

**ASKFOOD – Alliance for Skills and Knowledge to Widen  
Food Sector-related Open Innovation, Optimization and Development**



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**Report on Findings and Recommendations**

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Dissemination Level		
<b>PU</b>	Public	
<b>PP</b>	Restricted to other programme participants (including Commission services and projects reviewers)	
<b>CO</b>	Confidential, only for members of the consortium (including EACEA and Commission services and projects reviewers)	<b>X</b>

**Summary:**

This document includes the summary of the main findings on relevant needs and demand from food-related sectors concerning academic education and CDP. It capitalizes the main evidences collected in WP1 and is based on the interactive repository of emerging skills and future jobs, as they were analysed in the Forecast Aggregator (D 1.1), as well as on the map of the existing resources that are today available to (self-)invest on skills for the future of the food industry and food-related sectors. The results from the matching give the basis for some preliminary conclusions, that were discussed among the partners, so to create consensus on the next steps.

## Content

1	Introduction .....	4
1.1	The overall sequence of activities carried out in WP1.....	5
1.2	The methodological assumptions behind the implementation model.....	5
2	Results and main findings on trends, existing practices and potential drivers for Skills and Capacity building, updating and scaling-up.....	8
2.1	The Change Drivers and the TEMPESTS that are shaping trends in the food sector: main results from the Forecast aggregator.....	8
2.1.1.	TECHNOLOGY: ACCELERATED CONVERGENCE.....	8
2.1.2.	ECONOMY: REIMAGINING MONEY, POWER BALANCE AND OWNERSHIP.....	9
2.1.3.	MARKET: A NEW CIVIC DISCOURSE.....	9
2.1.4.	POLICY AND REGULATORY FRAMEWORK: POLICIES THAT MATTER.....	10
2.1.5.	ENVIRONMENT: ENVIRONMENTAL EATING .....	10
2.1.6	SCIENCE: FOODOMICS AND FOOD GENETICS .....	11
2.1.8.	SOCIAL DYNAMICS: ARTIFICIAL OVERTARGETING .....	12
2.2	The Interactive Training Gap identifier: the tool to support skills gaps for a successful professional career.....	12
2.3	The SMART Atlas: the tool to support skills gaps for a successful professional career .....	13
3	Recommendations on the future of training in the food sector and the purpose of the qualification strategy in the food and food-related sectors.....	13
3.1	Main recommendations related to the future of training in the food sector.....	13
3.1.1	TRAINING CONTENTS: .....	13
a.	Food-related disciplines. New areas of education and training in academia and VET should consider the following trends:.....	13
3.1.2	TRAINING AGENTS AND ENVIRONMENTS .....	14
3.1.3	TRAINING METHODS.....	15
3.2	Main recommendations related to the purpose of the qualification strategy in the food industry and in food-related sectors.....	16
3.2.1	The qualification strategy in the food industry .....	16
3.2.2	Hybridization and qualification strategies for the food-related sectors .....	16
3.2.3	The necessary dialogue with FDE, ESCO, ECCP, CEDEFOP, EACEA and the EU.....	16
4	INPUTS FROM THE ASKFOOD PROJECT: next steps .....	17
	The ASKFOOD project is aimed to:.....	17

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## 1 Introduction

The ASKFOOD ERASMUS+ Knowledge Alliance is a joint endeavour, involving 11 partners from 8 European countries, and addresses the best way to invest on training schemes and new interactions between universities and businesses in the food sector, so to:

- (1) create a solid base for the up-/re-skilling of food professionals;
- (2) define proper instructional and educational paths for new entrants in the industry;
- (3) implement an Open-/Shared-/Co-created- Knowledge Model in the food sector that can foster entrepreneurship and can drive innovation and competitiveness in the entire enlarged food ecosystem.

The aims of the initial activities put in place for the project start-up (**WP 1. ASKFOOD Smart Atlas: emerging Skills and Skill Needs, Trends and Demand**) are:

- (1) To generate interactive repository of the emerging profiles and emerging skills linked to present needs and future trends in the food industry and in food-related sectors (e.g. tourism, circular economy, nanomaterials, entertainment, health and wellness, textile and apparel);
- (2) To guarantee an effective matching between demand and offer of knowledge in the food sectors, based on the anticipation of disruptive mega and micro trends that will affect skill demand and training needs, in order to set up a future/forward-looking knowledge basis for the development and the delivery of effective learner-led and learner-centric academic and CDP training offer.

This report gives a quick snapshot of the main results and findings of WP1 and the related recommendations to the Consortium, in a way that especially WP 3 (ASKFOOD Innovative Training Package) and WP 4 (ASKFOOD Reversed Incubator) may rely on them.

Two preliminary steps are necessary in order to get the right point of view on this Report:

- (1) The overall sequence of activities carried out (with the innovative aspects and approaches that required extra implementation efforts)
- (2) The methodological assumptions that inspired the design and the implementation of WP1.

After these steps, the Report focuses on Findings and Recommendations and it is articulated in three Chapters:

- **Results and main findings on trends**, existing practices and potential drivers for Skills and Capacity building, updating and scaling-up
- **Recommendations on the future of training in the food sector** and the purpose of the qualification strategy in the food and food-related sectors
- **Recommended approaches** to manage the delivery of effective training offer and inputs for the ASKFOOD project's next steps.

A preliminary version of these results has been presented and disseminated at the 5<sup>th</sup> ISEKI Food Conference (Stuttgart, July 2018).

## 1.1 The overall sequence of activities carried out in WP1

The following activities have been carried out in ASKFOOD to support WP1:

### - Forecast Aggregator:

- a. open call for evidence, documents related to trends and scenarios in the food-related sectors;
- b. Discussion and approval of the TEMPEST model that includes eight areas/disciplines relevant for the skill trends identification and forecast;
- c. discussion on skills and trends and new professions within the project meetings and/or by emails exchange of documents;
- d. preparation of summaries and their approval for the virtual tool setting.

### - Interactive Training Gap Identifier:

- a. identification and analysis of the main career paths in the food sector
- b. analysis of the ESCO database
- c. discussion and approval of the documents and career maps for the virtual tool setting

### - Smart Atlas:

- a. Discussion about the main aims of the open repository
- b. Open call for collection of resources that fit the aims of the Smart Atlas.
- c. Approval of resources to be used for the virtual tool setting

Activities run in parallel; all ASKFOOD partners were involved, including some associated partners.

## 1.2 The methodological assumptions behind the implementation model

There is a main need for a transformational change in the way we usually approach job creation and investments on skills in the next future is linked to disruption in normal backgrounds, that usually are considered to define skills need and related training and learning schemes. This is especially true when we consider Food & Drink industries and food-related industries.

The ASKFOOD Knowledge Alliance is focusing both on Food and Drink Industry as well as on the ensemble of the economic sectors that depend on and are affected by the evolution of the Food Industry in the strict sense. As an example, the tourism industry has a growing demand trend for wine and food tourism, that is relevant for the 68% of global tourism operators (UNWTO, 2015). Nanotech and nanoscience industries consider applications in food ones of the still less exploited, but among the ones with the highest market potential (Cfr. Patel et al., *Application of Nanotechnology in the Food Industry: Present Status and Future Prospects*, 2018). Changes in logistics related to F&D distribution, safety and consumption styles are huge (Deloitte, *Logistics in the Food industry. A vision on 2020*, 2018).

Globally the food supply and manufacturing system is changing at incredible speed, and the food and food-related industries are evolving at the same pace under a “turbulent” and competitive environment. Changes happen quicker and reacting to them requires a constant anticipation of the technology and of the market and adequate skills how to use properly the entire potential competitive advantages of the companies.

Skill shortages and skill mismatch are major concerns for EU policymakers, as they require to adopt a different mindset for tackling investments on skills and jobs, focused on sustainable activation, continuous learning, job-task reengineering and promotion of higher-end product market/managerial practices. The difference

with the past is that - in such an environment that is quicker, more multidirectional, resulting from different factors and more difficult to foresee – usual approach to invest on skills is no longer effective.

In parallel a job revolution is going on, with a lot of uncertainty to be managed and this makes difficult and hard to predict what our working futures hold, as technological advances, an ageing workforce and the rise of the sharing economy cause new jobs to appear as fast as others vanish.

According to CEDEFOP<sup>1</sup>, with mass job destruction and sectoral restructuring following the recent economic crisis, *“four in 10 EU employers had difficulty finding people with the right skills, while unemployment rates peaked”*. Rapid digitalization and technological skills obsolescence have also raised concerns about the extent to which the EU workforce is adequately prepared for the fourth industrial revolution. Yet, *“despite worries of increasing skill shortages and gaps, about 39% of adult EU employees are over skilled and trapped in low quality jobs.”*

The EU food and drink industry is the largest manufacturing sector in the EU (€1,098 billion turnover, 2018) and one of the leading employers in the EU (4.24 million people employment and 289.000 companies). External trade counts for €102 billion per year (17,3% of the EU share of global exports) even if sales within the single market are still 90% of food and drink turnover<sup>2</sup>. The scale of the challenge for the food and food-related industries in fending off traditional career paths in food and food-related industries has now become much clearer, if no less daunting.

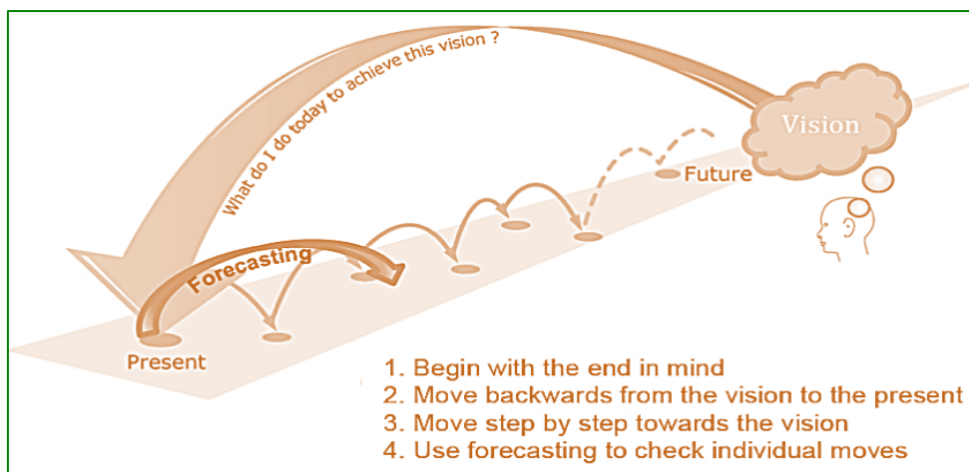
The ASKFOOD Project is investing in a coordinate creation of tools to support an open discussion on emerging, missing and future skills that the food and food-related industries will require. The first part of the project implementation (WP1) originated a combined ***Smart Atlas of emerging Skills Needs, Trends and Demand*** that is intended as a permanent support to immersive sessions among the key stakeholders to analyze future micro- and mega-trends that will act as powerbrokers for the skills and the jobs in the F&D industry, as well as in food-components that are emerging in different industries (i.e. tourism, health & life science, edutainment, logistics, nanoscience).

The first tool of the Atlas is the ***Forecast Aggregator*** that is intended as a knowledge aggregator that simplifies and integrates inputs from different scenarios, all of them Open Source, complex or interconnected to generate a concrete support for the analysis and the decisions about the emerging core skill set for the future of the food-related sectors. The methodology applied is based on **back-casting**<sup>3</sup> (**Figure 1**).

<sup>1</sup> CEDEFOP, *Insights into skill shortages and skill mismatch*, 2018. <http://www.cedefop.europa.eu/en/publications-and-resources/publications/3075>.

<sup>2</sup> Source: FDE, *Implementing the EU Food and Drink Industry's Ambition for Growth and Jobs*, 2016, [https://www.fooddrinkeurope.eu/uploads/publications\\_documents/Competitive\\_food\\_industry\\_growth\\_jobs\\_report.pdf](https://www.fooddrinkeurope.eu/uploads/publications_documents/Competitive_food_industry_growth_jobs_report.pdf).

<sup>3</sup> The term "Back casting" was coined by Robinson [Robinson,1982] as a futures method to develop normative scenarios and explore their feasibility and implications. It became important in the sustainability arena for obvious reasons and is often used as a tool to connect desirable long- term future scenarios (50 years) to the present situation by means of a participatory process. After creating a vision of a desirable future, alternative solutions are set out, with the participation of important stakeholders. Those alternative solutions are explored, and bottlenecks identified. With the involvement of the stakeholders, an option is chosen, and an action plan set up. The stakeholders then define their roles and commit to them. Back-casting is used in complex situations with many stakeholders where although there is a desired future vision, it is unclear how to reach it. It leads to research plans for implementation of the actions needed and participation is an essential feature. It can be characterized as a social learning process and the long-term perspective makes it possible to let go of the present way of meeting certain specific social needs. The method is used in situations where



**Figure 1. Backcasting as a method to support a normative strategy for skills investing in the food sector**

Back-casting is a planning method that starts with defining a desirable future and then works backwards to identify policies and programs that will connect that specified future to the present. As regards the skills, a forecasting approach has been used, predicting the future skills, jobs and competences needed in the future based on current trend analysis. The two methods applied to implement the tool, identified 8 main areas/disciplines that are relevant for the Food Sector and used to develop the **TEMPESTS model** to create a radar, and to track enabling (current) and emerging (future) trends.

The TEMPESTS model (**Figure 3**) is an acronym for technology, economic, market, political, environmental, social, transformation and science. These themes are sub-divided into focal areas, where quantitative indicators/metrics may also be used for comparative analysis. The model provides a conceptual and analytical tool for policymakers, food professionals, students, researchers, training agencies and University, enterprises, citizens and other stakeholders for understanding and evaluating the scale and scope of change adoption and its impacts at national, regional and local levels.

The initial inspiration for the TEMPESTS model in the ASKFOOD project is the model TEMPEST<sup>4</sup>, declined by the World Health Organization to track future scenarios for health technologies in different countries. The original TEMPEST methodology aggregates 84 (coded) quantitative indicators from a wide range of robust datasets (WHO, OECD, World Bank, EU, and others), developed from prior empirical research and secondary source material to provide an unbiased, transparent, and robust approach to isolating key data points(indicators) to drill-down and compare and contrast specific themes and sub-themes at the country and regional units of analysis. The benchmarking of selected indicators contributes to a more generic profile and informed understanding of the current health-technology nexus to provide stakeholders (i.e. policy-makers) with a useful template for evaluating the current and potential health technology landscape. TEMPEST thus identifies the front-runners, followers and laggards in health policy and technology. However, this does not suggest that the laggards should simply replicate the policies and practices of the front-runners,

there is a normative objective and fundamentally uncertain future events that influence these objectives. The knowledge about the system conditions and the underlying social dynamics can also have a powerful impact on the environment but are unpredictable. The need for participation of stakeholders is strong and the future vision cannot be realized by a hierarchical approach, or limited stakeholders. The desired future cannot be achieved by simply extrapolation from the present arrangements but need a fundamental different approach of fulfilling the social need.

<sup>4</sup> Currie, 2012,

[https://www.researchgate.net/publication/271563923\\_TEMPEST\\_An\\_integrative\\_model\\_for\\_health\\_technology\\_assessment](https://www.researchgate.net/publication/271563923_TEMPEST_An_integrative_model_for_health_technology_assessment)



as contextual factors may point to leapfrogging opportunities which require a tailored health technology policy agenda that may not work across all countries.

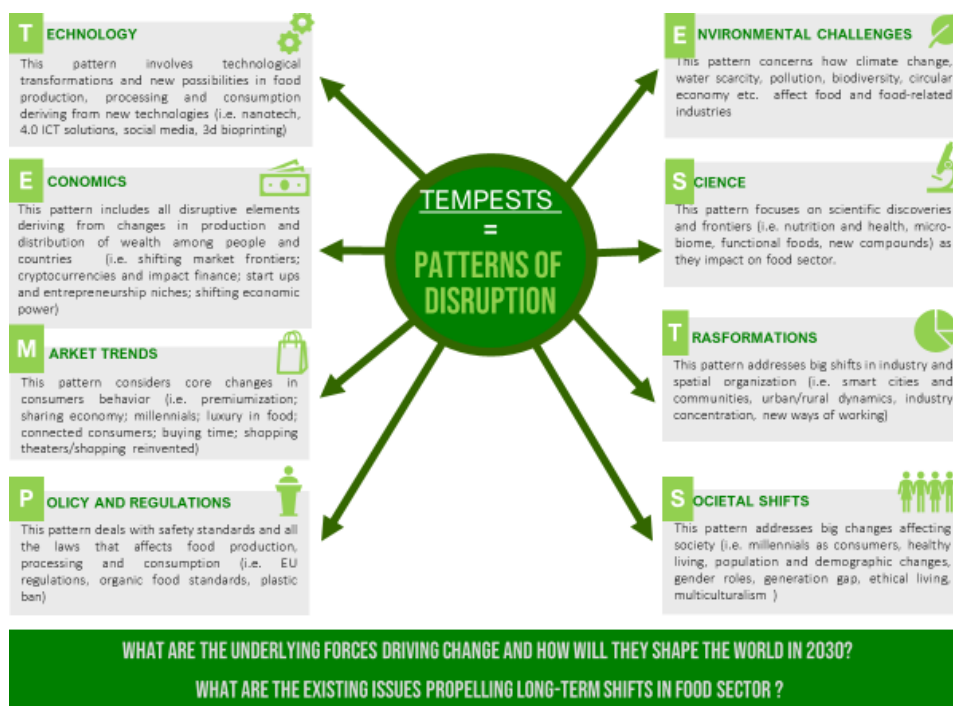


Figure 3. The TEMPESTS Model

The second tool of the Atlas is the **Interactive Training Gap identifier** that is a tool to self-assess skills, so to measure the gap between the existing and the desired skills according to the same job profile or to support personal career path or to measure – at organisational level – skill mismatch and desired skill sets to acquire in order to reach strategic goals for the company and to face properly future challenges.

In order to create the Interactive Training Gap Identifier, three methodological steps were put in place:

- Step 1.** Definition and classification of the skills
- Step 2.** Choice of the approach to connect skill needs and training design
- Step 3.** Map of the jobs and of professional profiles around which structuring the Interactive Training Gap Identifier.

## 2 Results and main findings on trends, existing practices and potential drivers for Skills and Capacity building, updating and scaling-up

### 2.1 The Change Drivers and the TEMPESTS that are shaping trends in the food sector: main results from the Forecast aggregator

#### 2.1.1. TECHNOLOGY: ACCELERATED CONVERGENCE

*The “Transformative Twelve” can deliver significant impacts to food systems by 2030*

The power of technology innovation is helping transform global food systems by helping to face the main issues on safety, quality, stability and enhancing the sustainability of the food chains. Technology is driving



change in the shape of demand (e.g. alternative raw materials and proteins; food sensing technology for safety, quality, and traceability; nutrigenetics for personalized nutrition, lab-created foods), processing, preparation, and distribution. Technology is also promoting value-chain links (e.g. mobile service delivery; big data and advanced analytics; ICT for real-time supply-chain; blockchain-enabled traceability), and it is creating more effective production and delivery systems (precision agriculture; gene-editing for multi-trait seed improvements; microbiome technologies to enhance resilience; off-grid renewable energy generation and storage; advanced robotics, Artificial Intelligence, and 3D-printing). The GRIN (Genetic, Robotic, Information and Nano-processes) technologies are one of the models that are expected will have an impact on the entire socio-economic globalization context. These trends are all based on a combination of the 4IR (Fourth Industrial Revolution or Industry 4.0) technologies that can enable innovation and solve the challenges faced in food systems.

## TRENDS

- New Technologies for Food Processing
- Plant and Animal Genomics and Related Technologies
- Human, Animal and Soil Microbiota
- Digital Technologies
- Nanotechnology

### 2.1.2. ECONOMY: REIMAGINING MONEY, POWER BALANCE AND OWNERSHIP

*Dramatic economic shifts are rearticulating the economic models (and the systems behind them)*

Trade threats, leasing and sharing instead of owning, cryptocurrencies, alternative securitization, globalization and the 4IR (Fourth Industrial Revolution) are modifying in a non-reversible way the meaning of food economy itself.

The Maker Economy and the Instant Entrepreneurship are democratizing food production, processing, and design. Prices of food and trade threats are used as a power weapon to address globalisation and the crisis of the middle class. Money and ownership are turning virtual, even if they are more real than ever as a hot topic for food security and food quality. The convenience format that allows the balance between demand and offer is shifting and introducing a new frame for traditional economics and economy models in the food industry.

Financial literacy is widening models and requires new skills and talents to make to food consumption proactive and the food entrepreneurs more powerful and competitive.

## TRENDS

- Price volatility and Land grabbing
- New currencies and alternative finance and to invest on food
- Shift in global economy power
- Start-up and Instant entrepreneurship
- Sharing economy for the next Industrial revolution

### 2.1.3. MARKET: A NEW CIVIC DISCOURSE

*Market and consumption trends are rearticulating the identity of consumers and communities in a global society.*

The future of food is undoubtedly changing, but while many of us have dabbled in UberEATS<sup>8</sup>, few have substituted meals with bottled drinks, or chocolate bars with grasshopper bars. Our established relationship with food may well be what stands in the way of its disruption. So, can we disrupt

in a way that allows us to keep our relationship with food? For example, the social aspects of eating are sustenance for another

part of our human needs — can they be bundled and commoditized too? Perhaps they can — the Nourished Project has explored using virtual reality to make users believe they are eating delicious foods.

## **TRENDS**

- Hybrid consumers
- Globalisation
- Healthy diets?
- Informant prosumers

### **2.1.4. POLICY AND REGULATORY FRAMEWORK: POLICIES THAT MATTER**

Self-regulation v/s bundled food policy will drive the future of the food regulatory cascade.

The main challenges in the food systems are asking for related policy options. On the other side, policy and regulation can inspire, orient, prioritize changes in the future of food and food-related issues. Various are the policy options that can help the food players to better address future challenges whether you consider the “Global-” or the “Pharma-” Food” scenarios, or if you consider the “Regional Food” or the “Partnership Food” scenarios (see the latest JRC Study for the EU Parliament). Emerging arguments will be dealing with how, in the future, the regulatory food framework will decline pairs of divergent trends:

- a) self-regulation vs. common standards to address the maker economy, globalization and international trade and mobility;
- b) sector-specific vs. bundled or integrated policy, i.e. when considering diet and health or start-up flexibility and related easy procedures or standards to market functional foods.

The intersection of the three usual regulatory drivers (i.e. fiscal pressure, relevance to public health and environment) leaves the food sector more exposed to significant changes in future regulation in a sort of “regulatory cascade” that will accelerate complexity and address main core aspects of the future food (product content; product labelling; on-packaging health warning; POS Information; advertising restriction; sale and possession; point of consumption; product taxes).

## **TRENDS**

- Food ethics and security will push multi-level governance forwards
- New skills for new jobs
- Predictive protection and adaptive regulation
- A new model for a new social compact
- Glanceable regulatory content

### **2.1.5. ENVIRONMENT: ENVIRONMENTAL EATING**

Environment is one of the main paradigms of the economy and society; it contributes to defining the overall scenario inside which all the other forces and drivers operate affecting the food system.

“Tell me what you eat, and I will tell you how you are, how you will be, and how the environment that surrounds you is”. Simplified into a slogan, this is basically the message of the Double Pyramid of Food and Environmental Impact developed by the Barilla Centre for Food & Nutrition (BCFN): a graphical representation which synthetically translates the complexity of the data derived from latest scientific studies on the nutritional value and the environmental impact of individual foods, to promote a diet that is sustainable for the individual and the ecosystem.

Natural resources are progressively decreasing due to population growth and new consumption models while scientific evidence from USDA (United States Department of Agriculture) highlight that the nutritional value of products from the primary production is lower than the 50's due to intensive farming (monoculture) and breeding models along the depletion of nutrients in the soil.

Factors that are highly affecting our environment and the trends in the consumption of non-renewable resources include among others the climate change, the serious water stress, the predominance of fossil fuel-produced electricity thereby the biodiversity is under serious risk.

In the agrifood sector additional aspects that are affecting the resources availability like the loss/waste of resources (eg. use of resources for biofuel production, the underutilized waste from food processing), the impact of water consumption and the damage of CO<sub>2</sub> emitted in the environment due to food processing. Increasingly important is the concept of “environmental sustainability” referred to the ability to maintain the quality and reproducibility of natural resources and the search for sustainable agricultural and food processing paradigms are of the great challenges for the next twenty years.

#### TRENDS

- Sustainability against climate change
- Food landscape and origin as a growing asset
- A “reinventing plastic” future
- Alternative proteins and insects to eat
- New blue and green challenges in the food – and food-related industry.

#### 2.1.6 SCIENCE: FOODOMICS AND FOOD GENETICS

*“Bioactive compounds” are compounds that occur in nature, as part of the food chain, that have the ability to interact with one or more components of the living tissue by showing an effect on human health.*

Food science is moving towards the so-called “genetic revolution” and focuses on bioactive compounds and genetics. The diversity of bioactive compounds derives from the infinite combinations of fundamental functional groups. The potential of each food matrix come from the combined and concerted action of nutrient components and biologically active compounds, i.e. polyphenols, carotenoids, lignans, glucosinolates, terpenoids, limonoids, phytosterols, etc., that can lead into a wide spectra of biological and physiological functions. Dietary components have beneficial roles beyond basic nutrition, leading to the advancement of the concept and perception of food as functional and nutraceutical. New potentials/features of nutrients should be considered, both qualitatively and quantitatively.

Since the content of nutrient and bioactive components could be significantly affected by numerous factors, i.e. the variety, season, location, ripening, growing conditions, technological and domestic processes; the wide range of factors is continuously increasing and enlarging in line with the new connotations of food chain, and directly links to food genetics and CRISPS. In parallel, this widens the potential impact of Open Science and Responsible Research and Innovation (RRI) and ask for jobs and skills not yet enough explored nor available.

#### TRENDS

- Food as Medicine (personalised nutrition, nutrigenomics, etc..)
- Health, Wellbeing and Pleasure
- Sustainability and security (GMOs, crops resistant to adverse climate conditions, organic production)
- Applied biosciences for the future (biotechnology, biosensors, bioengineering, bioinformatics....)
- Open Science

#### 2.1.7 TRANSFORMATIVE INDUSTRY: AMPLIFIED INTERSECTIONS

*Different mixtures are changing the way to think about the food sector: it's a new game-set, a different web altering the usual ways we consider the value chains.*

Trends are “profits waiting to happen”, as Chris Sanderson from the Future Laboratory uses to say. In the business world, “transformational change” involves a company making a radical change in its business model, often requiring changes in company structure, culture and management. “Transformational industry” means that, over the next two decades, the traditional food value chains (agriculture and stewardship; manufacturing and branding; distribution and logistics; retail and information; consumption and taste; disposal and renewal) will be reshaped by a totally new set of complex relationships, that is re-arranging the value-chains from efficiency to flexibility and include more and more daily and disruptive intersections with other industries.

## **TRENDS**

- Hybridisation
- Blockchain-based networks and trust
- Remixing standardization
- Retail and knowledge theatres
- Disruptive logistics

### **2.1.8. SOCIAL DYNAMICS: ARTIFICIAL OVERTARGETING**

*Lured by the promise of big data, organisations tend segment audiences too narrowly and unintentionally end up abandoning large groups.*

Both in politics and in market strategies, a global shift going towards individualism/tribes/groups is emerging, and it crosses age, ethnic, and social groups worldwide. It's one of the aspects that refers to increasing thoughtful and mindful consumers and citizens who take care and, increasingly, action as well.

Demographic changes are opening new frontiers for pressure and opportunities in the food sector. The Silver Economy and ageing of population will be a sort of new “Gold Mine” for food. Millennials and Gen Z, on the other side, open up the market to new talents and to an extended (by physical and technological networks) human capacity that is modifying innovation, social ties and creating different platforms for citizenship and for identity in a global society. An extremely visible and accessible world demands new sense making and explores a completely new dimension about the use of social innovation and data can enhance food-related decisions rather than automate them.

## **TRENDS**

- Ageing population
- Collaborative society
- Virtual nets and connected individualism
- Robotization and digitalization
- Social crisis and societal divide

## **2.2 The Interactive Training Gap identifier: the tool to support skills gaps for a successful professional career**

A complete description of the methodology is reported in D1.2.

Due to the main relevance, the career maps of professions food manufacturing, food service and food researchers have been selected. For the specific purpose only the positions and roles covered by graduates and post-graduates were considered, excluding all those covered by individuals with Secondary school degrees or coming from VET school careers.

For each career path and role, the current and future main sector-specific, non-sectors specific and personal skills have been identified. From the Forecast aggregator trends and signals, new professions and future skills have been also included. To avoid overlapping, for each career path the list of the ESCO professions already classified by ESCO have been added professions.

Tools to self-assess skills gaps by trainer providers, enterprises have been included.

The tool could represent a model applicable also in other sectors; meanwhile it offers the opportunity for future widening in other food-related sectors.

## 2.3 The SMART Atlas: the tool to support skills gaps for a successful professional career

The Smart Atlas is an Open Repository that capitalizes and re-uses materials that can be taken as an inspiration or as a self-training tool to increase Personal Knowledge, but it is also planned as a solution to increase Shared Knowledge and Knowledge Sharing in the Food Industry.

This Atlas was built based on 8 different types of resources: 1) MOOC; 2) Training Centres; 3) EU Project Results; 4) Research Centres; 5) Acceleration Programmes; 6) Crowdfunding/Crowdsourcing Platforms; 7) Start-ups; 8) Innovation Marketplace.

Overall, this tool could be used from different perspectives: as trainer, it could represent an innovative repository of knowledge opportunities and materials to be used to deliver concepts related to innovation in the food-related sectors, while as trainee or learner, various and diversified resources could be used to deepen aspects related to innovation and get acquainted about entrepreneurship opportunities relevant for their student and professional career.

## 3 Recommendations on the future of training in the food sector and the purpose of the qualification strategy in the food and food-related sectors

### 3.1 Main recommendations related to the future of training in the food sector

Considering all the contents included in the three virtual tools the following recommendations on the future of training in the food sector and the purpose of the qualification strategy in the food and food-related sectors

#### 3.1.1 TRAINING CONTENTS:

a. **Food-related disciplines.** New areas of education and training in academia and VET should consider the following trends:

- the widening of the food supply chains
- the increased complexity of the food system (economic, policy, social, industry)
- the advancements in science and technology as well as in Artificial Intelligence and digitalisation
- the need to provide concepts considering sustainability and innovation.
- These aspects imply the need to include new food-related disciplines and knowledge with priority given to:
  - consumer science,

- food law,
- food system,
- agro-food-business,
- bioinformatics,
- “omics” (metagenomics, proteomic),
- digitalisation,
- data science management (e.g. big data, blockchain approaches),
- new product design and development,
- innovative food processes and packaging,
- bio preservation,
- sensing and biosensors.

Additional aspects also include ethics and responsible research.

b. **Entrepreneurship.** The main relevance given to innovation and to innovative enterprises require to implement courses and modules and/or training approaches (either as independent training initiatives or as embedded in other courses) aimed to provide entrepreneurial skills.

c. **Personal and professional skills.** These skills are becoming more important when entering in the job market and/or applying for specific roles and positions and career upgrade. Main emphasis must be given to:

- Communication
- critical thinking
- team working
- problem solving
- project management

which are the most important ones and that that are becoming important in the job market. Active teaching methodologies have to be applied to allow learner both to study and to experience innovative disruptive environment where personal skills can be exploited.

### **3.1.2 TRAINING AGENTS AND ENVIRONMENTS**

Besides the conventional academia and HE training providers, new training environments need to be explored. Multisector and multidisciplinary environments involving actors and representatives of the different stakeholders of the food supply chains could offer to learners and trainees a stimulating environment, which can offer interactions with the future professional world. Interactions with other food-related sectors (e.g. social and political sciences, tourism, biotechnologies, nanotechnologies, material science) can contribute to enlarge the landscape of knowledge of the future food professionals and increase their capabilities to manage the main challenges of the food system and its increasing complexity.

The development and co-design of educational and training paths and programs between academia and industry and business, by matching academic knowledge, professional experience, and skills needs must be promoted.

Open-source platforms should be made available for HE and training providers as well as business interested to develop training with tools and materials that could be used for qualification, professional development, upgrade and upskill of practitioners and professionals at all levels.

### 3.1.3 TRAINING METHODS

New and disruptive educational and training methods need to be applied to respond to the diversified request of new skills in the food-related sectors as well as those of the future and unknown related professions. Conventional and passive methodologies and study programs paths do not allow to achieve the professional skills that satisfy the demand of the current job market as too much focused on “hard skills” and technical knowledge and limit the active participation of the new i- or z-generations of students. Problem-based learning, contest-based learning approaches need to be promoted and developed in multisector environments (e.g. academia, industry, etc.).

New trends in professional development and qualifications are progressively moving from the traditional study programs and degree concepts to the certification of skills and competences as also promoted by the European approach to **micro-credentials** that is expected to open learning opportunities to citizens and strengthen the role of higher education and vocational education and training institutions in lifelong learning.

Moreover, mobile and social learning along with “personalised” learning approaches are new educational approaches that could further help learners to learn and to apply this learning and the modern skills acquired into real working environments under easy and informal frameworks.

**Digitalisation** of the **educational methods** are currently leading to blended of fully online courses and programs and this also could increase learning opportunities and performances. Moreover, microlearning, gamification, video-based learning (videos and interactive videos), mobile apps for learning are new and innovative educational and training approaches and tools that are of growing interest especially in the development of professional competences with a higher engagement quotient and training impact.

**Digital technology** is expected to lead the modernisation of education and training with disruptive Higher Education and training applications. Virtual Reality, Augmented Reality, Artificial intelligence, and cooperative platform will revolutionize the learning methodologies and offer innovative tools to develop skills and competences, as well as knowledge transfer while keeping the education contents and the student experience. They will also influence student attraction and student retention.

Disruptive approaches are also needed to sort out the mismatch of skills between the of HE graduates and the job market with main reference to food- and food-related enterprises and business. Internships of students during their study program could be not enough to provide them professional skills and those required to promote innovation and/or to start new business.

**Entrepreneurship and innovation** are complementary in promoting economic and societal growth along with sustainability in today’s dynamic and changing food system.

In the last years some entrepreneurial training approaches have been developed at various levels also in the food-related sectors that in general are aimed to support mainly the development of the business ideas, while do not guarantee that of the skills and competences required to guarantee the sustainability and success of the new enterprise or start-up. Reverse incubator approaches in industry-focused and challenge-driven training, to flip-flop the typical mentoring relationship could be a disruptive methodology that could also favour the interplay between academia and industry/business and the development of new collaborative and open platforms for promoting innovation both in Higher education and in the food-related sectors. Eventually “reversed mentoring” training approaches as an industry-focused training are aimed to flip-flop the typical mentoring relationship between tutor/mentor in the company/factory/business and the



student (or trainee) in general). Rather than an experienced employee taking an inexperienced colleague under his or her wing, the inexperienced employee (i.e. the university student) acts as the mentor who provides insights into emerging technology and trends or, simply, a younger perspective, both of which may be valuable to the company.

### **3.2 Main recommendations related to the purpose of the qualification strategy in the food industry and in food-related sectors**

#### **3.2.1 *The qualification strategy in the food industry***

Food- and food related industry need to develop a specific strategy to qualify and highlight its role in the food system. This has to take into account:

- identification of the main scenarios and trends that are and will in the future affect the food production value chains and contribute to an increasing complexity of the food system.
- qualification of the workforce, by hiring graduates with the skills and competences able to match the growing complexity of the food systems and the current and future challenges.
- promotion of innovation by providing adequate tools to favour entrepreneurship especially among the young generation of professionals and graduates.

#### **3.2.2 *Hybridization and qualification strategies for the food-related sectors***

The food manufacturing sector is continuously growing in its complexity in the attempt to promote a sustainability and innovative food system. This implies a widening of the interactions with other food-related sectors that are currently gaining value thanks to the relative importance that food has in our life, culture and society. Modernisation, science and technology advancements are also promoting the need to interplay with disciplines and areas of the knowledge that were not considered as “food-related” until few years ago, like nanotechnology, physics or (soft) material science. Hybridisation, interdisciplinary and intercultural approaches are thus a key element to promote modernisation of the food sector and its qualification also by the identification of new ecosystems of collaboration and projects development.

#### **3.2.3 *The necessary dialogue with FDE, ESCO, ECCP, CEDEFOP, EACEA and the EU***

A dialog is necessary to be developed within a modern food eco-system with all the actors, stakeholders and policymakers’ representatives to promote innovation and sustainability of the food system focused in promoting the role of a modern higher education and training to guarantee a workforce of professionals and competent experts with the adequate skills and competences.

A knowledge-based food production, complemented with a skilled, upgraded and competent workforce will be able to lead the future European food production. The collaboration, within EU sponsored programs and frameworks could contribute to support, without overlapping, initiatives targeted to promote the modernization, economic growth and wellbeing societal as well as a sustainable and innovative food system.

#### 4 INPUTS FROM THE ASKFOOD PROJECT: next steps

The ASKFOOD project is aimed to:

- Co-design, pilot and implement disruptive entrepreneurial training methods like the Reversed Incubator and evaluate Garage-labs approaches
- Promote the development of innovative and disruptive training tools based (e.g. virtual reality) and innovative education methodologies and approaches (blended learning, problem- or challenge-based)
- Establish a Joint Platform (**ASKFOOD Innovative Training Hub**) to share, test and apply disruptive training solutions, collecting inputs, contents and supports from academia, industry, and other key stakeholders in the food-related sectors. The Platform will be **based on an “hub and spoke” model**
- Set a Permanent Observatory on skills and competences in the food-related sectors