISON Data Science Framework: Part 1. Data Science Competence Framework (CF-DS) Release 3

GENERIC SKILLS

- Experience in interaction with digital systems using various types of interfaces.
- Experts in risks and regulations as result of unsafe interaction with digital tools and data.
- Experts in communicating insights in required (digital) format and system to co-workers and managers.
- Ability to work with service and industrial robots using various interfaces like voice based or gestured based.
- **Adaptivity, learning agility and readiness for change mainly as result of the fast-changing technology context.**
- Self-leadership and the skill to deal with digital self-organising teams.
- **Skills on intercultural competences as result of the growing diversity in teams.**
- **Experience with the upcoming trend of wearable sensoring.**
- Understanding of the workflow of data-streams according to the international society of automation (ISA-95) standards.
- Ability for troubleshooting digital technologies and understand the impact of faults or perform basic preventive maintenance.
- Experience with the impact of digital devices, be able to recognise faults and act accordingly.
- Ability to effectively apply the decisions or results of complicated data analytics techniques, such as Machine Learning (including supervised, unsupervised, semi supervised learning), data mining, prescriptive and predictive analytics.
- Experience with accuracy metrics for data-validation in analytics projects, hypothesis testing, and information retrieval.
- Experience with interpretation of data, such as data-visualizations, data analysis, design dashboard and storytelling methods.
- Use domain knowledge to apply relevant data analytics applications; understand the results of general Data Science methods to domain specific data types.

SUPPORTING SKILLS

- Adaptivity, learning agility and readiness for change mainly as result of the fast-changing technology context.
- Skills on intercultural competences as result of the growing diversity in teams.
- Ability to maintain relationships with internal and external stakeholders.
- Ability to cooperate and communicate with non-experts and professionals of other fields.
- Ability to cooperate in virtual teams.
- Ability for networking and collaborating through digital channel.
- Ability for Interacting with and participating in communities and networks.
- Problem solving skills and awareness of different (digital) problem solving techniques and the ability to select appropriate approach.
- Ethical and safety skills with the ability to protecting self from online fraud, threats, Protecting data and digital identities and Ethical awareness.
- Computational thinking.

SPECIFIC SKILLS

Maintenance

- Knowledge about statistical process control and related asset performance metrics
- Knowledge about Load monitoring technologies to collect data on components condition
- Knowledge about process sensor technologies that provide data relating to output characteristics
- **Basic AI understanding**
- Ability to work with computerized maintenance management systems
- Ability to work with supply chain management systems
- Ability to work with order systems

Operations

- Able to work with distributed control systems
- **Able to work alongside co-bots**
- Able to work with energy monitoring systems and analyse data to optimize usage
- Familiar with production process design, factory design principles and functions of different units.

Logistics

- Able to work with supply chain management systems.
- Able to work with Inventory systems.
- Able to work with warehouse systems.
- Able to work with tracking and tracing solutions.
- Able to use the data provided by supply chain control towers.
- **Understands the tagging and tracing possibilities like QR codes, RFID technologies, barcodes.**

Imprint

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