

CURRICULUM FRAMEWORK FOR MANAGERS

in the Chemical, Pharmaceutical, Rubber and Plastics Sectors



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1 Introduction

This document provides a framework of digital skills, supporting transversal and social skills to make sure that managers are prepared for the digital transformation of the chemical, pharmaceutical, rubber and plastics sector. Managers of different domains like maintenance, operations, logistics, research and development of HR. This framework can be used at vocational education & training (VET), university institutes or other training institutes to make sure that the new generation of managers possess the required advanced digital skills and qualifications. This will enable managers 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. Digitalization will impact all basic tasks for a manager: lead, develop people, coach, celebrate, check, support, develop, listen, control, reduce cost, standardize, steer, facilitate, communicate, analyze and learn.

We present a framework as digital skills for curricula- and final-qualifications for trainees that must be acquired during the education. 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.

2 The impact of digitalization on the tasks of managers

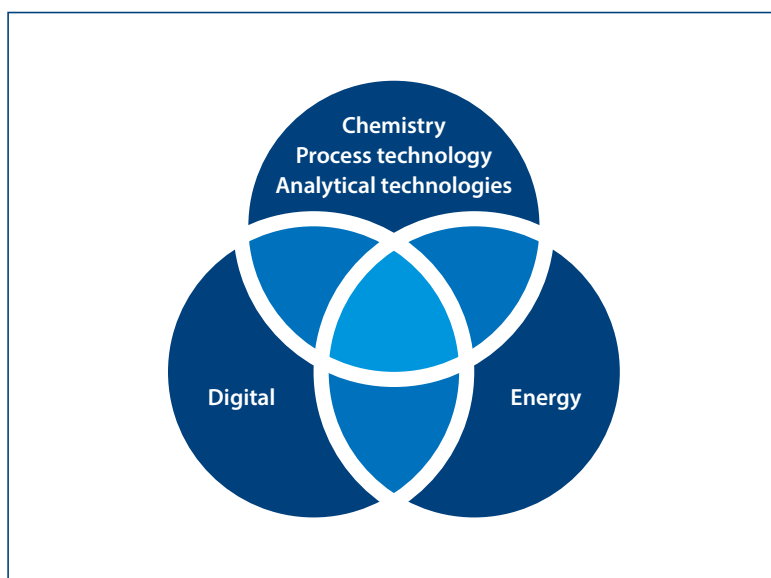
The impact of digitalization on managerial occupations is not as destructive, though it is a fact that the human role in human-machine interaction can never be neglected. Especially for the kind of efforts done by humans using the technological development to achieve desired results via machines. However, managers in managerial positions are required to have qualifications and advancement in technology to stay competitive in this digital transformation. Managers perform nonroutine tasks that cannot easily be replaced by machines, since machines do not have capacities such as originality, persuasion, social perceptiveness, neither can they act as mentor or show empathy for others (Asad, 2021 & Fossen 2019).

The disruptive nature of digital technology asks for upskilling every 10-15 years and maybe every 5-6 years. Managers have to build competences how to stay accountable using autonomous decision-making systems and need knowledge on ethical AI guidelines, trustworthy AI and approaches. Managers have a role to assure availability of data and generate insights from the growing amount and growing variety of data. Their data analysis skills are also becoming more and more important.

For the social- and cognitive-skills, we stress the need for adaptivity, learning agility and readiness for change mainly as result of the fast-changing technology context. The growing diversity in teams ask for improved skills on intercultural competences.

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.



4 Curriculum framework

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

We propose the following expected learnings for curriculum framework for academic and vocational institutes with a course for managers active in maintenance, operations, research and development or logistic engineering. A number of skills are aligned with the Edison Data Science Framework (EDSF)¹ concerning domain knowledge and Expertise (DSDM) and data management and governance the skills at a beginner's level for data science analytics.

GENERIC SKILLS

- Able to Lead virtual team.
- Able to stay accountable when using decision support system.
- Able to use explainable AI technology to understand how decisions are being taken.
- Advanced Translator skills to form a bridge between business objectives and the data team
- Able to identify digital skill demand for the related teams.
- Able to form a team-based on data roles.
- Familiar with concepts of Human Robotics interfacing.
- Knowledge about legislation on data storage and data usage.
- Familiar with concepts of industrial data spaces.
- Able to act as responsible for Cyberthreat Detection and Mitigation.
- Familiar with concepts of Artificial intelligence (Machine learning, Responsible AI, and Explainable AI).
- Use appropriate data analytics and statistical techniques on available data to discover new relations and deliver insights into research problem or organizational processes and support decision-making.
- Develop required data analytics for organizational tasks, integrate data analytics and processing applications into organization workflow and business processes to enable agile decision-making.
- Visualise results of data analysis, design dashboard and use storytelling methods.
- Use domain knowledge (scientific or business) to develop relevant data analytics applications; adopt general Data Science methods to domain specific data types and presentations, data and process models, organisational roles and relations.
- Analyse information needs, assess existing data and suggest/identify new data required for specific business context to achieve organizational goal, including using social network and open data sources.
- Operationalise fuzzy concepts to enable key performance indicators measurement to validate the business analysis, identify and assess potential challenges

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 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	Operations	Logistics
<ul style="list-style-type: none"> ■ Familiar with condition based monitoring management frameworks maturity systems for asset owners ■ Knows Selection criteria for maintenance decision support systems ■ Has knowledge on statistical process control, physics-based models and data-driven models. ■ Has knowledge on Maintenance data gathering and monitoring strategies. ■ Has knowledge on Materials and inventory management systems and underlying philosophy ■ Is familiar with Digital twin components and basic architecture. ■ Has insights how a virtual model of the physical world enables data analysis, system monitoring to alert problems, downtime prevention, and future planning via simulations. 	<ul style="list-style-type: none"> ■ Able to select and use Industry 4.0/ Smart industry Maturity models for the own organization ■ Familiar with the concept of Cyber-Physical Systems. ■ Familiar with concepts of distributed robust system-wide optimization methods. ■ Familiar with concepts of system operation methods combining data-driven and model-driven approaches ■ Understands the working of Energy monitoring systems at unit, production and site management. ■ Has knowledge about available machine interfaces and data standards: ability to decide which standards are applicable for given application. ■ May Act as sponsor of digital transformation process. 	<ul style="list-style-type: none"> ■ Is an expert in the criteria to select inventory tracking systems, supply chain management systems. ■ Is an expert in the criteria for the selection of communication software that provides real-time updates on goods movement ■ Has Intermediate knowledge about user models and personas for inventory and supply chain management systems. ■ Has basic knowledge on pros and cons of Blockchain and ledger technologies for tracing of transactions and movements of goods



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