Deliverable 6.1

CATALOGUE ON ANALYSIS OF CONTENTS, FORMATS AND NEEDS FOR TRAININGS

Work package number and title:	WP6
Lead-beneficiary:	Ecsite
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DISCLAIMER: This deliverable presents a mapping based on reflection that had taken place until the end of October 2018. As visioning on the kind of skills, abilities and qualifications needed for 'new' Food and Nutrition Systems takes place in the City Labs (November 2018 – February 2019), this deliverable will need to be updated accordingly. Therefore, it can be considered a work-in-progress. A more comprehensive reflection on needs, including an updated version of D6.1, will be available with D6.3 (Toolkit for use of educational modules).

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Document History and Information

Version	Date	Description and comments	Author
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Feedback by Reviewer 2	19 November 2018	The deliverable was found to address the project objectives and be technically sound. Nevertheless, some format revisions and concept clarifications, taking into account the perspective of a novel reader, were considered necessary.	Jonas Lazaro Mojica (F4L) on behalf of WP4
Second draft	22 November 2018	Formatting and concept clarifications raised by Reviewer 2 were addressed.	Cristina Paca & Carmen Fenollosa on behalf of WP6
Feedback by Reviewer 1	28 November 2018	Two suggestions: - Start more clearly from FIT4FOOD2030 objectives and needs that arise from there - Move synthesis chapter (4) forward.	WP1 – VU – Barbara Regeer
Final draft	30 November 2018	Clarifications and concerns raised by Reviewer 1 were addressed	Cristina Paca & Carmen Fenollosa on behalf of WP6

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1. Introduction

1.1 FIT4FOOD2030 project and its competence-building objectives

FIT4FOOD2030 supports the urgently needed transformation of Research and Innovation (R&I) on Food and Nutrition Security (FNS) in Europe. To achieve that, FIT4FOOD2030 will create a sustainable, multi-stakeholder platform, mobilizing a wide variety of stakeholders at the level of cities, regions, countries, and Europe wide. Known as the FOOD 2030 Platform, this network will make R&I policies on FNS more coherent, build competences of current and future researchers, entrepreneurs, policy-makers and society at large, and raise awareness around FOOD 2030.

The three inter-linked structures of the FOOD 2030 Platform are:

- EU Think Tank: the link between the EC and Member States & Associated Countries, with a global outreach;
- Policy Labs to increase and align public/private R&I policies/programs on FNS, building on and expanding existing national/regional networks; and
- City Labs to develop/pilot action-oriented trainings for students, consumers, researchers and professionals linking Science Centers/Science Shops to networks of the Milan Urban Food Policy Pact cities.

Education is a crucial element for this transformation. Via the structure of the City Labs, WP6's key objective is to deliver a set of transformative, hands-on future-oriented trainings on food system Responsible Research and Innovation (RRI) and R&I for primary, secondary and university-level students as well as professionals such as entrepreneurs and social agents.

The City Labs will develop a combined total of 18 educational modules. Each lab will take into consideration their area of expertise and the vision of future-proof food systems developed in their City Lab in order to select the target audience and educational level, the learning approach (deep learning or light learning), the topic (connected with the FOOD 2030 Research & Innovation priorities) and the specific competences addressed by the educational modules they develop. In order to cater to this diversity, the deliverable will deliberately take a broad approach.

1.2 Purpose of the deliverable

The objective of this deliverable is to provide good practices, inspiration and food for thought to the City Lab coordinators during the development of their own educational modules. The main result is a cluster of the competences on the needs that the educational modules should ideally respond to. It starts from the competences identified by the Policy framework FOOD 2030, to move to the FIT4FOOD2030 partners understanding of them and includes key competences for a responsible Research and innovation. In addition to that, it catalogues 40 content sources, formats and activities that can be used as stimulation to the City Labs when co-creating the educational modules with diverse groups of stakeholders.

The deliverable has been compiled based on desk research of the EU landscape and input from the project partners and City Lab coordinators.

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2. Mapping of needs

2.1 Introduction

This section aims to provide a non-exhaustive yet comprehensive statement of thinking around educational needs within the FOOD 2030 and FIT4FOOD2030 project. What the project understands as needs are the competences required by the next generation of professionals, including researchers, policy makers, entrepreneurs but also students that will take part in the food system.

This mapping starts with a reflection around the project operationalisation of the needs identified by the FOOD 2030 policy framework. The external sources cited later have been chosen for their educational relevance to the framework needs out of a wish to align our thinking with key international benchmarks.

The European Commission describes FOOD 2030 as *'a timely EU research and innovation policy response to the recent international policy developments including the SDGs [Sustainable development goals] and COP21 commitments'*[1]. Therefore understanding the competences linked to the SGDs should be taken into account when developing the educational modules as well.

Additionally, the World Economic Forum's system initiative on Shaping the Future of Education, Gender and Work through engagement with business, government, civil society and others[2] to educate and empower citizens and unlock potential aligns very much with the fourth pillar of the FOOD 2030 framework[3]. The deliverable also cites the Organisation for Economic Co-operation and Development's (OECD) work on education and skills acknowledging its role as a key source of data and information for the field. Their indicators developed through the Programme for International Student Assessment (PISA) are the trusted source for information regarding the state of education in the different member countries and the go-to source for policy makers. Additionally, both initiatives work in a multi-stakeholder approach and are mindful of the perspectives of stakeholders that are more difficult to reach at the City Lab-level, such as business and industry.

Attention was paid to projects identified at the project proposal stage as important Responsible Research and Innovation (RRI), communication and education activities upon whose achievements the City Labs could build (e.g. EnRRICH and RRI Tools among others)[4], initiatives to which project consortium members are linked (e.g. PlayDecide) and projects highlighted as success stories (e.g.

[1] European Commission. FOOD 2030 research area page. Access: http://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=food2030

[2] World Economic Forum. Shaping the Future of Education, Gender and Work. Access: https://www.weforum.org/system-initiatives/shaping-the-future-of-education-gender-and-work

[3] The FOOD 2030 policy framework fourth pillar is INNOVATION and empowerment of communities: boosting innovation and investment, while empowering communities; a broad innovation ecosystem leading to new business models and value-added products, goods and services, meeting the needs, values and expectations of society in a responsible and ethical way; more and better jobs across the EU, fostering thriving urban, rural and coastal economies and communities; through closer partnerships with industry and food producers, markets that function in a responsible manner thereby fostering fair trade and pricing, inclusiveness and sustainability; scientific evidence and knowledge from a wide diversity of actors underpinning the development and implementation of FNS relevant policies, at all geographical scales (Local to Global). http://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=food2030

[4] FIT4FOOD2030 consortium. FIT4FOOD2030 proposal, p. 16.

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Hypatia project)[5] in the framework of 'Science with and for Society' strand of funding of the European Union's Research and Innovation programme Horizon2020. Resources developed in these projects are the subject of several textboxes throughout the deliverable.

Finally, insights from the FIT4FOOD2030 proposal, research and consultation with project partners and the City Labs, and results from the City Labs' work carried out with stakeholders thus far complete this deliverable. This deliverable will be revised over the course of the project to include new perspectives brought in by the different City Labs as their work advances.

2.2 The FIT4FOOD2030 and FOOD 2030 approaches

Based on the FOOD 2030 policy framework, the FIT4FOOD2030 project identified the need for a food system and RRI approach to Research and Innovation. In turn, this requires new competences such as skills to **work in collaboration with different stakeholders**, do **foresight analysis**, balance between risks and benefits through **technology assessment processes**, reflect on **alternative approaches** to the problem with other actors, and also integrate **knowledge on ethical, legal and social aspects**.

The means to deliver these new competences will be a set of **transformative**, hands-on **future-oriented trainings** on food system (R) R&I for primary, secondary and university-level students as well as professionals. In this context, Responsible Research and Innovation principles will be embedded both in the activities' design process and the activities themselves to foster **multi-stakeholder engagement**, **critical thinking**, **collaborative learning skills** and **transdisciplinary approaches** to food **systems learning**. Particular attention will be paid to initiatives making use of **STEAM**.

Key elements of the FIT4FOOD2030 approach will be analysed in turn.

- *Responsible Research and Innovation (RRI)*

The principles of Responsible Research and Innovation (RRI) emphasise the development of mutual **responsiveness** and shared **responsibility** among **diverse stakeholders** in the pursuit of Research and Innovation that addresses the grand challenges facing our societies.

More precisely, the EU-funded project RRI Tools proposes the following working definition: 'Responsible Research and Innovation is a dynamic, iterative process by which all stakeholders involved in the R&I practice become mutually responsive and share responsibility regarding both the outcomes and process requirements'[6] (Klaassen et al, p.4). More specifically, actors must feel **empowered** and responsible for **outcomes** that meet societal challenges (i.e. ethically acceptable, sustainable and socially desirable outcomes) and for delivering a Research and Innovation **process**

[5] SiS.Net. 'The Hypatia project: Inspiring teenagers all across Europe in a gender-inclusive way to follow a STEM-related career'. SiS.Net Science with and for Society Success Stories #9. URL: http://www.sisnetwork.eu/media/sisnet/swafs_success_story_hypatia.pdf

[6] Klassen, P.; Kupper, F.; Rijnen, M.; Vermuelen, S.; Broese, J. 2014. D1.1 Policy brief on the state of the art on RRI and a working definition of RRI. RRI Tools project. https://www.rri-tools.eu/documents/10184/107098/RRITools_D1.1-RRIPolicyBrief.pdf/c246dc97-802f-4fe7-a230-2501330ba29b

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that is diverse and inclusive, anticipatory and reflective, open and transparent, and responsive and adaptive to change.

The EnRRICH project, central to the rationale behind FIT4FOOD2030 educational modules deep approach to learning with society and a key initiative identified at the project proposal stage, further builds on this framework to propose an **RRI Competence Framework**[7] heuristic that helps educators (and potentially other competence deliverers) to reflect on competences that contribute to fostering RRI. The competences identified have been mapped onto four 'dimensions' (broadly in line with the process requirements proposed by the RRI Tools project). In the EnRRICH tool for educators, each competency is in turn further described in terms of cognitive (knowledge), psychomotor (skills) and affective learning domains as a further step for implementation.

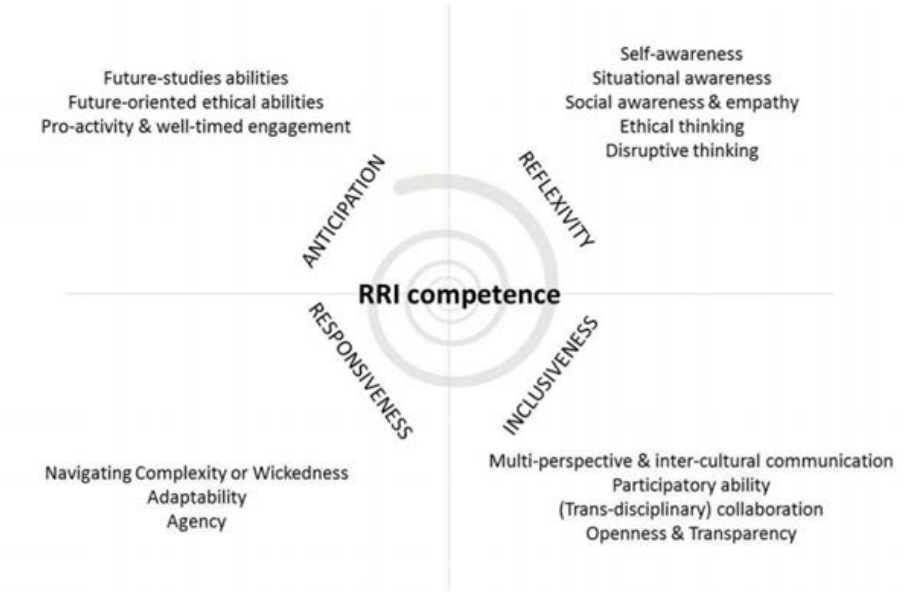

Figure 1. An RRI competence framework. Source: Tassone & Eppink, 2016, p. 16

A key recommendation is to build on existing projects seeking to provide such skills, and thus avoid further fragmentation and duplication of initiatives. Materials from RRI Tools project can serve as a starting basis for future developments: RRI Tools training resources and advice tailored to different target groups: secondary education (reflections and a practical handbook for teachers), higher education institutions (reflections and useful links), science engagement organisations (reflections and useful links), project- and inquiry-based learning in STEM, the co-creation of community-based participatory research and RRI implications for citizen science.

Focus on: Hypatia project and gender inclusiveness as an element of RRI

Theoretical framework: Based on a postmodern feminist viewpoint, the Hypatia framework 'encourage[s] all learners, regardless of their biological sex, to value their own experiences and

[7] Tassone, V. and Eppink, H. 2016. EnRRICH Tool for Educators: (Re-)Designing curricula in higher education from a "Responsible Research and Innovation" perspective. EnRRICH project deliverable. URL: https://www.livingknowledge.org/fileadmin/Dateien-Living-Knowledge/Dokumente_Dateien/EnRRICH/D2.3_The_EnRRICH_Tool_for_Educators.pdf.

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interests, and reflect on their relevance for science learning'. A multi-level framework (individual, interactional, institutional, and societal/cultural) guides inquiries into how conditions and constraints at each levels shape STEM activities in various ways to include (or exclude) various types of learners. The framework gives rise to a set of criteria for the analysis the gender inclusiveness of existing STEM education activities, or for the design new, gender-inclusive activities.

Institutional guidelines: Concrete suggestions for transforming gender inclusion capacity at the institutional level. The guidelines address individual staff members, staff teams, management and external stakeholders, and are based on the basis of the project's experience in the National Hubs.

Gender balance and facilitation guidelines: Advice for facilitators in implementing gender-inclusive activities, acknowledging biases and stereotypes and making sure they are not perpetuated in interactions with participants and stakeholders.

- *Open Science (OSc)*

'Open Science represents an approach to research that is collaborative, transparent, and accessible. A wide range of activities comes under the umbrella of Open Science, including Open Access publishing, Open Data, Open Notebook, Open Peer Review, and Open Education. Also included is citizen science, where non-specialists engage directly in research. Open Science goes hand-in-hand with research integrity, and requires legal and ethical awareness on the part of researchers'.[8]

Open Science is considered a prerequisite for researchers to undertake RRI. Grouped in four larger categories of skills and expertise, the competences for Open Science identified by the European Commission's Working Group on Education and Skills under Open Science are:

- **Open access publishing**: library and research information skills; open publication literacy skills;
- **Data management and open data**: data science skills;
- **Professional research conduct**: research management skills (leadership, management and soft skills; entrepreneurship); legal skills; research integrity and ethics skills; and
- **Acting beyond one's scholarly and disciplinary community, including taking advantage of and fostering citizen science, broadly understood**: including non-academic stakeholders in research design and development processes; involving stakeholders in the collection and analysis of research data; working with citizen science platforms; communication skills.

A key recommendation is to build on existing projects seeking to providing such skills, and thus avoid further fragmentation and duplication of initiatives. The FOSTER project e-learning platform and its Open Science training handbook (2018) and the resources available via OpenAire are particularly relevant.

[8] European Commission. 2017. Providing researchers with the skills and competences they need to practise Open Science. Report of the Working Group on Education and Skills under Open Science. Directorate General Research and Innovation. July. URL: https://ec.europa.eu/research/openscience/pdf/os_skills_wgreport.pdf

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- *Open Innovation*

The fourth pillar of FOOD 2030 is related to innovation and the empowerment of communities, and although it does not make an explicit reference to Open Innovation, the spirit is very much the same. The concept of Open Innovation, which is still evolving, as understood by the European Commission[9] is characterized by:

- 'Combining the power of ideas and knowledge from **different actors** (whether private, public or societal actor) to **co-create** new products and find solutions to societal needs;
- Creating **shared economic and social value**, including a **citizen- and user-centric approach**;
- Capitalising on the implications of trends such as digitalization, mass participation and collaboration.'[10]

A key concern of the educational modules will be to equip future generations of citizens with the competences required to interact in such complex innovation eco-systems where innovation is not the result of a linear flow but rather the outcome of a complex co-creation process.

- *Learning with society*

The educational module development in the FIT4FOOD2030 project is inspired by the EU-funded EnRRICH project and methodologies such as community-based participatory research. For EnRRICH, a key design principle for RRI in higher education is '**education with society**'. When it comes to concretely applying this principle in educational modules, the project distinguishes two pedagogical approaches, a light and a deep approach.

In general terms, the 'deep approach' describes a **real-time** and **real-life** activity where students learn by performing a project that responds to a **real need** and which is implemented **in coordination with actors outside the classroom**[11].

At least 25% of all modules developed by the FIT4FOOD2030 City Labs will follow a deep learning approach.

Focus on: A 'deep approach' case study

Healthy Mind, an activity developed by the Living Lab for Health at IrsiCaixa in the framework of XploreHealth project, is an example of a 'deep approach' module piloted in a Science Shop context. It involved high school pupils as co-researchers working together with Master students/research groups in universities and research centres. The students contributed to defining and conducting each phase of a research project defined by their needs and concerns regarding mental health.

[9] European Commission. 2016. Open Innovation, Open Science, Open to the World – a vision for Europe, p. 11- https://publications.europa.eu/en/publication-detail/-/publication/3213b335-1cbc-11e6-ba9a-01aa75ed71a1
[10] European Commission, 2016, p. 14
[11] EnRRICH project, 2016, p.12-13

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In contrast, a 'light approach' develops similar competences and discusses similar needs and challenges but confines itself to imparting knowledge in a classroom context, with hypothetical projects. The level of engagement of outside actors is less deep, with site visits, excursions or guest lectures being envisaged. Implementation tools highlighted by EnRRICH include **deliberative methods**, **dialogic tools**, **role play** for **collaborative skills** and the design and evaluation of hypothetical projects.

Around 75% of all modules developed by the FIT4FOOD2030 City Labs will take a light learning approach.

Focus on: PlayDecide as a dialogic tool

A card game for simple, respectful and fact-based group discussion, PlayDecide helps dialogue participants to familiarise themselves with a (sometimes controversial) social or scientific question, see it from different perspectives and form or refine their own opinion on the issue. A positive consensus is sought in a group setting and voting on a number of proposed policy positions takes place at the end. This tool can serve various purposes, from seeking direct input to a certain (policy) decision to raising awareness about an issue.

- *From Science, Technology and Mathematics (STEM) to STE(A)M - the creative potential of arts, socio-economic sciences and humanities with STEM*

The importance of STEM competences to enable future generations to thrive in a fast- paced and changing world has long been accepted. The sources we have consulted for this deliverable agree on the importance of these subjects and the need to increase the rates of STEM literacy among our youth, especially in those groups that are still underrepresented. However, in the past few years the 'A' has been included in the acronym when discussing these subjects. What the 'A' stands for is, however still under the discussion although a widespread explanation is that the A in STEAM stands for the importance of the inclusion of Art.

For the European Commission the A stands for 'all others disciplines': 'Making **connections between STEM and all other disciplines** – what is often referred to as STEAM – pushes the boundaries of science to embrace the creative potential of linking the arts, scientific enquiry and innovation. Innovative new ideas and creative solutions often emerge at the interface between disciplines and involve different societal actors. Innovation is linked, directly or indirectly, to human experience, needs and problems'.[12]

In 'From STEM to STEAM (education): A necessary change or 'the theory of whatever'?' Maria Xanthoudaki discusses the main interpretations for the 'A' in STEAM. On the one hand, she raises concerns about the wide scope of this approach which risks transforming STEAM into 'a synonym of the school curriculum itself'. On the other hand, the same report quoted above stresses working across disciplines and connecting horizontally knowledge and subjects. She identifies this '**across-**

[12] European Commission. 2015. 'Science Education for Responsible Citizenship', Directorate-General for Research and Innovation, p. 21. URL: https://ec.europa.eu/research/swafs/pdf/pub_science_education/KI-NA-26-893-EN-N.pdf

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borders', **interdisciplinary** and **connecting** character of STEAM as the most valuable perspective - a deep integration of disciplines that responds to learning for the 21st century: 'Successful learning in the 21st century depends upon horizontal connectedness across areas of knowledge and subjects as well as to the community and the wider world; it emphasizes the fact that knowledge and technologies do not exist in isolation. Interdisciplinary innovation is primarily about team-work, where members of the team bring different skills and perspectives which together bring added benefit.'[13]

2.2.1 Insights from the FIT4FOOD2030 project consortium: Visioning at the Kick-off Meeting

The aim of the visioning session at the Kick-off Meeting was to create a common vision for the FIT4FOOD2030 project and ensure partners are aligned and work towards the same goals. The process of visioning elicited open contributions. Indirectly, it can be seen as a pooling of insights from project partners. A protocol was developed by the partners in charge of methodologies and visioning. It proposed discussions around two broad stakeholder groups: **researchers and students**, and **entrepreneurs and social agents** and comprised of three questions:

Imagine it is 2030 now.

*Which **FNS R&I competences** did we build up for the following key actors? Which **actors** are responsible? If this vision for 2030 is achieved, **how did our project FIT4FOOD2030 contribute** to a future-proof food system?*

Figure 1. Protocol for visioning on competences at the Kick-off Meeting, January 2018

- *Competences for researchers and students*

Participants merged the two categories of 'researchers' and 'students' under the heading of 'empowered researcher/RRI citizen': in an ideal scenario, there are no researchers anymore but **curiosity- and knowledge-driven RRI citizens**.

A strong **awareness of** and **interaction with society** on the part of the new RRI citizens and **consideration of environment**, **engagement of relevant stakeholders** to **integrate different types of knowledge** is seen as an ideal future.

Appreciative enquiry (new modes of enquiry to generate new ideas and models) having a broad approach and open mind towards a problem, being reflexive with learning attitude and tolerant to uncertainty and appreciating a wide variety of knowledge combined with critical thinking.

Overall, there is a strong focus on **soft skills, attitudes and competences**: listening, communication and stakeholder interaction.

Competences and skills will be developed at **every educational level** and across **types of education**:

[13] Maria Xanthoudaki. 2017. 'From STEM to STEAM (education): A necessary change or 'the theory of whatever'?' Spokes magazine. URL: https://www.ecsite.eu/activities-and-services/news-and-publications/digital-spokes/issue-28

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- vocational, more practically driven research competence;
- applied research, consultancy/management/advisory-driven research; and
- basic academic research competence, or core traditional research skills (design research – data collection and analysis – integrate findings)

Focus on: Competences Reflection Instrument to improve RRI implementation

The Living Lab for Health (IrsiCaixa), in collaboration with Athena Institute (Faculty of Science, Vrije Universiteit Amsterdam), has been working to develop a Competence Reflection Instrument which includes a total of eight categories to reflect on competences to cover in educational processes. Some of the categories are not covered in the current lists of competences and have been identified by analysing RRI criteria i.e. engagement skills and evaluation of research processes and outcomes with critical thinking, flexibility and adaptability.

Competences for socio-scientific reasoning for RRI:

1. Recognising scientifically investigable questions
2. Identifying evidence needed in a scientific investigation
3. Method definition
4. Drawing conclusions with scientific, ethical, legal and social reasoning
5. Communication skills
6. Demonstrating understanding of scientific concepts
7. Engagement skills
8. Evaluation with critical thinking, flexibility and adaptability

Actors responsible for change: To find an answer to what was considered to be a shared societal challenge, different actors need to be involved as change agents, brokers or other intermediaries: from institutes for higher education, educational communities, ministries, the European Commission to local governments. Effective change agents, like FIT4FOOD2030 aspires to be, are needed in different areas and the being identified, motivated, convinced and supported to speed up the process. Teachers are identified as boundary partners towards the change.

The **Research and Innovation system** needs to change accordingly to support development in these directions, with more challenge-driven research from the perspective of real-life actors', including the co-creation of research and its products.

- *Competences for entrepreneurs and societal actors*

Commonalities across the two actor groups included **critical thinking skills**, **abstract and holistic thinking skills** about the impact of their actions, a sense of **urgency** about the problem and **self-motivation** to make a difference, **communication skills** (openness and the ability to start dialogues) and **ethical approaches**.

In addition, **creativity**, **knowledge of up-to-date research and system/impact analysis**, **awareness** of **societal needs** and the **will to act** upon these and **new business models** (not only based on an

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economic bottom line) were highlighted specifically for entrepreneurs. It was considered important for societal actors to follow actively health and environmental considerations and, in their turn, to show **openness** to (actively) **engage with research**.

The responsibility for engendering change was seen as shared by a wide range of actors. There was no apparent hierarchy of responsibility – all have to work together to make the change happen.

2.2.2 Insights from the City Labs: Visioning on future-proof food systems

Albeit not focused explicitly on educational needs, formats or contents, the **visioning workshops on the shape of future-proof food systems** that took place in the City Labs (from June to October 2018) did reveal stakeholder aspirations regarding competence-building, among citizens and consumers in particular but also for various other categories of professionals. **Target groups** mentioned by participants include young students, students specialising in the field of food and nutrition systems, opinion-makers, mediators (such as journalists and science communicators), farmers and professionals in hospitality industries.

The notion of **empowerment** featured repeatedly across the different City Labs, together with **awareness** and **consciousness. Food education/literacy** was often seen as the key means to arrive at these desirable states. Education would impart **specific knowledge** on particular aspects such as seasonal products, the processes of food production, packaging, distribution and waste management and mitigation, and the health and environmental consequences of certain food choices but also build more **general capacity for critical thinking**. Other characteristics mentioned in relation to education are: '**education with experience**', **openness to the broader community**, **co-creation with citizens** and using the culture of food and its diversity to connect people.

The goal of competence-building and awareness-raising is often expressed as **(behavioural) change**: informed choices, different mindsets and attitude shifts; one participant referred to 'thought through consumption'. At times, it appeared from the contributions that participants felt the act of providing information would be sufficient to result in behavioural change, but on occasion other aspects are important: offering choices and preserving the **enjoyment** ('the fun in food') as a motivating factor emerges in several Labs. Moreover, some participants challenged the possibility of 'teaching' and influencing complex aspects such as diet and specified that change will not be achieved until the attitudes in question become an 'organic part of the institutional system'.

In terms of the **specific knowledge** that participants think should be imparted and the **directions of change** that should be encouraged, some directions could already be observed: towards veganism, traditional (less industrial) food, responsible use of resources, locally produced and less processed food. Nevertheless, these knowledge components were not without disagreement in the plenary session. Several axes of contention could be identified in the analysis of the visions: on the importance of **local-ness** in the FNS system and the role of **science and technology** (large-scale, high-technology food systems). This indicates that further disagreement could arise during the prototyping of the educational modules, and that content-free formats that promote general competences for negotiating values might be needed to overcome potential disagreements. This issue has been a concern for the consortium and more specifically for the City Labs coordinators,

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and exercises on advance facilitation to deal with this and other problems will be carried out during upcoming trainings.

More specific visioning exercises on competences. The kind of skills, abilities and qualifications needed for 'new' Food and Nutrition Systems are scheduled to take place at the level of the City Labs: internally with science engagement staff and educators from the host organisations, but also with heterogeneous stakeholder groups using a workshop or hands-on formats (November 2018 – January 2019).

Focus on: 'Do It Yourself Biotechnology', an inspiring example for ethics in innovation?[14]

DIY Biotechnology is a movement that is broader in scope than citizen science, touching upon 'Open Science activism, art-science, pre-competitive business incubation, (speculative) design, hobbyism, science communication and more'.[15] It is currently developing outside academia and industry.

Key characteristics that hold potential and relevance for RRI and OSc:

- **Inclusiveness** and **transparency**, including in terms of access to scientific resources (instruments, laboratories and publications), facilities and training
- The development of a **practice-based ethics**: 'DIYBio practitioners explore ethical issues in a broader perspective, signal ethical issues earlier, and signal different issues.' 'DIYBio projects have the ability to organise moral deliberation, indirectly and directly, and not just as a means to restore trust in science or communicate science.' 'DIYBio includes art-science practices, which are noteworthy for their examination of the ethical challenges of contemporary biotechnology research.'
- Potential for **innovation**: new methods of applied problem-solving that reflect a co-creation approach to knowledge and technologies, including market-value creation
- **Public dialogue** around **safe and responsible research** and the **ethics** of technological innovation, enhancing collective and individual capacity to morally assess such developments
- Contribution to **societal needs**, alongside traditional innovation paths; accelerators of change
- Potential for education: **project- and practice-based learning**; open sharing of methods and skills; improvisation and experimentation

[14] Based on DITOS project. 2017. 'Do It Yourself Biotechnology' (DIYBio) for open, inclusive, responsible Biotechnology. DITOs Citizen Science Policy Brief #2. May 2017. URL: https://waag.org/sites/waag/files/ditos-policybrief2-20171004-diybio.pdf

[15] DITOS project, 2017, p.1.

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2.3 International resources of educational relevance to FOOD 2030 and FIT4FOOD2030

2.3.1 UNESCO: Education for Sustainable Development Goals (SDGs)[16]

UNESCO, the United Nations' specialized agency for education, has produced a framework report to guide the implementation of SDG 4 Quality Education and its associated commitments. It highlights Education as a key enabler to transform individuals into change makers capable of making sustainable development a reality.

In broad terms, the framework argues that individuals should reflect on one's actions, consider broad impacts from a variety of perspectives and be empowered to act in complex situations. To do so, some of the key competences identified as relevant for all SDGs are:

- **System thinking**: recognising and understanding relationships; analysing complex systems, different domains and scales; dealing with uncertainty;
- **Anticipatory competency**: understanding and evaluating multiple futures; creating visions about the future; applying the precautionary principle; assessing consequences; dealing with risks and uncertainty;
- **Normative competency**: understanding and reflecting on norms and values; negotiating sustainability values, principles and goals;
- **Strategic competency**: collectively developing and implementing innovative actions
- **Collaboration competency**: learning from others; empathy; empathic leadership; dealing with conflicts; facilitating collaborative and participatory problem solving;
- **Critical thinking competency**: questioning norms, practices and opinions; reflecting on values, perceptions and action; taking a position;
- **Self-awareness competency**: reflecting on role in the community and society; evaluating and motivating one's actions; dealing with feelings and desires; and
- **Integrated problem-solving competency**: applying different problem-solving frameworks; developing viable solutions.

Further insights. The report also elaborates **learning objectives** (further specified in terms of cognitive, socio-emotional and behavioural aspects) as well as **topics** and **learning approaches** and methods specific to each SDG to be pursued in synergy with the key competences enumerated above. In this respect, a broad spectrum of goals holds interesting insights for educational module development: SDGs 2 'Zero Hunger', 4 'Quality Education', 8 'Decent Work and Economic Growth', 9 'Industry, Innovation and Infrastructure', 11 'Sustainable Cities and Communities', 12 'Responsible Consumption and Production', 13 'Climate Action', 14 'Life below Water', 15 'Life on Land' and 17 'Partnership for the Goals', if not all SDGs.

[16] UNESCO. 2017. Education for Sustainable Development Goals; Learning Objectives. http://unesdoc.unesco.org/images/0024/002474/247444e.pdf.

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2.3.2 OECD: The Future of Education and Skills - Education 2030[17]

The OECD has launched a project called *The Future of Education and Skills 2030* with the aim of helping countries to find answers to what knowledge, skills, attitudes and values today's students will need in order to thrive and shape the world, especially in a world that is increasingly uncertain, volatile, complex and ambiguous. It is being developed as an iterative process and co-created together by government representatives and thought leaders, experts, school networks, school leaders, teachers, students and youth groups, parents, universities, local organisations and social partners.

The learning framework is still under development and should be finished by the end of 2018 but a position paper has already been released. The project vision is that education should help learners fulfil their potential to contribute to shaping the well-being of individuals and the planet. Besides, they need to become responsible and empowered and favour collaboration above division and sustainability above short-term gain. Finally, individuals should become able to embrace the challenges they are confronted with.

The project has already identified **three transformative competences** that need to be fostered if learners are to become 'innovative, responsive and aware':

- Creating new value: **thinking creatively** and **work collaboratively** to devise new solutions, new sources of growth and development. The constructs that underpin this competency would include **adaptability**, **creativity**, **curiosity** and **open-mindness**.
- Reconciling tensions and dilemmas: In order to reconcile conflicting views and needs and to balance between competing demands, young people will have to become **system thinkers**, recognising interconnections and understanding other actors.
- Taking responsibility: This is a prerequisite to the other two competences identified. A key element for this competency is the concept of self-regulation which involves **self-control**, **self-efficacy**, **responsibility**, **problem solving** and **adaptability**. Advances in developmental neuroscience point out to the fact that adolescence could be the opportune time to develop this competency.

Further insights. In practice, the delivery of these competences would happen in a process of **reflection**, **anticipation**, and **action**, and a set of specific constructs and design principles will be formulated to make the framework implementable.

2.3.3 WEF: New Vision for Education: Unlocking the Potential of Technology[18]

The WEF has produced a detailed analysis of the research literature to define the 16 most critical '21st Century Skills'. While the report focuses on the potential of technology to help close the skills gap, the initial discussion of the needs for the future is relevant for the current analysis. In addition

[17] OECD (2018). The Future of Education and Skills. Education 2030. URL: https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf
[18] World Economic Forum. 2015. New Vision for Education - Unlocking the Potential of Technology. http://www3.weforum.org/docs/WEFUSA_NewVisionforEducation_Report2015.pdf

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to foundational literacies, several higher-order **competences** and **character qualities** that students will need.

The report understands competences as 'how students approach complex challenges':

*… [**Critical thinking** is the ability to identify, analyse and evaluate situations, ideas and information in order to formulate responses to problems. **Creativity** is the ability to imagine and devise innovative new ways of addressing problems, answering questions or expressing meaning through the application, synthesis or repurposing of knowledge. **Communication** and **collaboration** involve working in coordination with others to convey information or tackle problems.* [emphasis added]

Additionally, character qualities refer to 'how students approach their changing environment' and count: **persistence**, **adaptability**, **curiosity**, **initiative**, **leadership**, and **social and cultural awareness**. It has to be noted that these character qualities are listed as competences or skills in other reports from the field, or as constructs that support particular competences.

Further insights.[19] Overall, the report notes the lack of consistency in defining and measuring the skills grouped under competences and character qualities. Related work done by the FIT4FOOD2030 project could contribute with insights to this discussion.

Additionally, the report proceeds to discuss the technological means available to close the skills gap, and thus could be of relevance to those City Lab coordinators who are interested in utilising technology in the development of the educational modules.

2.4 Working definition of competency for the purpose of this project

The different reports consulted for this deliverable have provided us with interesting insights regarding competences. There does not seem to be agreement on an exact definition though concepts such as skills, attitudes, values and how to equip learners to approach complex challenges keep coming back. It is also agreed that even though competences cannot be taught, they can be developed with effort, and more crucially, with support.

City Lab Coordinators can refer to the OECD report that defines competency as more than just knowledge and skills: it involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context.

They should also refer to the competences as described by the UNESCO: the specific attributes individuals need for action and self-organisation in various complex contexts and situations. They include cognitive, affective, volitional and motivational elements; hence they are interplay of knowledge, capacities and skills, motives and affective dispositions. Competences cannot be taught,

[19] Further WEF outputs that could be relevant to consult are the 2017 White Paper on 'Realizing Human Potential in the Fourth Industrial Revolution. An Agenda for Leaders to Shape the Future of Education, Gender and Work' which includes reflections and benchmarks on future-ready educational ecosystems, http://www3.weforum.org/docs/WEF_EGW_Whitepaper.pdf, and the 2018 report on the 'Future of Jobs', http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf

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but have to be developed by the learners themselves. They are acquired during action, on the basis of the experience and reflection.

Further specification in terms of cognitive (knowledge), psychomotor (skills) and affective learning domains for each of the competences identified will not be carried out in this deliverable. Based on the particular competence mix chosen, the translation of competences into learning objectives for educational module development will take place at the level of the City Labs and a methodology format to this end will be proposed to the City Lab coordinators at the third training (26-27 November 2018).

3. FIT4FOOD2030 R&I insights for competency building

Research results from WP2, WP3 and WP4 could offer interesting insights for the City Labs when developing their educational modules: on the one hand, trends, drivers and barriers of the EU food system and, on the other hand, the needs, barriers and enablers for policies and governance of food systems and FNS R&I.

At the moment of the submission of this deliverable most of the FIT4FOOD2030 project research is still ongoing and, therefore, the outcomes that can be reported on are very limited. In the next iteration of this deliverable we expect to be able to provide more meaningful input.

3.1 Needs identified by in the mapping of trends, drivers and barriers of EU food system and R&I

Attachment 6.5 (Description of Trends) to Deliverable 2.1 (Report on baseline and description of identified trends, drivers and barriers of EU food system and R&I) identifies key trends and the implications of each trend for R&I strategy needs. Two aspects that are particularly relevant for competence building are recommendations concerning:

- Research and Innovation focus (e.g. research directions that are underexploited or where knowledge gaps have been identified)
- Research and Innovation approach (e.g. (socio-economic) impact studies, action-oriented research, multi-disciplinary research)

This deliverable can provide significant insights for the City Labs, especially as they have already progressed in identifying the trends that are enabling or detrimental to their vision.

3.2 Needs identified by mapping food policies and governance of EU food systems

Deliverable 2.2 (Report on overview of needs, barriers and enablers for policies and governance of food systems and FNS R&I – comparison to global systems) will produce a map of European food policies, among which are initiatives that target the 'education sector' and 'research sector', as well as specific policy instruments such as 'information measures', 'education measures', and 'participation/co-creation'. Such policies have the potential to touch on competency issues more explicitly. They are being considered at the national level by the City Lab coordinators, but placing them in a broader European context will undoubtedly reveal new perspectives and insights.

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4. Competence clusters

Following the mapping of different perspectives on educational needs, a clustering exercise took place, resulting in the identification of ten broad dimensions or competences that recurred throughout the reports consulted. While the clusters thus identified are self-standing to a certain degree, there are also significant overlaps and interlinks.

The approach taken simply aims to identify directions that could prove useful in guiding the City Lab coordinators in developing their educational modules and to make it easier to work with the catalogue activities presented in Section 5.

- **Anticipation and future-oriented competency** (cited by UNESCO, EnRRICH, FIT4FOOD2030)

This cluster revolves around understanding and evaluating multiple futures via future studies[20] and foresight, creating visions about the future, applying particular tools and concepts such as the precautionary principle, impact analysis, technology assessment processes, and having competences for ethical discussions oriented towards the future and the capacity to deal with risks and uncertainty.

Some activities that bear the hashtag **#futuring**: DIY workshop 'Hack Your Food'; DITOS project resources; Education for Sustainable Development Goals; Futurescape City Tours; Play the City; Serious Game: the JRC Scenario Exploration System.

- **Communication** (cited by WEF, OSc, FIT4FOOD2030, CLs).

Further specification on the nature of communication (e.g. multi-perspective, inter-cultural) and to specific means (e.g. openness to dialogue, ability to open dialogue) can also be noted.

Some activities that bear the hashtag **#communication**: e.g. CBPR module; Debating Matters; EuroStemCell project resources; HOLY animation; Our Trust in Food; PlayDecide; Serious Game: the JRC Scenario Exploration System.

- **Collaboration** (cited by OECD, WEF, UNESCO, FIT4FOOD2030)

Collaboration was suggested by almost all of the reports revised, either explicitly as 'collaboration' and 'collaborative learning skills' or by implied under other domains such as 'multi-stakeholder engagement'. Further specification related to the what of collaboration (learning from others; empathy; empathic leadership; dealing with conflicts; facilitating collaborative and participatory problem solving) and with whom (multiple stakeholders; actors from outside the classroom; across disciplines - see also transdiciplinarity) can also be noted.

[20] Future studies is a scientific research field involving scholars and researchers across many disciplines. A major focus of futures studies according to the **World Future Studies Federation** is how we envisage and develop desirable outcomes in the times ahead. More information concerning this concept can be found on website of the The World Future Studies Federation (www.wfsf.org). The project **ENRRICH** also refers to this concept. From their perspective future studies would refer to knowing and understanding concepts, methods and tools for exploring possible development of societal challenges in the future, for imagining possible futures, for exploring possible solutions to societal challenges and possible future implications and impacts of scientific and innovation practices (e.g. Scenario analysis, forecasting methods, etc.).

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Some activities that bear the hashtag **#collaboration**: City Region Food System toolkit; CBPR module; Ecotrophelia; Education for SGDs; Food and food labels; InGenious; SySTEMS thinking.

- **Creativity** (cited by WeF, OECD, UNESCO, FIT4FOOD2030)

Creativity, 'the ability to imagine and devise innovative new ways of addressing problems, answering questions or expressing meaning through the application, synthesis or repurposing of knowledge'[21], emerges as a key competency in most of the reports.

Some activities that bear the hashtag **#creativity**: Biologigaragen; Education for SDGs; Gamestorming; HOLY animation; InnovationSpace

- **Critical thinking** (cited by UNESCO, OECD, WEF, CLs, FIT4FOOD2030)

Whether seen more minimally as competences to identify, analyse and evaluate situations, ideas and information in order to formulate responses to problems (WEF), or widened to include the questioning norms, practices and opinions, reflections on values, perceptions and action, and taking a position (UNESCO), critical thinking is a recurring constructs in the reports consulted.

Some activities that bear the hashtag **#criticalthinking**: Eathink 2015; Debating Matters; Education for SDGs

- **Empowerment for transformation and acting as change agents**:

While perhaps broader in scope, and requiring several competences in itself, the fact that citizens should become empowered to act towards change is also one of the elements that can be elicited from the reports. Certain cross-cutting attitudinal characteristics such as resilience and adaptability, participatory ability, self-regulation and other self-oriented competences resonate with this cluster.

Some related activities that bear the hashtag **#transformation**: FoodSpan, Games for Change; Hypatia Toolkit; PhotoVoiceFood; Systems Thinking Playbook; THINK: The process of Innovation

- **System thinking** (cited by OECD, FIT4FOOD2030, UNESCO)

Either explicitly or implicitly referenced by the frame of other competences, system thinking is a recurrent competency when talking about how to tackle complexity or wicked problems. Its scope is recognising and understanding relationships; analysing complex systems, different domains and scales; dealing with uncertainty and ambiguity.

Relevant activities bear the hashtag **#systemthinking**: Complex System Analyser; Education for SDGs; FoodSpan; FoodSource; Serious Game: SySTEMS Thinking lesson plans; Systems Thinking Playbook

[21] [21] World Economic Forum, 2015, New Vision for Education, p.3.

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- **Transdisciplinarity** (cited by FIT4FOOD2030, STEAM, RRI, CLs)

The concept of transdisciplinarity facilitates addressing a complex challenges such as the ones we can find within the Food system by facilitating inputs from across scientific and non-scientific stakeholder communities and facilitating a systemic way of addressing a problem.

Related activities bear the hashtag **#transdisciplinarity**: to be compiled

- **Reflexivity** and **awareness** (cited by UNESCO, OECD, EnRRICH)

This cluster touches in particular on a need to reflect on one's role in the community and society, on the norms and values that motivate one's actions and practices, including evaluating those actions. Social and cultural awareness and awareness of other perspectives and societal needs also appear repeatedly in the reports.

Some activities that bear the hashtag **#reflexivity**: Education for SDGs; HOLY Animation; Hypatia toolkit; PhotoVoice Food; PlayDecide.

- **Responsibility** (cited by UNESCO, RRI, OECD, FIT4FOOD2030)

At the core of the concept of RRI, responsibility can be broadly understood in 'a prospective notion, that matches the complex society of today, that acknowledge the importance of knowledge while accommodating its limitations, that allows for a deeper reflection about ways of doing and being and for the cultivation of social values and socially-relevant choices' [22]. The sources consulted address both a sense of individual responsibility (enabled by self-regulation via self-control, self-efficacy, problem solving and adaptability) and shared responsibility among diverse actors towards making trade-offs to advance towards R&I that addresses grand challenges.

Some activities that bear the hashtag **#responsibility**: Amsterdam Green Campus; InnovationSpace; VeldAcademie; Biologigaragen; CBPR module; Education for SDGs; Futurescape City Tours; Games for Change; OSOS resources; PlayDecide.

- **Other**

Elements related to **content** have also emerged, which will be tagged with the hashtags **#foodsystem** and **#R&Isystem**.

#foodsystem: IFSTAL; Eathink 2015; FoodSpan; FoodSource; Food System Primer; Organic.Edunet; Our Trust in Food; Sustainable Food Security MOOC; SySTEMS Thinking lesson plan.

#R&Isystem: Ecotrophelia; Our Trust in Food MOOC; THINK: The process of Innovation; USchool

[22] Tassone, V. and Eppink, H. 2016. EnRRICH Tool for Educators, pp. 5-6

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5. Catalogue of contents, activities and formats

The activities gathered here are the result of desk research and the input given by the different City Labs. The selection aims to offer at least several activities that relate to the clusters identified and to the target audiences available for City Labs.

We have divided the activities in two groups, the ones that are more inspirational, mostly showcases of **interesting initiatives** and **concrete resources** are summarised in terms of stakeholder involvement, content, format, and intended audience. It is hoped that consulting the catalogue will raise awareness of existing practices and tools or spark new ideas in the development of the educational modules.

This catalogue of activities is not final, as along the lifespan of the project we expect partners, and more specifically City Labs to feed it with new activities.

5.1 Inspirational examples

The following examples were brought in as inspirational examples of competence-building initiatives by the City Lab coordinators. They illustrate how certain institutions implement transdisciplinarity, design thinking, and other concepts in practice.

Amsterdam Green Campus

#multistakeholder #transdisciplinarity #responsibility

Target audience: entrepreneurs, governments and research and educational institution representatives, students, general public

Format: innovation hub/living lab/inspirational example

Description: Amsterdam Green Campus aims to process scientific knowledge and technology faster from education and get it to entrepreneurs. Specific food-related projects address permaculture gardens and biodiversity, and the Campus' Living Lab brings together scientists, entrepreneurs, residents, students, students and other interested knowledge generate about alternative forms of agriculture, nature and nature conservation. The Living Lab consists of test fields, ecological experiments, educational projects, excursions and information facilities.

Link: http://amsterdamgreencampus.nl/home/

Eating City Summer Campus

#professionals

Target audience: professionals, researchers aged 22 to 32

Format: inspirational example

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Description: The campus is an example of bringing together young people, researchers, senior professionals working in the public and private sectors to build understanding and trust around complex and challenging issues related to urban food systems. The participants are chefs, farmers, students in environmental sciences, food sciences, nutrition, urban planning, economy, communication, or citizens involved in civil society and advocacy.

Link: https://www.eatingcity.org/summer-campus/why-a-summer-campus/

Food Academy

#deeplearning #multistakeholder

Target audience: Higher Education students, professionals

Format: university course

Description: The Food Academy Amsterdam offers an education course focused around training as a food technologist, quality specialist and information officer within the food sector with real life projects. It is a collaboration between Wellant college and Inholland University of Applied Sciences and Wageningen University and Research Center; each offers future professionals a particular mix of skills including entrepreneurship, innovation and knowledge development. During their training students work with real questions from the business community, making the transition to higher professional education easier. Business interactions happens via professional practice, company assignments and guest lecturers.

Link: https://wellant.nl/mbo/locaties/wellant-mbo-amsterdam/food-academy-amsterdam/

InnovationSpace, Arizona State University

#transdisciplinarity #collaboration #creativity #responsibility

Target Audience: Higher Education students

Format: university course/project

Description: Innovation Space is an education and teaching lab organised by several Arizona State University schools (engineering, business, design) which offers a two-semester collaborative undergraduate design course during which student teams create product designs within a framework of responsible innovation, i.e. create market value and serve real societal needs while minimizing impact on the environment. The course uses a product-development model based on Integrated Innovation and biomimicry, and projects are delivered in collaboration with paying sponsors.

Link: http://cns.asu.edu/research/rtta-3-anticipation/innovationspace

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Interdisciplinary Food Systems Teaching And Learning (IFSTAL)

#transdisciplinary #foodsystems

Target Audience: Higher Education students (undergraduate, postgratuate)

Format: university course

Description: IFSTAL is a learning community and interactive resource designed to improve postgraduate level knowledge and understanding of the food system. IFSTAL addresses the urgent need for a workforce skilled in food systems thinking. Those engaging with IFSTAL will be better equipped to address the systemic failings in food systems.

Link: https://www.ifstal.ac.uk/

Pathways to Sustainability: Food path at the University of Utrecht

#multistakeholder #transdisciplinarity #sciencesociety

Target Audience: higher education institutions

Format: university course

Description: Future Food Utrecht is a hub within Pathways to Sustainability, one of four strategic themes of Utrecht University. It houses researchers from across disciplines and offers a unique environment for inter- and transdisciplinary research and education related to food. Three transdisciplinary 'pathways' that identify key societal questions at stake that need to be addressed jointly between fundamental researchers and key stakeholders working on future food: Future Production & Consumption, Future Health and Future Efficiencies. The project also actively involves students within these research themes.

Link: https://www.uu.nl/en/research/sustainability/research/future-food-utrecht

Unique Action Research at the VeldAcademie

#multistakeholder #transdisciplinarity #deeplearning #responsibility

Target Audience: primary, secondary, and higher education students, researchers, professionals, citizens

Format: Science Shop model

Description: Veldacademie answers societal questions, including those related to food and nutrition, in the city of Rotterdam through collaborations with various programmes: from university to practical schools, from spatial and social science studies to medical education. Through unique action research, research and education work together and children and their families are followed and supervised for three years. Almost weekly there are lesson programs in the classroom, which are conceived and executed by students from different study programs. In the lesson knowledge is

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brought about health and the many aspects that have to do with it. In addition, data is collected during the lessons for the research.

Link: https://www.veldacademie.nl/en

USCHOOL

#designthinking #R&Isystem #deepapproach

Target Audience: secondary school students (ages 16-18)

Format: afterschool programme

Description: USCHOOL is an innovative afterschool program for 16-18 year-old students in Hungary. The organisers partner with NGOs, larger for-profit organizations as well as start-ups to create a program for empowering and enhancing the skills and competences of students. The curriculum is based on the design thinking methodology and helps students develop their own project, and even launch a (social) enterprise. It is free of charge and students are supported by mentors throughout the process.

Link: http://uschool.hu/about/

5.2 Concrete resources

Biologigaragen, Copenhagen, Denmark, 'Group Experiment Nights'

#creativity #responsibility

Target audience: all audiences

Format: collaborative, hands-on workshops held in an open lab facility

Description: Biologigaragen collaborative workshops explore, in groups of 15-20 participants, Do-It-Yourself science subjects with a hands-on approach (information on how to run the activities is available on their website). They are animated by several experts, some with a scientific background and others with an artistic approach. Experimentation is a key component. Topics have included oyster mushrooms in the city, herbal medicine, fungi, DIY yeasts, fermentation, miso soup and Nordic tofu.

Link: https://biologigaragen.org/category/gens/

City Region Food System Toolkit

#multistakeholder #collaboration

Target audience: Local teams that want to assess and build sustainable city region food systems.

Format: applied set of tools

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Description: The City Region Food System Toolkit is part of the Food for the Cities Programme of the Food and Agriculture Organisation (FAO). 'The toolkit aims at to help local authorities and other stakeholders to strengthen the understanding of the current functioning and performance of a food system in the context of a city region, within which rural and urban areas and communities are directly linked. In particular the toolkit provides guidance on assessing the food systems and it forms the basis for further planning to reinforce and promote the sustainability of CRFS. It is meant to be a resource for policymakers, researchers, and other key stakeholders and participants who want to better understand their own CRFS and plan for improvements.'

Link: http://www.fao.org/in-action/food-for-cities-programme/toolkit/introduction/en/

CommNet project: Communicating the Bioeconomy

#content

Target audience: young people aged 5 to 16

Format: classroom activities

Description: The project proposes resources to inform on the bio-economy research (food, fisheries, agriculture and biotechnology). Its FAB Toolkit contains activities for children aged 5 to 16 and includes teachers' guides, presentations, worksheets and activity sheets.

Link: http://commnet.eu/

Community-based participatory research (CBPR) module - University College Cork, Ireland

#communication #collaboration #responsibility #reflexive

Target audience: Higher education students; academics and research staff

Format: university course module

Description: These materials were developed as part of the EnRRICH project to support academic and research staff with embedding CBPR within the curriculum, with a focus on CBPR as an approach to Responsible Research and Innovation (RRI). The module materials include a handbook, resources, slides and exercises and are free to download and adapt.

Link: https://www.ucc.ie/en/scishop/resources/module/

Complex System Analyzer – Joint Research Centre, European Commission

#systemthinking

Target audience: Professionals, researchers, university students

Format: gerious game (1- to 2- day multi-stakeholder participatory process)

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Description: This tool proposes a participatory process to decompose and analyse complex systems so as to identify leverage points on which to act in order to influence the system in question. The ultimate aim is the generation of intervention strategies that maximise the chance of reaching one's desired state. Printable versions are available upon request.

Link: https://blogs.ec.europa.eu/eupolicylab/complex-system-analyzer/

Debating Matters

#content #criticalthinking #communication

Target audience: 16 to 19 year-olds

Format: themed guides for debate

Description: Debating Matters proposes an innovative and engaging approach to debating. They have topic guides on issues such as Organic Food, Genetically Modified Food and Biofuels among others. The guides serve preparation for debating issues in a debating society style format.

Link: http://www.debatingmatters.com/topicguides/topicguide_categories/C27/

Design Challenge: The Ideal Meal - Teachers TryScience

#content #transdisciplinarity

Target audience: 12- to 18-year-olds

Format: Lesson plan including hands-on activities

Description: To create a vision of a more sustainable system of food production and distribution, participants redesign a sample diet where the nutritional value is optimised, the impact in the environment minimised and the price remains affordable.

Link: http://www.teacherstryscience.org/lp/design-challenge-ideal-meal

DIY workshop 'Hack Your Food' - Waag Society & Pieter van Boheemen

#futuring #hacking #doittogether #citizenscience

Target audience: high school students, professionals and the general public

Format: hands-on workshop

Description: Participants receive an introduction to alternative protein sources and build their own microalgae reactor in groups of 4 to 5 participants. The experience can include food tasting and finishes with a reflection on what would be necessary to turn algae into an acceptable protein source, or if such alternatives are needed at all. Participants are also invited to reflect on the maker experience.

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Link: https://github.com/BioHackAcademy/BHA_Photobioreactor (open-source repository of materials) & https://waag.org/en/event/food-2030-research-innovation

Do-It-Together Science (DITOs) project resources

#futuring #hacking #doittogether #citizenscience

Target Audience: citizens of all ages

Formats: hands-on activities

Description: The activities proposed by the DITOs project aim for the direct, hands-on engagement of citizens in science and innovation guided by the principles of biodesign (the use of living things in designing products or art) and environmental sustainability. A sample of activities related to food include 'Make your own yogurt', 'PH meter', 'Bacteria detector' and 'Grow your own vegetables'.

Link: http://www.togetherscience.eu/

Eathink2015 project

#content #foodsystem #criticalthinking

Target audience: primary and secondary school students

Format: lessons plans, school garden guide, PC games

Description: The showcase of the Eathink2015 project that could be useful for giving inspiration for the educational module development. The project worked to enhance students' and teachers' critical understanding and active engagement in global development challenges, with a specific focus on food security and sovereignty, sustainable food systems and smallholder farming. They created several complete lesson plans 'with a specific focus on food security and sovereignty, sustainable food systems and smallholder farming'. The material is targets primary and secondary school students and is already translated to several languages. It is also accompanied by a guide for school garden development and some educational games for PC.

Link: https://eathink2015.org/en/about/

Ecotrophelia

#multistakeholder #collaboration #innovation #R&Isystem

Target audience: University students

Format: competition

Description: A competition supported by national and European food federations. Its aims are to promote entrepreneurship and competitiveness within the European food industry by implementing a training network of excellence in food innovation and the organization of national and European

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food innovation competitions. Supporting materials such as competition guides and rules are available online.

Link: https://eu.ecotrophelia.org/

Education for Sustainable Development Goals. Learning Objectives – UNESCO

#futuring #collaboration #creativity #criticalthinking #systemthinking #reflexivity #responsibility

Target Audience: educators

Format: learning objectives guide

Description: This document is a resource that can be used by educators when developing trainings, textbooks, MOOCs and exhibitions. The tool is divided per SDG. Each of the sections contains, learning objectives, suggested topics and examples of learning approaches. For the project SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (life Below Water), SDG 15 (Life on Land) and SDG 17 (Partnerships for the Goals).

Link: http://unesdoc.unesco.org/images/0024/002474/247444e.pdf

Engage2020 Action Catalogue

#format #multistakeholder #catalogue

Target Audience: institutions organising public engagement activities

Format: online catalogue of engagement methods

Description: An online decision support tool that is intended to enable researchers, policy-makers and others wanting to conduct inclusive research to find participatory methods suited for their project needs, considering parameters such as objectives sought, levels of participation envisaged and type of stakeholders.

Link: http://actioncatalogue.eu

EnRRICH project promising practices

#RRI #deepapproach

Target audience: Researchers, Higher Education Insititutions

Format: Good practices, case studies, downloadable modules

Description: The project proposes good practices and case studies that demonstrate the embedding of RRI in modules and courses across a range of topics. Collaborating with Civil Society Organisations (CSOs) is a particular focus. While food is not a topic directly covered, but these best practices could

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serve as inspiration for the development of educational modules directed at higher education audiences.

Link: http://www.livingknowledge.org/projects/enrrich/enrrich-resources/

EuroStemCell project resources

#ethics #RRI #debate #communication

Target audience: primary and secondary school students

Format: debate guides

Description: The 'Debating Science Issues' series focuses presents contentious issues from several stakeholder perspectives and introduces several ethical questions, to be discussed in the form of a debating motion proposed in a debating society. An example related to food is that of Genetically Modified foods.

Link: http://www.debatingscienceissues.com/wp-content/uploads/2012/09/GMF-print-friendly.pdf

Food and food labels: From food to meals – making choices – SAILS project

#content #format #inquirybased #collaboration

Target Audience: 11- to 19-year old students

Format: Teaching, learning activities and case studies

Description: This enquiry and assessment unit consisting of four hands-on, collaborative activities helps students understand food labels and the composition of food while developing scientific reasoning and collaborative work.

Link: http://www.sails-project.eu/units/food-and-food-labels.html

FoodSpan

#foodsystem #systemthinking #transformation #problemsolving #inquirybased

Target audience: high school students

Format: lessons plans and related activities

Description: 17 lesson plans (45- to 55-minutes) and teacher guides that can be used in a sequential order or as standalone lessons. Each lesson includes an introductory warm-up, activities that facilitate a rich exploration of the lesson topic, optional activities, and lesson extensions that can serve as homework assignments or projects. The programme proposed culminates in a final 'Food Citizen Action Project' where students apply what they have learned by identifying a food system

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problem and designing an intervention to address it. Other materials available include an infographic, ideas for films and a discussion guide.

Link: http://www.foodspanlearning.org/lesson-plans/

Foodsource – Food Climate Research Network (FCRN), University of Oxford

#systemthinking #foodsystem #content

Target audience: All

Format: collection of materials

Description: This resource proposes a collection of materials on food systems, with a focus on sustainability. An image and video library accompanies the textual content to communicate food system issues and ideas. Topics addressed include the food system, the environmental impact of food, food systems and greenhouse gas emissions, the climate and environmental change impact on food systems, the food system-diet-health connection, livestock issues, infectious diseases and healthy sustainable eating.

Link: https://foodsource.org.uk/

Food System Primer – Centre for a Livable Future, John Hopkins' Bloomberg School of Public Health

#foodsystem #content

Target Audience: educators, students, journalists, policymakers, researchers, and other engaged citizens

Format: articles, reports, lesson plans, and other resources

Description: The primer contains short readings grouped around 8 key food system topics. Anecdotes and images bring concepts to life and links to other resources such as articles, reports and lessons plans allow users such as educators, students, journalists, policymakers, researchers, and other engaged citizens to deepen their knowledge. Topics addressed include the food system, food production, food distribution, food processing, food and nutrition, food safety, wasted food and food policy.

Link: http://www.foodsystemprimer.org/

Futurescape City Tours

#futuring #transdisciplinary #STEAM #responsibility

Target Audience: citizens and stakeholders

Format: large-scale deliberative exercises

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Description: A walking tour of the urban environment that uses photography, facilitated deliberation and informal exchanges with researchers, stakeholders, city planners, and officials to guide reflections on the past, present and future of cities. The format intentionally addresses barriers to access, seeking to create an environment that encourages all participants to voice their concerns and desires for the future of their communities. A how-to guide is available from the organisers upon request.

Link: https://cns.asu.edu/fct

Games for Change

#transformation #responsibility

Target audience: various, depending on game

Format: Online games

Description: Games for Change is a collection of digital and non-digital games that engage with contemporary social issues aiming for social innovation.

Link: http://www.gamesforchange.org/

Gamestorming

#format #transformation #creativity

Target Audience: professionals, innovators, educators

Format: co-creation tools

Description: A toolkit full of activities oriented towards innovators and change-makers. The platform offers games/activities intended to develop a range of skills, from planning to vision, to team-building and eliciting fresh thinking and ideas.

Link: http://gamestorming.com

HOLY Animation

#communication #STEAM #reflexivity #creativity

Target Audience: primary and secondary school students

Format: teaching method to work with STEAM tools

Description: HOLY encourages young people to express their thoughts about current topics through animations and provides workshops on how to do this. It relies on an online animation tool that allows participants to make a visual story step-by-step and workshop guidelines. The method is implementable in regular classes, project weeks, and/or in a multidisciplinary context. The teaching

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aims are to form opinion and social awareness about current themes, encourage media wisdom, creative education and visual self-expression, and build communication skills. (Only in Dutch)

Link: http://www.holy.nl/

Hypatia Toolkit (project resources)

#reflexivity #transformation #inclusiveness #RRI #Gender

Target Audience: 11 to 16 year olds, teachers, professionals

Format: formal and informal setting education activities

Description: While not directly oriented towards food systems or innovation, Hypatia activities were conceived with particular attention to gender inclusiveness. Modules are available for three implementation settings (school, science centre and museum and industry/business or research institutions) aimed at students aged 11 to 16, and professionals (teachers and science communicators

Link: http://www.expecteverything.eu/hypatia/toolkit/

inGenious

#multistakeholder #collaboration

Target Audience: primary and secondary school

Format: resources

Description: inGenious offers a database of activities from school-industry collaborations (practices and policies) in the field of STEM. It aims to serve as a point of reference and inspiration for future collaborations between stakeholders for STEM learning.

Link: http://www.ingenious-science.eu/

Open Schools for Open Societies (OSOS) project resources

#deepapproach #multistakeholder #responsibility

Target Audience: Primary and secondary school students

Format: open school models, lesson plans and inspiring project suggestions

Description: The project proposes resources that open up schools to the community: student projects meet real needs in the community and use local expertise and experience. One of the key aspects of OSOS is the inclusion of RRI - Responsible Research and Innovation principles. Examples of OSOS accelerators of relevance to the topic of food systems include: 'Sustainability in the school for our future' (engineering design process; development of a product that improves the local

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enviroment); 'The school garden as an open school for leaning, action and innovation'; 'Greener Greens? Sustainable food choices'; 'Strategies of waste prevention and resource management' and 'Beeds need Trees - Trees need Bees'

Link: https://www.openschools.eu/

Organic.Edunet project resources

#foodsystem

Target Audience: primary and secondary school students, and young agricultural experts

Format: resource repository

Description: The project offers content and format ideas linked to organic agriculture and agroecology. Educational scenarios are available for several student target audiences and can be implemented in different contexts.

Link: http://www.scientix.eu/projects/project-detail?articleId=44336

Our Trust in Food - EIT FOOD & University of Reading

#foodsystem #R&Isystem #innovation #systemsthinking #communication

Target Audience: students, citizens of all ages

Format: MOOC/online course

Description: This Massive Online Open Course (MOOC) addresses global food supply systems from the perspective of different across in the food system. It also zooms into consumer perspectives, including their role in engaging with innovation in the food sector.

Link: https://www.futurelearn.com/courses/food-supply-systems

PhotoVoice Food**, Heart Healthy Hoods project**

#STEAM #reflexivity #transformation

Target Audience: citizens

Format: participatory-action research strategy

Description: The project provided photo cameras to 24 residents of two socially underprivileged municipalities of Madrid to document what food means for them. At regular intervals, participants met to discuss the images taken and cluster them and debate in a group setting. This participatory-action research ultimately aimed to understand the role of the local food environment in relation to diet and obesity. Images were edited and discussed to tell a story in a very powerful way.

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Link: https://hhhproject.eu/hhh-sub-studies/photovoice/

PlayDecide

#reflexivity #responsibility #communication

Target Audience: students (13 and over), citizens of all ages

Format: debate card game

Description: A card game for simple, respectful and fact-based group discussion (4-8 players/group) on social and scientific issues. A session lasts 90 minutes and is structured in three stages: information, discussion and shared group response. Players familiarise themselves with a question, see it from different perspectives and form or refine their own opinion on the issue. A positive consensus is sought in a group setting and voting on a number of proposed policy positions takes place at the end. A variety of kits already exist while the project also offers instructions for developing a customised Decide kit.

Link: https://playdecide.eu/

Play the City

#multistakeholder #futuring

Target Audience: citizens of all ages

Description: Play the City proposes a city-based playful approach for informing city development, based on stakeholder analysis, a game platform that enables stakeholders to visualise ideas, plans and projects, test alternative scenarios and implement decisions; and results in an innovative strategy and action plan.

Link: https://www.playthecity.nl/

Serious Game: The JRC Scenario Exploration System

#futuring #systemthinking #communication

Target Audience: citizens of all ages, professionals

Format: serious game

Description: The Serious Game is a future simulation tool that aims to engage participants in future-oriented systemic thinking through a playful methodology and interaction with other stakeholders. The participants must take action across three time horizons to reach their long-term objectives as a policy maker, a business, or a civil society organisation while the public voice observes and assesses future impacts according to its interests. A version on food safety and nutrition developed for the European Commission Directorate General for Health and Food Safety already exists, looking at how current EU food safety legislation could affect food-related innovation in the long-term.

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Link: https://blogs.ec.europa.eu/eupolicylab/serious-game-the-jrc-scenario-exploration-system/

Sustainable Food Security: The value of systems thinking, by Wageningen University and Research

#systemsthinking #foodsystem

Target Audience: Higher Education students

Format: MOOC/Online course

Description: This Massive Online Open Course (MOOC) hosted on the EdX platform teaches users how to apply the principles of systems thinking to food production systems, particularly in relation to their environmental impact.

Link: https://www.edx.org/course/sustainable-food-security-the-value-of-systems-thinking

Systems scramble

#systemsthinking

Target Audience: 4-years-old and over

Format: game

Description: This short activity asks players of all ages to move around the activity space, figuring out their role in the system and re-evaluating it as the system changes. The motto is 'one change can affect everything else!' Resources available include an activity guide, a facilitator guide and a training video.

Link: http://www.nisenet.org/catalog/systems-scramble

SySTEMS Thinking - New York Hall of Science (NYSCI)

#systemthinking #foodsystem #inquiry #collaboration

Target Audience: Ages 12-18

Format: lesson plans

Description: A three-lesson plan with activities centred on the importance of analysing the local food system, the generation of a simple model of the local food system and gathering of data (in the school or neighbourhood) about a suspected problem within the local food system.

Link: http://www.teacherstryscience.org/lp/lesson-2-systems-thinking

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Systems Thinking Playbook of Climate Change

#systemthinking #transformation

Target Audience: Citizens of all ages

Format: short games, strategic exercises

Description: This resource represents an adaptation of the popular 'The Systems Thinking Playbook' to the topic of climate change. It contains a collection of 22 short games or strategic exercises aimed to inspire the appeal and effectiveness of other types of presentations by demonstrating various aspects of systems thinking.

Link: http://klimamediathek.de/wp-content/uploads/giz2011-0588en-playbook-climate-change.pdf

THINK: The Process of Innovation

#R&Isystem #transformation #STEAM

Target Audience: students ages 12-18

Format: Lesson plans

Description: THINK is a 5-8 hour lesson plan introducing the concept of innovation and its process and inspire students to act as innovators in their daily lives. The lessons use the IBM's Think App and video making as a means to capture an aspect of everyday innovation, be it an already existing idea or a new idea.

Link: http://www.triscience.org/lp/think-process-innovation

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6. Conclusions

The objective of this deliverable is to be a source of inspiration and reflection for the City Lab coordinators during the development of their own educational modules. The project's initial intuitions pointed towards the need to equip our society with a set of competences that will enable them to navigate a changing, volatile and complex world. This intuition has been confirmed by the desk research carried out in order to prepare this deliverable, which is presented in Section 2.

In Section 3, the deliverable has also briefly considered some of the results already produced by the project, namely Deliverable 2.2 (Report on overview of needs, barriers and enablers for policies and governance of food systems and FNS R&I – comparison to global systems) and attachment 6.5 (Description of Trends) and Deliverable 2.1 as they could potentially offer interesting insights on educational policies and key trends and their implications for R&I strategy, needs that will help identify areas of work for educational modules.

The food system is fertile ground for a paradigm shift in the way Research and Innovation is approached and would therefore highly benefit from educational modules that work towards fostering a particular set of competences such as: anticipation and future-oriented competency, communication, collaboration, creativity, critical thinking, empowerment for transformation and acting as change agents, system thinking, transdisciplinarity, reflexivity and awareness, responsibility and self-regulation, outlined in Section 4. Although some of the competences identified (e.g. responsibility) might be more suitable to be developed during certain windows of opportunity in one person's psychological development (e.g. adolescence), the importance of lifelong learning is also highlighted in the different reports.

The catalogue of formats and contents in Section 5 offers inspiring examples to help in the prototyping of new educational activities. The number of activities that could potentially be included in this catalogue is endless; 42 examples were selected for the scope of the project based on their relevance and inspiring character. Some of them are individual activities but several represent broader collection of resources that could be explored further.

This deliverable is by no means exhaustive or final and will continue to be enriched with the inputs received from the City Labs' work on the ground with different groups of stakeholders.

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