D1.1
Cost effective IMA methods digital compendium and facilitators/multipliers

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Legislation

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Euratom Research and Training Programme (2014-2018) – Council Regulation (Euratom) No 1314/2013 of 16 December 2013 on the Research and Training Programme of the European Atomic Energy Community (2014-2018) complementing the Horizon 2020 – The Framework Programme for Research and Innovation (OJ L 347, 20.12.2013, p. 948).

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1. BACKGROUND

This document provides a participatory production of outlines, developments (joint activities), pilots (small-scale on specific thematic), and validation of cost-effective Impact Monitoring and Assessment (IMA) methods taken from identified good practices, in particular cutting-edge approaches and mechanisms from the rural development arena, sustainable land management, and evidently food security and nutrition programmes, all related to cities and regions food systems (CRFS). Likely all other WP, WP1 aims at fostering synergies with IMA strategies and methodologies practiced in other initiatives e.g., EU-funded projects, etc.

The chapter 1 provides an overview of the project Cities2030 perspective regarding IMA applicable to CRFS, chapter 2 introduces the set of indicators which are considered for the IMA and that integrates in priority the ones defined by the MUFPP monitoring framework. Chapter 3 proposes a series of criteria interlinked with the anticipated activities for the collection of the good practices. Finally, chapter 4 delivers the good practices identifies and suggested by the project consortium and which are explored on the matter of applicability, innovation and transferability potential. Figure 1a illustrate the functionalities of the compendium considering the overall project dimension and interlinks with WP and partners.

Figure 1a – Functionalities of the compendium
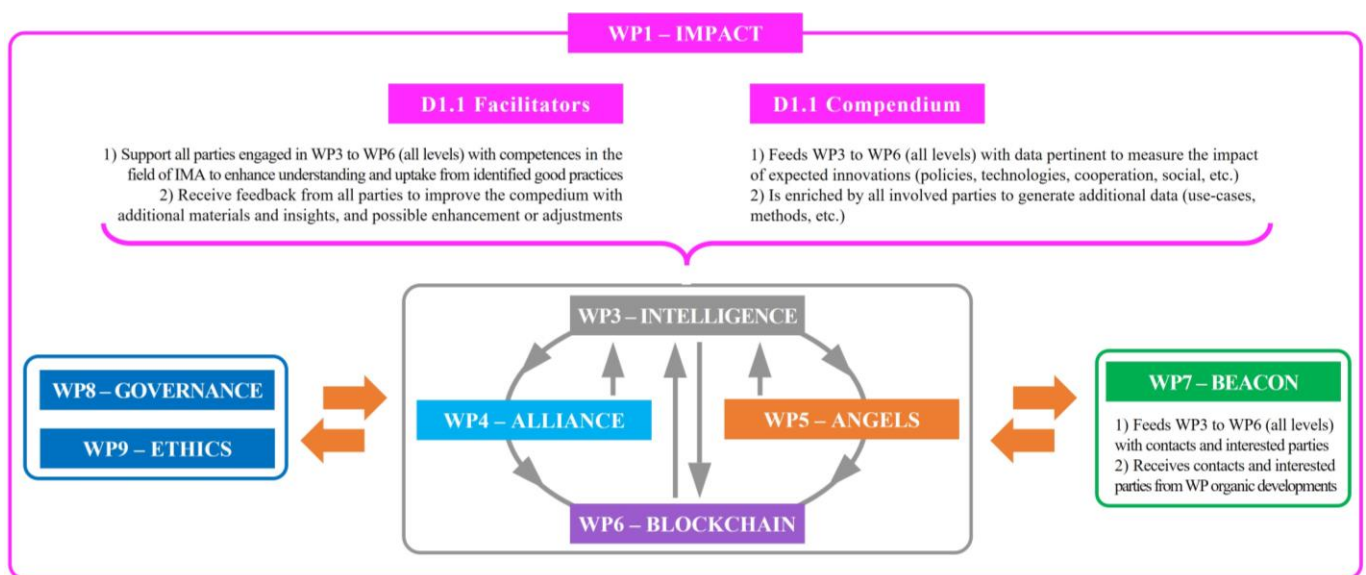
The document is prepared by the lead partner IAAD (P5) with the supervision of a number of partners especially active in WP1 e.g., UNIVE (P1), SLEAN (P14), LLF (P25). WP1 secures all activities effectively meet each of the call's expected impact (CEI) with the support of a continued, systemic and digital-based IMA methodology which generates Cities2030's CRFS indicators, and city/region fact-sheet instruments. These indicators are rooted in existing monitoring frameworks which are, the MUFPP (focus), the FAO, EIT Food and EIT Climate KIC, to name but these few. The development of the compendium is implemented in work package 1 (WP1) which aim is to ensure alignment between operations, methodologies and anticipated results, incorporating a risk and change plans, yet it is not indeed the core objective. This provision is elaborated via a framework comprising structured interviews and consultations (compilation of qualitative results and cross-check on quantitative data), photomonitoring (when applicable), and participatory transect walk and observation (also when applicable).

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The compendium aims at generating a framework to contribute to the development of the project impact action strategy (PIAS) beyond the call's expected impact (which is centered in the MUFPP monitoring framework essentially). The compendium is especially prepared considering one of the specific objectives of the project: increasing cities and regions cooperation efficiency via an enhanced set of indicators (see chapter 2).

The compendium is a source of information for the modulization, implementation and improvement of the project's PIAS, used by all partners active in WP1.

In addition, the compendium provision is also useful in providing information on IMA when pertinent in a series of anticipated activities of co-creation in WP4, WP5 and WP6.

WP1 establishes a group of facilitators for the collection of cost-effective IMA, who maybe staffs in partners' structures or in partners' networks structures, and who are proficient in one or more of the project's 10 focus areas (see figure 1a). The role of these facilitator is to observe and discuss identified CRFS-driven needs of local/regional significance, liaise these needs with the project's monitoring framework of indicators, and to deliver suggestions for the accuracy, alignment and enhancement of the PIAS.

This group of specialists may also be composed of actors of CRFS representing different positions in food supply and value chains.

Facilitators interact with partners according to action plans related to specific activities which can be those embedded in any tasks implemented by work packages 1 to 6 e.g., CRFS labs, capacity building programme, research and surveys, production of reports and specific deliverables. Also, facilitators may promote organic events and activities addressing specifically IMA methods, and invite all partners to attend, including any other interested parties engaged in Cities2030.

Figure 1b – Project Cities2030 focus areas

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Likely all other WP, WP1 aims at fostering synergies with IMA strategies and methodologies practiced in other initiatives e.g., EU-funded projects, etc. These synergies are framed in the project's Synergies action plan (D7.3) and coordinated by the aforementioned group of facilitators.

Cities2030 develops beyond the 6 categories of indicators identified by the MUFPP[3], to enhance the framework of indicators (outcomes, impact, indicators, recommendations, etc.), following two significant drivers: FOOD2030 (4 pillars) and urbanisation processes as such (to meet SDG 11 and UN's New Urban Agenda). Cities2030 ambitions to add a series of categories not represented in the MUFPP monitoring framework, and explore further fine-tuning indicators to relate with vital outcomes, impact and recommendations.

Especially, Cities2030 generate a category of indicators to assess impacts of cooperation between the different actors of the CRFS: cooperation mechanisms efficiency. They are process indicators that reflect the potential to achieve impact in the CRFS complex system. Also, Cities2030 explore generating and assessing the impact of cooperation mechanisms between cities and regions with well-developed CRFS policies and those with less-advanced, to generate guidance and lessons learned, as well as new forms of collaboration, twinning and synergies.

The role of cities in future-proofing the food systems is unanimously acknowledged and encouraged, which puts importance and urgency to cities taking on an agency for food system transformation and actively seizing the opportunity for strengthening urban resilience. Or, to use a catchphrase - turning big societal challenges into opportunities for development, using one problem to fix several others. Behind the catch phrase, there are several barriers for cities to embark on food system transformation, as it is a massive complex to address, let alone putting into an orchestrated, forward action. The macro-narrative of food system transformation must be actionable and the systemic change an accumulated effect of deeply contextualized actions. Cities2030 enable key mechanisms and structure actionable resources to assist cities tackle the following challenges.

Cities2030 continuously promotes participation in the Food Systems Dialogues (FSD), an UN-based global series of facilitated round-table conversations and consultations, that encourage joint action for transforming food systems, to address a series of challenges listed further, with the incorporation of a comprehensive set of key learnings and evidence-based practices, that are facilitated by the FSD. Since their launch in June 2018, 23 FSD events have taken place across Europe and the world, and Cities2030 will create conditions to increase this number by 50 by 16.10.2024.

One of the key outputs of the project is the characterisations of cities engaged in the project considering the aforementioned indicators e.g., out of the proposed monitoring framework indicators, how many are perfectly reflected and covered by current municipal initiatives, how many are partially covered and how many indicators are not addressed at all.

Cities2030 assist cities in defining priorities for interventions per identified needs via a structured assessment with the measurable indicators from the monitoring framework. The collected data provides cities and regions and all remaining actors of the CRFS with pertinent and accurate information, especially which intervention areas and objectives are required. Once the assessment process is concluded, intervention areas are prioritized per an emergency scale e.g., typology of the target groups, number of citizens served, extent of the transformation, etc., and a feasibility scale which is the cost-effectiveness driver, e.g., cost, calendar, resources, etc.[4]

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[3] *The Milan Urban Food Policy Pact Monitoring Framework*, MUFPP, FAO and RUAF, 2019
[4] *Cali's Food Systems: A Diagnostic Synthesis to Determine Priority Action Areas for Sustainable Food Systems*, Aronson S., 2019

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Indicators are identified under WP1, WP3, WP4 and WP5 via characterising the CRFS landscape (starting point at WP3), and consolidated under WP4 and WP5, to feed the prioritization matrix (see figure 1c, below).

Figure 1c – Suggested matrix of prioritisation scale
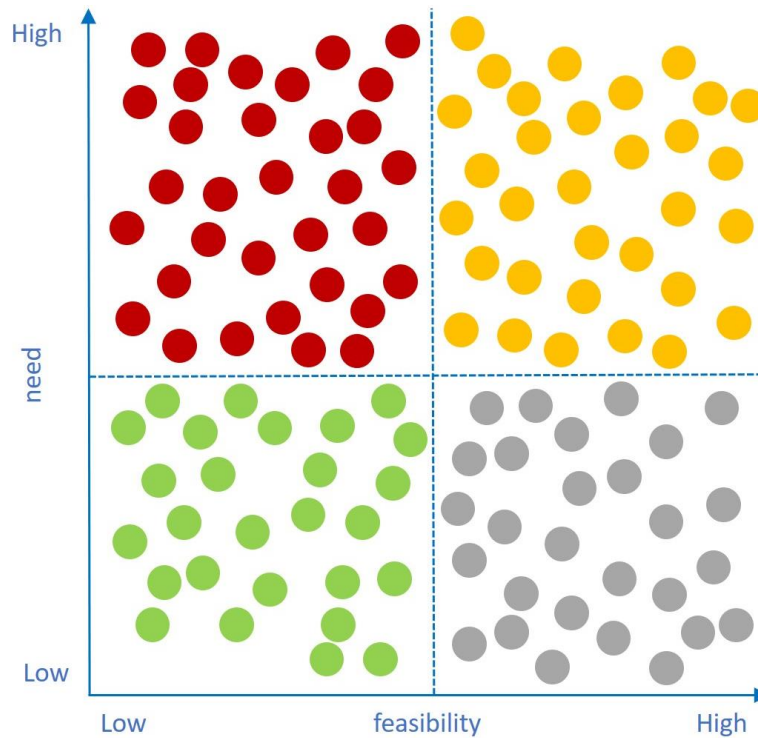
The green dots represent the indicators related to recommended actions and outcome which are not of paramount priority and unlikely possible to achieve within reasonable resources and time. The red dots represent the indicators (actions/outcomes) which are indeed greatly needed but unlikely possible to achieve within reasonable resources and time. The grey dots represent the indicators (actions/outcomes) which are not of paramount priority though likely possible to achieve within reasonable resources and time. The orange dots represent the indicators (actions/outcomes) which are of vital importance and which are possible to achieve within reasonable resources and time.

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2. SOURCES FOR INDICATORS

There are a number of indicators assisting governing bodies (private or public) monitor and assess food systems and ecosystems and specially CRFS, most of them related to food security. A number of bodies actively contribute to delivering these indicators such as the UN-related World Food Programme, World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), the World Bank and most of nations' governing agencies [5].

The UN-related Food and Agriculture Organization (FAO) develops the Food Insecurity Experience Scale (FIES) [6] and the prevalence of undernourishment (PoU, SDG 2, indicator 2.1.1) [7]. The FAO together with aforementioned bodies delivers the Food Security Outcome Monitoring [8] and a series of supporting reports such as the yearly State of Food Security and Nutrition in the World (SOFI) [9].

Cities2030 draws from the mechanisms and approaches practised by these organisations to frame food-related needs to generate a food system and ecosystem taxonomy that will feed the project observatory The "CRFS Intelligence Lab", established at UNIVE (P1).

Today, an increasing number of bodies contributes to defining and structuring food indicators with a more holistic approach incorporating a larger number of impact areas such as production, behaviours and waste.

Such bodies are distributed in the society at large and represent government agencies and the private sector. For example (non-exhaustive) the International Panel of Experts on Sustainable Food Systems (IPES-Food), an independent panel of experts, the Local Governments for Sustainability (ICLEI) an international organization of governments (local, regional, national), the Economist Intelligence Unit (EIU) with the Barilla Center for Food and Nutrition, an initiative from the private sector, Eurocities and EU-funded structures such as Climate KIC and EIT Food hubs (to mention but these two).

Cities2030 engages these bodies to creates synergies with developing and anticipated activities, examines frameworks, approaches and methodologies to uptake all pertinent information and experience, and to secure accuracy and result-driven mechanisms for the production of the project's system thinking framework. The MUFPP provides a monitoring framework (MMF) organised in 6 categories, outcomes areas (impact), recommended actions and 44 indicators that may be compared to other factors practiced by comparable initiatives.

Both UN's SDG 11 [10] (to simplify for other SDG are applicable) indicators 11.3 (urbanisation, land consumption), 11.4 (heritage) and 11.6 (waste) and UN's New Urban Agenda [11] comparable indicators are represented in the MMF, however could be subject to more inclusive integration, namely in terms of urbanisation as such. Urbanisation is partially represented in the category governance, production (land e.g., soil consumption) and waste. The Figure 2a (next) illustrates part of these indicators.

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[5] *Diet and nutrition, The Norwegian Institute of Public Health*, 2020
[6] *The Food Insecurity Experience Scale*, 2020
[7] *the Prevalence of Undernourishment* (PoU, SDG 2, indicator 2.1.1), 2020
[8] *Food Security Outcome Monitoring Q3 2019*, 2019
[9] *State of Food Security and Nutrition in the World 2019*, 2019
[10] *SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable*, 2020
[11] *The New Urban Agenda (Habitat III), UN*, 2017

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Figure 2a – Summary comparative table of food-related indicators

	GV	DI	SE	PR	DI	WA	SC	RE	CI	CL	IT
MUFPP	●		●		●	●					
EIU		●				●					
FAO FIES		●	●								
FAO PoU				●							
ICLEI*			●	●	●			●		●	
CKIC* *		●	●	●	●	●	●	●	●	●	
EITLF* *	●			●	●	●					●
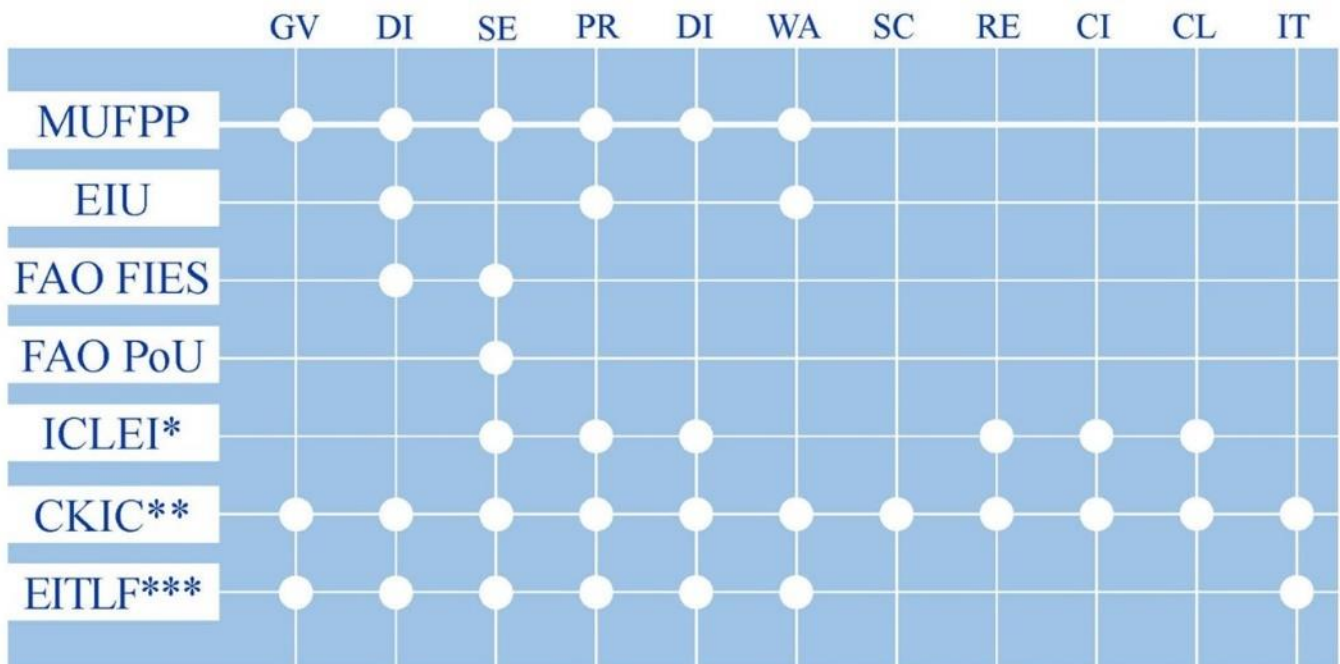
GV: food governance | DI: sustainable diet and nutrition | SE: social and economic equity | PR: food production | DI: food supply and distribution | WA: food waste
SC: food security | RE: resilience | CI:circularity | CL: culture and education | IT: digitalization and connected environments

*ICLEI 5 Pathways [12] (extrapolation).
**Climate KIC Food value chains strategy [13] (extrapolation).
**EIT Food Strategic Innovation Agenda (2021- 2027) [14] (extrapolation).

Cities2030 draw key learnings from the MUFPP and leverage developing experiences from pilot cities to bring accuracy and result-driven mechanisms for the co-creation of the policy and living labs, and for the Single Click CRFS Platform (S2CP). However, Cities2030 develops beyond the 6 categories enhancing the framework (outcomes, impact, indicators, recommendations, etc.) with two key pathways: nature-based solutions (NBS) and urbanisation as such. Still Cities2030 plans to keep the same number and nature of categories, only further fine-tune indicators and relates with novel outcomes, impact and recommendations. A number of NBS approaches already deliver evidence [15] and urbanisation is at the very core of cities thus well documented and piloted.

Finally, Cities2030 proposes to digitise the MUFPP framework, whilst deploying pilots in cities per the MUFPP approach, to transform this framework in an actionable mechanism, the Single Click CRFS Platform (S2CP). The S2CP key function is to assist cities governing bodies secure the management of sustainable CRFS. To that end, the S2CP delivers CRFS indicators that will be displayed in a dashboard (visualisation) adaptable to all pertinent devices and media: smartphones, tablets, laptops, and last but not least digital monitors throughout the city, to secure transparency and inform citizens on the status of their city's food system in real-time. S2CP serves two key purposes, first provide a collective information gathered from all points of the CRFS, delivered by all agents of the CRFS, second data-driven management instrument to assist in decision-making processes by all agents of the CRFS, thus cities as well.

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[12] *ICLEI 5 Pathways*, 2017
[13] *Climate KIC "Food value chains strategy*, 2019
[14] *EIT Food Strategic Innovation Agenda (2021- 2027)*, 2018
[15] *Cities with Nature*, ICLEI, 2019

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3. IMA for CRFS

3.1 Drivers

The IMA methods practices sought must be sourced from food system environments (if not CRFS entirely). Cities2030 considers cost-effective drivers such as costs associated with data gathering and compilation, examination and categorisation, understanding, and overall management. Therefore, these drivers also are the criteria to identify methods suitable for the present compendium, which are suggested in the table 3.1a (below).

Table 3.1a – Suggested criteria for cost-effective IMA methods selection

Criteria	Understanding	Examination/categorisation	Data collection process	Management
Purpose: targets a pertinent component of the CRFS	The data and information environment are pertinent for CRFS frameworks	Facilitate the quality of the examination and categorisation process via non-biased data		
Transparent: easily understood or recognised by all users, especially individuals from vulnerable groups				Abides the four foundational principles: findability, accessibility, interoperability, and reusability (FAIR) [16]
Gender neutral: avoids bias towards a particular gender [17]		Facilitate the quality of the examination and categorisation process via non-biased data		
Inclusive: facilitates CRFS multi-actors' contribution, especially individual from vulnerable groups		Facilitate the quality of the examination and categorisation process via multi-actors inclusive engagement	Facilitate the collection process via multi-actors inclusive engagement	
Scale: involves the largest number of CRFS actors, especially citizens (households)				
Swift: data is easily gathered, provides timely and seamless portability of information		Facilitates swift and simple processing	Facilitates swift and simple collection	
Clarity and insight: the data's information environment is comprehensive and facilitates clarity and understanding [18]	The data and information environment are pertinent and displayed clearly to facilitate its understanding	The data and information environment are pertinent and displayed clearly to facilitate examination/categorisation		
Accessibility: facilitates the identification, collection, and use of data effectively [19]			Facilitates accessibility to ensure optimum and swift collection	
Interoperability: facilitates data interoperability [20]		Facilitate the use of data via different information platforms, equipments and applications (software) to access/exchange/integrate throughout a maximum number of scopes (local, regional, etc) boundaries, etc.	Facilitate the use of data via different information platforms, equipments and applications (software) to access/exchange/integrate throughout a maximum number of scopes (local, regional, etc) boundaries, etc.	Facilitate the use of data via different information platforms, equipments and applications (software) to access/exchange/integrate throughout a maximum number of scopes (local, regional, etc) boundaries, etc.

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[16] *FAIR data*, 2021

[17] *Adding a Gender Lens to the Milan Urban Food Policy Pact Monitoring Framework*, Young L. et al., in *Urban Agriculture magazine*, 2020

[18] *Code of Practice for Statistics*, UK Statistical System, 2021

[19] *International Open Data Charter*, 2021

[20] *Introduction to data interoperability across the data value chain*, Morales L. et al., UN Statistics Division, DESA, 2019

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Table 3.1 proposes a set of criteria to select pertinent methods of IMA which will be examined to assess the impact of the innovations generated by WP4, WP5 and WP6, whereas the project's IMA method which is entitled 'project impact action strategy' (PIAS) assesses the project's impact as such. The framework of implementation of the PIAS is defined in the materials delivered for deliverable D1.2 entitled with the same name. These criteria are interlinked with 4 key dimensions understood as facilitating the use of the method and the data collected.

3.2 Multi-actors ecosystem

Food systems actors are substantially encouraged to engage together to drive innovation actions by a vast number of pan-European and international bodies. Multi-actors approaches to tackle needs and foster transition towards sustainable food systems is among the highest priorities in the EU globally, and especially when considering EU-funded initiatives.[21] These actors are mentioned as "*food producers, processors, retailers, procurers, food service industry, nutritionists, universities, SMEs and local/regional business, educators, behavioural and social scientists, museums/science centres, professional associations, innovative ICT companies, banks, venture capitalists and other sources of investment, NGOs, media and citizens*"[22] and effectively gathered in the project sphere via the partners and their respective networks.

Cities2030 implements CRFS policy and living labs to generate citizen-driven, inclusive and co-creation and co-production processes, considering labs as "A Living Lab is an orchestrator of open innovation processes focusing on co-creation of innovations in real-world contexts by involving multiple stakeholders with the objective to generate sustainable value for all stakeholders focusing in particular on the end-users"[23]. In that way, the initiative is a cross-sector and multi-actors effort to assist cities and regions implement sustainable CRFS, and achieve specific objectives. Cities2030 supports cities to overcome existing barriers to food system transformation and to develop integrated, sustainable and safe urban food system policies and strategies.

Cities2030 build upon evidence and intelligence gathered by cities and regions leading CRFS transformation to generate actionable instruments to deploy and multiply good practices to other cities that are aiming at prioritizing their policy agenda on food system transformation. Among these instruments are the Cities2030 CRFS Policy Labs (CRFS-PL) and CRFS Living labs(CRFS-LL). For example, "Agrotopia", a living lab initiative by Inagro in Belgium (P6) bringing evidence that agriculture and industry are compatible when it comes to land use with a sustainable approach[24]. Agrotopia is structured to facilitate co-creation processes to innovate with a multidisciplinary and multi-stakeholder approach to ideate and deliver high-tech glass and urban horticultural concepts. Many CRFS-related projects (such as Fit4Food2030[25]) consider the notion of platform as a sustainable, multi-stakeholder ecosystem investigating research priorities for sustainable and improved food systems. However, some of these projects lack of technological support to facilitate the implementation of innovation actions and policies, and the WP6 addresses this need via this S2CP.

Cities2030 contributes to engage the agri-food community in the development of solutions to remove the barriers to adoption of digital technologies, providing a data-driven ICT platform which derives value for multiple actors from the data collected throughout the food chain: the S2CP. The S2CP is a data-driven CRFS management platform for data collection, analysis and representation in multiple interfaces.

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[21] *Multi-actor projects: scientists and farmers creating solutions together*, The agricultural European Innovation Partnership (EIP-AGRI), 2019

[22] *FOOD 2030 - Empowering cities as agents of food system transformation (CE-FNR-07-2020)*, Funding & tender opportunities (SEDIA) platform, 2019

[23] U4IoT_LivingLabMethodology_Handbook.pdf

[24] *Greenhouse Agrotopia study report design phase*, 2017

[25] FOOD 2030 Platform, project FIT4FOOD 2030, H2020 ref. 774088

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This platform provides a key technological asset in data capture and storage and information analysis, and allows stakeholders to use a more optimal collaboration and monitoring of processes and data following the maximum of privacy and integrity. Collaboration services will be implemented to enable S2CP decision support system to report increases in stakeholder's collaboration performance levels and decision-making accuracy. Particularly, a service-based open collaboration space will be incorporated, to be used by Cities2030 participants to improve their multi-stakeholder dialogue processes. In this space, blockchain technology will be employed to provide some proof of concepts of token-based monetization processes, and reflect multi-stakeholder interaction in a reliable and transparent way. Blockchain technology, in this sense, has opened the door to new applications and paradigms to rebuild trust in decentralized data governance in the form of digital authentication, tracking of data property rights and distribution of goods, reliability of information and the provision of digital incentives to food stakeholders.

WP3 implements the participatory (multi-agents) design and production of policy and living labs. WP3 liaise with WP5 specifically, within which a marketplace for optimization of multi-stakeholder dialogue processes will be provided, in which blockchain will be employed to provide some proof of concepts of token-based frameworks and processes, in a reliable and transparent way. Commonly, cities do not have a clear business case from which to strategize and build upon. Cities2030 provides cities' specific roadmaps are dynamically generated taking direction from policy (vision/ goals) and bottom-up input from experimental and multistakeholder interaction and joint action (solution/ results). This dialectic is key to the resilience roadmap. However, being too complex to draw out a strategy for simple implementation; the opportunities are rather exposed with the multiple perspectives and since prototyped and tested for viability and desirability.

Cities2030 practices a multi-actor approach at 'macro', 'meso' and 'micro' levels, exploring, testing, scoring and validating local and regional supply and value chains, introducing the concept of 'food environment' e.g., supply and value chains ecosystems. The 'macro' level connects with production quantities which are adjusted on a "right amount of the right source" basis. The meso level links with sustainability, resources' use efficiency, productivity, quality, profitability and the social environment (e.g., employment and livelihood) of the comprehensive value chain production system. The micro level relates with innovative nutraceutical frameworks supported by 'omic' technologies e.g., proteins (proteomics) and metabolites (metabolomics), characterisation of functionalities, community data examination (diet habits, regional and local food belts, circularity, etc.) and combines information with other sources of data.

All-in-all, Cities2030's multi-actors approach generates a dynamic ecosystem to provides an effective and cost-effective platform to facilitate an accurate and efficient impact monitoring and assessment process.

Cities2030 builds upon and combines a citizen-driven demand (quality, transparency, safety) policy-driven demand (Green Deal) and business-driven demand (productivity) to deliver pioneering solutions, and test on the ground social-driven innovative solutions which ensure food systems are more circular, transparent, sustainable and socially appropriate. In that way, Cities2030 practices the horizontal integration of all stakeholders involved in the value chain from producers to citizens.

Cities2030 proposes an innovative CRFS multi-actors' driven IMA framework to facilitate efficiency and accuracy, and ensure a systemic approach with heightened consistency to facilitate the delivery and improvement of sustainable CRFS, that are more accurately adjusted to human and planetary health, to better align local and regional supply and demand, enhanced accessibility to all citizens, significantly decreases (or even ends) food waste and losses, and substantially limit or mitigate environmental damage via bioremediation and circular systems.

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4. COMPENDIUM

Considering the provision found in chapters 1, 2 and 3, the compendium (gathering methods proposed by the partners) aim at providing pertinent data to generate the project's IMA methods. Here, partners register existing and applicable good practices of their knowledge, related to impact monitoring and assessment, with actually may target the largest spectrum of CRFS, considering the project's 10 focus areas (see figure 1b, chapter 1). Therefore, partners register here IMA that may provide structured feedback (via the assessment) from a targeted actor (or targeted actors), not strictly related with its role/position in the CRFS.

P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
1	UNIVE	https://www.cbnagro.tech/ CBN AgroTech hardware and software solution. It is an active startup in the grain industry based in Romania. Founded by two brothers, it aims to technologize agriculture through silo sensors and revolutionize the field. The mission is not only to maximize post cultivation crops but also maintain quality in the entire supply chain. The app solves problems of humidity, heat and storage conditions by covering a complete traceability from harvesting to the table.	The startup has developed a ventilation algorithm which bases on data to preserve agricultural products in storage. The app is a software mix with hardware equipment compatible with temperature sensors already installed in the silos and connect the fan automation system. Basically, farmers can leave the silos on autopilot, directly from the mobile phone. The app helps in grain management by saving temperature data, analysing the data evolution over time and receiving reminders to prevent forgetting temperature readings.	The app is in line with the categories of "food supply and distribution" and "waste management" of the MUFPP.	The start-up's mission is to help farmers store safely and therefore to not lose quality or quantity, allowing goods (grains) to keep for 6-12 months and sell when price is more advantageous and allows obtain a profitability between 10% and 12%, compare if they would sell immediately after harvest. More importantly, by aggregating and correlating the data, the app provides solutions that lowers waste by 2-3%, lowers risks and electricity costs. These storing solutions from preservation to inventory and transportation benefit the population and environment.	The app can be accessed from all devices (tablets, PCs and smartphones) in any country. Smartphones can be either running Android or iOS; while computers can be using any web browser. The app offers a free version with base solutions and an annual subscription version providing a full software solution.
2	EPC	https://edoapp.it/ EDO sai cosa mangi? (Know what you eat) It's a smartphone application created by an Italian Incubator of start-up based in Emilia Romagna region in cooperation with the	The algorithm at the base of the app takes into account the ingredients and nutritional values embedded in the bar code of a commercialised product and calculates a "tailor-made" rating, aligned with the personal parameters defined by the	The app is on line with the Sustainable diet and nutrition Action of the MUFPP.	The aim of this app is to offer consumers a tool to gain greater awareness of what they eat and to have an indication of the quality of the products from a nutritional point of view, based on exclusively scientific criteria. The algorithm is	The app is available on Google Play and can be used in many different context and countries

P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
		University of Bologna – Food science and Technologies- (Cesena lab) to facilitate the understanding of food labels, summarizing the information and reworking it in a clear but scientifically accurate way to help users in gaining greater awareness of what they eat	user (i.e., vegetarian, celiac, sporty or sedentary lifestyle, pathologies, etc.). The app provides indications of the quality of the products from a nutritional point of view, based on exclusively scientific criteria. The nutritional data are evaluated in relation to average daily needs, while for the ingredients characteristics are taken into account the most recent studies of the effects on the human body and on health.		not polluted with any commercial consideration. Users can contribute to feed the data base adding a missing product by simply sending 3 pictures of the products to the company. All basic functionalities are available in the free version, which is customizable with the eating habit and requirements of every such as age, sex, weight and type of diet (i.e. omnivore, vegetarian and vegan), allergies or pathologies, etc. According to the users' choices, EDO, suggests also healthier alternatives to the investigated product	
5	IAAD	'Alo Gıda 174' (Allo 174 Food Line) http://www.alo174.gov.tr/ works with standard landline/mobile systems and the Internet via the App WhatsApp. The system is citizen-based and driven by food safety. It was established to enable consumers to reach relevant authorities easily and effectively in all kinds of notices and complaints regarding food at retail level, directing the communication to a single center, swiftly returning to the consumer, and tracking the result. In this process, citizens also participate in the works carried out by the competent authorities. One of the main focus area regarding IMA is on	The method is created to target citizens at retail level, and proposes no specific links to the MUFPP Monitoring Framework. The method is practiced by a governmental body, but could as well be adjusted for local and regional levels e.g., cities and regions. But such a system can actually be set for actors of the CRFS in a systematic way, to the extent it is structured with the MUFPP categories. However, Cities2030 set of indicators goes beyond the MUFPP and integrates additional indicators that should be incorporated. The possible best applicability besides the phone lines	The method is created to target citizens, thus consumers e.g., focus area "markets" and, to some extent, "consumption" (at retail level), therefore the applicable MUFPP indicators are centred in the category "food supply and distribution".	Engaging all actors of the CRFS into a single system to collect data, and especially citizens at retail level, proposes a set of innovative dimensions related to societal engagement as such (societal/social innovation) and to the ICT dimension, integrating a set of technologies (blockchain, machine learning, data governance) belonging to the state of the art and offering these technologies as a set of services for easy interaction by food systems managers.	Phone lines and the Internet are currently harmonised in the EU27 and to some extent at pan-EU level. One of the most relevant EU policies (strategy/directive) to support the transferability is the EU Single Digital Market. https://digital-strategy.ec.europa.eu/en/policies

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P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
14	SLEAN	Individual consumer's Food Carbon Footprint provided by the retailer (S Group, Finland) Finnish food retailer, S Group's, mobile app tells individual consumer's food basket climate impact. The S Group is a large cooperative and the owners of the cooperative (2,4 million people) can upload the application from AppStore or Google Play. The carbon footprint calculation is based on the individual customer's true purchase information. The carbon footprint calculator does not take into account the climate impact of individual products, as reliable and comparable product information is not yet fully available. However, the calculator shows with sufficient accuracy the magnitudes of the climate impacts of the product groups e.g., agriculture products, meat, fish, vegetables, bakery, and their effects on their own carbon footprint.	The mobile application is addressed only to S Group's customers who are also S Group cooperative's owners.\n\nThere is no direct link to the MUFPP Monitoring Framework.\n\nThe retailers' engagement in the Food System transition is necessary. Retailers have a major power and tools to influence consumers. They can educate and facilitate consumers by responsible marketing efforts to choose more sustainable options e.g., local food, organic food, national food, seasonal food, less meat, more plant-based food.	The method is created for S Group's specific "owner" customers, on an individual level, therefore there are no applicable MUFPP indicators.\n\nHowever, it would be interesting to explore and test how willing the food retailers and sellers are to provide accumulated data on food consumption. The consumer behavior, over time, could be monitored by indicators grouped e.g., by product groups, premises, cities, regions. The indicators are e.g., volume, the origin country of the food, organic/non-organic, logistics route etc.. If the retailer has a customer account system, then the analysis based on the customers' background information extends the view.	The big data that is collected by food retailers' give a fact-based view into consumers' consuming behavior. The data is a valuable asset for retailers. They have mainly used the collected data for internal purposes e.g. selection and inventory planning. However, the retailers have faced the pressure of enhanced social responsibility. They have to do their share. One way to promote sustainable and healthy food is to provide feedback and information to consumers about their consuming behavior. The indicators can reveal, for example, the consumer's preferences regarding meat and plant-based food.	The mobile application is addressed only to S Group's customers who are also cooperative owners.\n\nThe method itself is applicable to any food retailer and seller that can merge the data of food items, cash register system, and customer identification.
16	TTZ	The methodological basis of the "Municipal Sustainability Compass" https://www.fh-mittelstand.de/fileadmin/pdf/Sonstiges/00_KNK-Leitfaden_komplett_2015.pdf transparently and systematically presents the evaluation of the various sustainability criteria in relation to a specifically examined legislative	The methodological basis of this guide is a study by the Fachhochschule des Mittelstands in Bielefeld (FHM), in Germany, in March 2013 and proposes to develop from a local starting point (district) then transferred to the national level (including legislation) for evaluating municipal measures and projects. The result of this	This methodology can be practised for the sustainability categories of the the MUFPP monitoring framework.	The methodology could be fully digitalised via the integration of Cities2030 instruments, especially the Social Spaces for Research and Innovation (SSRI), the sentiment analysis for Twitter and the geospatial CRFS web services	The methodological transfer of the Municipal Sustainability Compass model should reflect a proposal for a municipal sustainability strategy to be tested on the basis of a concrete case study.

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P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
		project. A look at the National Sustainability Compass makes it clear that the political dealing with the measurements answers to two questions : 1. What criteria are used as a basis for the concept of sustainability? 2. Which method is used to make these criteria measurable ?	transfer process is the Municipal Sustainability Compass for determining and presenting the sustainable benefits of these municipal measures and projects.			
19	SINNO	SSRI-MAA tool aims to register and monitor the innovation at a well defined Social Space for Research and Innovation, covering actions, action plans, stakeholders and their representativeness. (web link soon)	The Tool, currently in development phase, specifically allows to monitor and assess impact of the activities performed and the participation of the actors in any existing or developing CRFS Lab	The Tool will provide Context, Policy & Performance indicators catalogue and monitoring KPIs concerning Pilots, Projects and Actions: - KPIs per SSRI pillar (policy, user, ….) - KPIs scaling. - Global KPIs, (SDG, EU2030,…) if they are clearly linked with local indicators	The MAA Tool brings an untapped dimension in the joint monitoring and assessment of the progress and maturity of Living and Policy Labs allowing the management of stakeholders linked to their representativeness and daily work reported or monitored.	The MAA Tool is part of the WP6 platform and is available for use by all the CRFS Labs of the project.
20	UPM	These ETSI standardized method focus on monitoring the evolution of a city towards an even smarter city. The city indicators may be used to show to what extent overall policy goals have been reached or are within reach. With a starting point in the smart city definition, and taking into account the wishes of cities and citizens with regard to smart city indicators, the indicators are arranged in an extended triple	Themes such as people, planet, prosperity, governance, and propagation are considered, considering subthemes conforming to major policy ambitions have been identified. Under these subthemes in total 73 city indicators have been selected. Indicators are sorted in a table, which considers applicability formulas, required data to measure	Regarding MUFPP framework, this method considers local food production, resiliency in food networks, and food consumption. Thus, these indicators are related MUFPP's Food production and Food supply and distribution.	Sometimes, the indicators used in the city's evaluation are not in line with the city goals. This can, for instance, contribute to a poor evaluation of future city developments, that are evaluated according to indicators that have nothing to do with what was idealized by the city managers or planers. This evaluation framework is a means to quantify objectives and provide the necessary tools to	The potential for transferability to CRFS is scarce, since the indicators are more intended for the general development of a city, and not particularly towards its food systems, so only some indicators can be applied. However, the assessment framework can be used since it requires that the information necessary to measure these indicators be defined very well, Expected data source, expected

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		bottom line sustainability framework, https://www.etsi.org/deliver/etsi_ts/103400_103499/103463/01.01.01_60/ts_103463v010101p.pdf	this indicator, expected accessibility and data availability.		monitor the indicators and evaluate their improvement factors.	availability, collection interval, expected reliability, expected accessibility, etc.
25	FFI	The LocalMultiplier 3 (LM3) method allows community, municipality, or organisation to measure how their spendings generate local economic impact and benefit to communities. (incl.difference of using local or non-local suppliers impact on local economy) https://www.lm3online.com/	This tool examines the impact of cash flows on the local economy. The analysis takes into account both the population's set of choices (where and how to spend financial resources) and local government considerations in the context of public procurement (opportunities to win local producers and service providers in the announced procurements).	Method could be used for the MUFPP framework of actions' categories Food Governance and Social and economic equity.	LM3 doesn't directly impact innovation potential, but it helps to identify where changes need to be made to improve the impact.	Tool explores the multiplicative effect of circulation of money in a specific area on a local scale; it can be used in different contexts and scopes.
26	GGP	FoodShare is a digital platform for connecting food donors and food recipients that use food for final consumption or for processing in order to produce bio-based agricultural inputs (fertilizers). This platform is developed within Pilot 9 in the H2020 Ploutos project by partners from Serbia (FSH) and North Macedonia (GGP). It is an ongoing project 2020-2023. The aim of the Pilot is to Facilitate the transfer of surplus food from farms to socially disadvantaged groups, by aligning logistics and processes. https://foodshare.foodscalehub.com/	This digitally supported solution can be used for developing a model for food sharing, reducing food waste and greenhouse gas emissions, that can be implemented on a wider scale (national or regional). The current functioning of this solution uncovers different categories of challenges that are of a significant value for future development of solutions that have the purpose of solving food waste. There is a possible link to the MUFPP Monitoring Framework concerning the areas of "food waste" and "social and economic equity".	The FoodShare platform is targeting Donors (small businesses and corporations in the food industry, producers, processors, farmers, retailers, wholesalers, distributors) and Recipients (non-profit organizations and local assistance programs that redistribute the food to those in need, soup kitchens, SOS children's villages, homeless support services, day care and addiction rehabilitation centres, and more). The applicable MUFPP indicators can be in the categories of "food waste" and "social and economic equity".	This innovative solution presents a good example of using digital technologies in connecting different stakeholders in the agro-food value chain in the process of solving one very crucial issue in the sustainable food systems and that is food waste.	Considering the simplicity of the solution, it can be easily adapted for different types of users across the stakeholders in the agro-food value chain.

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P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
27	AGFT	FoodShare is a digital platform for connecting food donors and food recipients that use food for final consumption or for processing in order to produce bio-based agricultural inputs (fertilizers). This platform is developed within Pilot 9 in the H2020 Ploutos project by partners from Serbia (FSH) and North Macedonia (GGP). It is an ongoing project 2020-2023. The aim of the Pilot is to Facilitate the transfer of surplus food from farms to socially disadvantaged groups, by aligning logistics and processes. https://foodshare.foodscalehub.com/	This digitally supported solution can be used for developing a model for food sharing, reducing food waste and greenhouse gas emissions, that can be implemented on a wider scale (national or regional). The current functioning of this solution uncovers different categories of challenges that are of a significant value for future development of solutions that have the purpose of solving food waste. There is a possible link to the MUFPP Monitoring Framework concerning the areas of "food waste" and "social and economic equity".	The FoodShare platform is targeting Donors (small businesses and corporations in the food industry, producers, processors, farmers, retailers, wholesalers, distributors) and Recipients (non-profit organizations and local assistance programs that redistribute the food to those in need, soup kitchens, SOS children's villages, homeless support services, day care and addiction rehabilitation centres, and more). The applicable MUFPP indicators can be in the categories of "food waste" and "social and economic equity".	This innovative solution presents a good example of using digital technologies in connecting different stakeholders in the agro-food value chain in the process of solving one very crucial issue in the sustainable food systems and that is food waste.	Considering the simplicity of the solution, it can be easily adapted for different types of users across the stakeholders in the agro-food value chain.
32	VIZ	**Sustainable Food Cities (SFC) Network**—a network of over 55 cities in the UK - is a unique community of practice driving food system change and a step forward in scaling up and out urban food strategies in a national context.They developed multiple resources that helps councils and community food initiatives to make the case for and measure their progress towards more sustainable and secure food systems. For example, to help stakeholders on their journey towards becoming a Sustainable Food Place, they have collated examples of What you can do, Guides and toolkits, Local policy,	The SFP Food Partnership and Strategy Toolkit includes resources which are open and available online. For example, the Good Policy for Good Food shows the wide range of policy levers that local authorities have at their disposal to support local food systems and embed that change for the long term. The **toolbox of 29 policy levers** is illustrated by clear practical examples of where these have been successfully used, inspired by the achievements of Sustainable Food Places Network members and beyond. The guide is by no means exhaustive but tries to paint a relatively comprehensive picture of	This practice could be relevant for all MUFPP objectives because the areas covered are heterogeneous: Food Governance and Strategy, Good Food Movement, Healthy Food for All, Sustainable Food Economy, Catering and Procurement, Food for the Planet	It is intrinsically innovative because it is designed to promote and facilitate innovation in the food arena. The possibility to get access to a wide range of resources, which are easy to use and based on direct experiences of local communities, is a potent way to promote innovation at a different levels and by including the stakeholders	The website is available and reachable, the resources are well organised and it is to find them

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P	Partner	Method outline and weblink	Applicability	Indicators per the MUFPP	Innovation potential	Transferability potential
		Evidence of impact, Case studies, Webinars and a directory to Who can help	existing local food policy levers and best practice. From the adoption of healthy and sustainable food policies for the local authority, to making best use of Supplementary Planning Documents, Street Trading Policies, Section 106 Agreements, clauses on use-types in the Local Plan, adopting the Living Wage, using Meanwhile Leases, business rate reliefs and more. It is regularly updated			

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5. ROADMAP TOWARDS 2030

5.1 Specifics on impact

WP-1 delivers a digitally enhanced "Impact Monitoring and Assessment Tool" (IMAT), to facilitate and accelerate the identification, monitoring, assessment and characterisation of the project Cities2030's overall impact, considering a precise framework detailed in the miscellaneous outputs produced in the scope of the project.

This results in a series of information ranging from text content to cartography-based illustrations, on specific project activities, within which we find the partners' cities pilot experiments. What are cities pilot experiments? They are actually: (i) a "demonstration" (futureproof) of an innovation to answer to FOOD2030, comprising co-benefits, and; (ii) a city-scale description of that demonstration as a "progress" towards FOOD2030 e.g., how the innovation effectively answers to identified needs, considering the resources involves (infrastructures, human efforts, products and services, etc.).

This context places Cities2030's IMAT in a unique position to serve as a basis for an advanced "automated system", comparable to the one mentioned in the topic "*HORIZON-CL6-2022-COMMUNITIES-01-04: Social innovation in food sharing to strengthen urban communities' food resilience*" and referred as "*automated systems to search, collect and – especially – update existing urban and peri-urban (food sharing) initiatives*".

This matter should be explored together with Cities2030's synergies network, to co-create a working group who could develop specifically on this concept, and connect with all applicable platforms as well, for instance independent bodies, EU-UN agencies frontrunners as a whole, and referred in the project description as: the Milan Urban Food Policy Pact (MUFPP)[26] and EUROCITIES WG Food[27], the International Panel of Experts on Sustainable Food Systems (IPES-Food)[28], 100 Resilient Cities, C40 Cities, Climate KIC, EIT Food, EUI, ICLEI, IFOAM, IPES Food, FAO, the Future Food Institute, EPI-Agri, the Nordic Food Policy Lab, RUAF, Slow Food Europe, Sustainable Food Cities, and more.

Also, considering the recently established EU MISSIONS, the project Cities2030 could also liaise with the IBF Microbiome Working Group, the agricultural European Innovation Partnership (EIP-AGRI), the Agricultural Knowledge and Innovation Systems (AKIS), the European Network for Rural Development (ENRD), the Directorate-General for Agriculture and Rural Development (DG AGRI), the Food and Agriculture Organization of the United Nations, to name but these few, and more globally, all the actors of the EU Mission: A Soil Deal for Europe[29].

Existing "CRFS-related" platforms would be an added-value on this matter, such as the Food Systems Dashboard, which interlinks information from a vast series of sources to provide users a comprehensive viewpoint of specific food systems. Users can evaluate components these food systems across countries and regions. Most prominently, users may as well recognise and prioritize pathways to sustainably improve one of the key pillars of the FOOD2030 policy: the diets and nutrition component of their food systems.[30]

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[26] The Milan Urban Food Policy Pact, the Milan Urban Food Policy Pact, November 2021
[27] "Food cannot be treated as every other commodity", Dario Nardella (President of Eurocities and Mayor of Florence), EUROCITIES, October 2021
[28] Towards a common food policy for the European Union, International Panel of Experts on Sustainable Food Systems (IPES-Food), February 2019
[29] EU Mission: A Soil Deal for Europe, the European Commission, March 2022
[30] EU Mission: A Soil Deal for Europe, the European Commission, March 2022

Deliverable D3.7 – 100 innovation frameworks for CRFS
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Finally, we suggest to connect the project IMAT with the Half Double methodology. This method[31], supervised by BIO (P5), is all about placing an extreme focus on three core elements: (i) impact, maintain focus on deliverables yet enhance focus on visibility and internet presence (maximum audiences outreached) and effect (maximum individuals, organisations and communities practicing the project actionable results); (ii) leadership, sustain professionalism and increase focus on active involvement and leadership of project participants and actors of the food systems and (iii) flow, sustain focus on optimisation of resources and enhance focus on Cities2030 result-oriented progression. BIO (P5) liaise with the Half Double Institute to integrate the practices in the project activities.[32]

5.2 Roadmap for 2030

Together with studies and assessments, the project Cities20303 highlights that:

a) food system transformation is imperative, forcing to robust, science-driven monitoring to oversee public and private resolutions and, especially, assist those cities and regions;

b) monitoring the entire food systems and the interfaces between their functionalities is paramount to foster emergent policy adjustments necessary to meet the FOOD2030 priorities, related EU-UN agendas and ultimately the Sustainable Development Goals (SDG);

c) a shared vision and definition of what is "constitutes" a food system must be explored to facilitate characterising a framework for an overarching monitoring strategy comprising all dimensions and their respective constituent indicator scope, whist considering current theories of change such as the concept of food "environment";

d) a multi actors mechanism is necessary to structure a digitally enhanced tracking system to determine food systems performance and liability comparable to the S2CP.

Cities2030 proposes to further the impact monitoring and assessment (IMA) dimension of food systems via a set of distinct measurements functions, outlined in the table 5.2 (below), that must meet the FOOD2030 priorities.

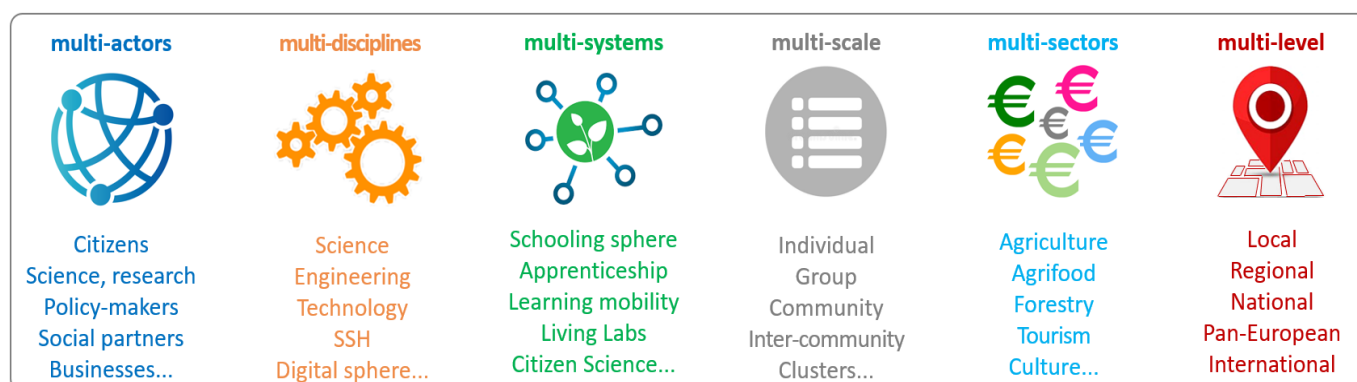*Table 5.2 – Suggested measurement functions for cost-effective IMA*

Function	Rationale
Typology (taxonomy)	Typologies are a valuable and practical classification methodologies to characterise similarities and differences between identified functionalities of food systems, whilst lessening the analytical complexity inherent to the proteiform orders and sui generis nature of food system dynamics. Typology design allows to address this heterogeneity which characterise food systems considering a limited number of complexions such as rural and traditionalist, unofficial and developing, promising and diversifying, innovating and officialising, mechanical and cooperative, to name but these few. Five food system types are identified: rural and traditional; informal and expanding; emerging and diversifying; modernizing and formalizing; and industrial and consolidated. Patterns across the five system types in key outcome variables align with narratives provided by the food systems and nutrition transition literature, demonstrating the usefulness of this classification method.
Social Sciences and Humanities	The Social Sciences and Humanities (SSH) functionalities of food systems maybe connected to participatory approaches regarding monitoring and evaluation to facilitate social knowledge, individual and communities-driven acceptance, and upscaling of bottom-up methodologies. Using cognitive mapping and social network analysis via the methodologies practiced in the project e.g., structuring Social Spaces for Research and Innovation (SSRI) via multi actor approaches (MMA), community of practice as an open collaboration space, the CRFS Labs as such, social media sentiment analysis (via Twitter in Cities2030), geospatial web service to allow information to be published in Open Geospatial Consortium (OGC) standardized services and format, cartography (heat maps, clusters, etc.) to obtain a spatial vision of the distribution and relevance, etc. Graphical semiquantitative procedures allow to evaluate even minor changes in targeted audiences' perceptions and distributed mixes of information on food systems.

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[31] How Agile Methods Inspire Project Management - The Half Double Initiative, Hager, L. T. , et al. Aarhus Uni., in Conference IT Project, IRWITPM, June 2016
[32] The Half Double Methodology, the Half Double Institute, February 2022

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Multipoint approach	The figure 5.2 (below) suggests a cross-scale, multi- and cross-levels, multi- and cross-sector, cross-governmental, multi actors, multi-disciplines. Cities2030 significantly tackles food systems vulnerabilities that may propagate across the food supply chain, which are interlinked across scales and levels, can be mutually synergistic: improvement actions in one scale or level may as well adversely impact those in a different scale or level, adjustments to answer a specific stress in one scale or level regularly worsen vulnerability to another. Cross-scale approaches may better contribute to more accurate trade-off examinations for improved IMAT: for instance, relating future urban-driven demands for distinct sources of foods with rural-placed ecosystem services provision under the perspective of Sustainable Development Goals. City and regional level governance model of food systems, the central thematic of the project Cities2030, across scales and in times of socio-ecological change, are currently characterised by poor knowledge. Multipoints approaches provides pertinent modelling frameworks to sustain harmonised indicators for assessment.
True Cost Accounting	True Cost Accounting (TCA) is a pioneering approach to food system characterisation that provides a comprehensive understanding of the food nexus, understood as the combination of all functionalities from farm to fork, comprising the four pillars of FOOD2030: nutrition, climate, circularity and innovation. TCA practices offers to typify the prominent financial and non-financial advantages food systems considered as "sustainable" have on societal challenges such as public healthcare, biodiversity management, climate action, employment' rights, socio-cultural multiplicity, and gender-based equality. TCA practices also serves purposefully IMA challenges via developing as a systemic measure for food systems appraisal, to evaluate, quantity, value the positive and negative effects, internalise positive and negative externalities of food for incentivising sustainable choices, of identified functionalities, whilst being suitable for multi actors settings
Citizen Science (see also chapter 6)	As an exploitation measure (post-project), Cities2030 could raises the ambition in the Citizen Science arena via the transition from citizens' engagement in the collection and extraction of information in a vast number of systems (for example, water, biodiversity, waste, etc.), towards "citizens' sensing and actuation", via a digitally enhanced framework, inspired by the 'CitizenSensing' project[33], to name but this one. This approach contributes to provide impetus for Pan-EU-AC networks of Citizen Science (focus on Youth and women) or young practitioners on food systems, enhanced existing performance indicators (from soil's organic carbon to food and climate broadly), specially at macro, meso and micro level (global impacts of the actions, Pan-EU-driven data on food dynamics), generate a robust, interactive, participative and dynamic (continuous update) knowledge basis (taxonomy, etc.), boost synergetic mechanisms in the food-Nexus (specially cross-borders, and trans-regional), a modelling/assessment framework (mathematical and digitally enhanced), integrate more Social Science and Humanities to augment knowledge on the different dimensions addressed by the project Cities2030 e.g., gender and inclusion, social, economic and cultural empowerment in support of the EU Green Deal, foster public-private incentives for multi actors management via furthering and structuring science-policy practice, augment knowledge on biodiversity and pedodiversity relationships, food systems enhancement and human health via scenario planning and examinations, integrate Soil Organic Carbon (SOC) in landscape management and use, beyond storage as such, and ultimately FOOD2030 co-benefit.
ICT enablers	The ICT arena represents naturally a formidable potential to enhance IMAT ranging from connected remote-sensing systems to advanced digital twins. Cities2030 proposes to further exploring different approaches and their combinations to facilitate co-creating "automated-systems", together with all actors of the CRFS, to scan and map the progress of selected Food Environment and Value Chains innovation, towards FOOD2030 objectives, via digitally enhanced monitoring and assessment framework and instruments. For instance, this allow to typify how the aforementioned innovation frameworks deliver co-benefits to the four Food 2030 priorities as well as the EU Farm to Fork Strategy.

Figure 5.2 – Multipoints intervention approach

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33 CitizenSensing Project, JPI Climate, the European Union, FORMAS (Sweden), RCN (Norway), NWO (The Netherlands), FCT (Portugal)

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6. CITIZEN SCIENCE

6.1 What is Citizen Science?

Citizen Science entails building knowledge outside "conventional" and "recognised" scientific channel, and correlates with thew principles of Responsible Research and Innovation (RRI).[34] In a broader scope, it is understood to relate with the participation of "volunteer scientists" in scientific activities, and maybe more specifically, monitoring. Though "volunteer" actions in scientific developments does not represent novelty[35], the use of the "label" Citizen Science gained popularity in the past two decades, and comprises a vast panoply of practices, subject to distinct definitions, leading to discussion around and a continual development of what is intended by Citizen Science (Eitzel et al., 2017).[36]

6.2 Link with Cities2030

Citizen Science environments as a strategy to generate a robust and cost-effective monitoring framework, whilst structing and even augmenting knowledge (expertise and training): the example of the UK farming scene, and the connection between soil health and healthy, sustainable and nutritious food.

The EU recently launched the European Green Deal (EUGD), which encompasses a vast action plan to accelerate the transition to a more climate-neutral continent, comprising the EU's climate objectives for 2030 and 2050, also integrating the Farm to Fork Strategy, and the FOOD2030 policy triggered in October 2015 (Milan World Expo) and in practice since then.[37]

Specially, the EU launched the EU soil strategy for 2030, to assist shaping sustainable future with decisive and concerted action at EU and at global level.[38] Food systems are currently characterised by the lack of functional interfaces of knowledge and policy critical for transformation towards FOOD2030.[39] Mobilisation of society for transformation is subject to substantial research and examination, and bottom-up initiatives, spanning from capturing socio-technical transitions mechanisms comprising contentious politics[40], to national civil society movements such as "*Démocratie alimentaire*"[41], to the international arena e.g., "Food Systems 4 People".[42]

In the last decade, the soil health and food quality nexus is subject of accelerating interest considering diverse dimensions spanning from long-time independent non-profit worldwide organisations such as Earthworm Foundation[43] to national programmes such as the Portuguese strategy "*Prevenção da contaminação e remediação do solo*" ("Soil contamination prevention and remediation") led by the Portuguese Environment Agency (APA)[44], Pan-EU-AC level initiatives such as the EU Mission "A Soil Deal for Europe", to UN-FAO-driven initiatives such as the "Global Soil Health"[45] or agency e.g., the United Nations Convention to Combat Desertification (UNCCD).

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Cities2030 gathers a remarkable group of expert to explore Research and Innovation Actions (RIA) challenges and needs towards a resilient, safe, equitable and soil health driven food system concept, and structure recommendations to drive cross-scale, cross-governmental and cross-sectoral cooperation comprising the society at large, scientific and technology communities (and the knowledge scene more globally), policy and governance, summarising, the vast number of profiles of actors of change from the soil and food nexus, spanning from scientists to the unorganised public.

These experts could further the current developments on Citizen Sciences in support of the project anticipated instruments delivered to assist cities and region in managing their CRFS.

Well managed soils are the basis for sustainable agriculture, affecting food production, environmental impact, economic and societal concerns. As such, preserving and improving soil health is of interest throughout the food system, however, it is farmers who carry the greatest burden in managing, and consequences of poor, soil health.

In the UK, farmers are required to have their soils lab tested every 5 years; although informal soil monitoring will occur in between (from simple assessments of whether land is too wet for vehicles, to digging holes to look at soil physical and biological characteristics). However, this is unlikely to be sufficient to inform decision-making and to observe the results of changes to management practices.

Citizen science, where the farmers are the citizen scientists, could provide the ideal solution to this knowledge gap, by co-creating with a highly engaged community and providing evidence that can be used to educate, design and monitor progress towards key targets, and drive policy.

Whilst some factors that influence soil health can't be changed, e.g., soil type, weather, typography, farm management can have a big impact on soil health and improve soil yield. As living systems, soils will adapt and change to the conditions that are given to them by climate and human management practices. As such, it's essential for farmers to be able to monitor and understand the health of their soils.

A Citizen Science approach would give farmers the ability to do this through a toolkit of quick and easy to perform tests that provide objective insights into the physical, chemical and biological properties of their soil. These tests are (a) soil texture (physical soil condition, as a proxy for understanding soil structure); (b) soil infiltration (physical soil condition, as a proxy for understanding soil structure); (c) soil colour (as a proxy of soil organic matter content, chemical soil condition); (d) soil earthworm counts (biological soil condition, as a proxy for biodiversity), and; (e) vegetation cover (as a proxy of how well soil is protected).

The data is entered into an online platform interlinked with the project "Single Click CRFS Platform (S2CP), collating data from all around the UK, and allowing farmers undertaking tests to follow up their measurements over time and identify changes to and the potential needs of their soils.

The platform allows farmers to compare their results with those from other farms, communicate with other farmers, facilitating knowledge exchange and best-practice generation.

Cities2030 implements futureproofing activities in identified rural, peri-urban and urban areas outlined by the concept of simplified socio-ecological systems (SIMSES). Citizen science uses the collective strength of communities and the public to identify research questions, collect and analyse data, interpret results, make new discoveries, and develop technologies and applications – all to understand and solve key environmental problems.

Citizen science fill data gaps, leverages large numbers of people to perform research that other resources may not have been available to pursue, and builds meaningful relationships with communities fostering innovation through co-creative processes and incorporation of new ideas.

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Citizen science initiatives could support the goals of Cities2030 and could be identified or triggered through a vast panoply scoping process involving a comprehensive online search, a series of Open Calls and advertisement across the SIMSES and citizen science networks as well, and of course across the project Internet presence. The citizen science initiatives could then be evaluated against a criteria of need co-created with the SIMSES communities and the highest scorers selected for regional funding.

The S2CP platform could be used to monitor these citizen science initiatives, via the development of the project IMA framework (metrics, instruments, other resources), to evaluate Citizen Science impacts across five specific domains: science, society, governance, the economy at large, and the environment.

The S2CP platform, which is developed considering best practices in the co-creation of hands-on innovation frameworks, would then provide clear recommendations for those involved in Citizen Science projects, making it a pertinent online platform through which to evaluate the aforementioned initiatives, as well as providing them with clear directions for improvement.

Citizen Science Monitoring System with an App – Well managed soils are the basis for sustainable agriculture, affecting food production, environmental impact, economic and societal concerns. As such, preserving and improving soil health is of interest throughout the food system, however, it is farmers who carry the greatest burden in managing, and consequences of poor, soil health. In the UK, farmers are required to have their soils lab tested every 5 years; although informal soil monitoring will occur in between (from simple assessments of whether land is too wet for vehicles, to digging holes to look at soil physical and biological characteristics). However, this is unlikely to be sufficient to inform decision-making and to observe the results of changes to management practices.

Citizen Science, where the farmers are the citizen scientists, could provide the ideal solution to this knowledge gap, by co-creating with a highly engaged community and providing evidence that can be used to educate, design and monitor progress towards key targets, and drive policy. Cities2030 could bring together data from operational Earth Observation (EO) and on-the-ground monitoring, to identify vulnerabilities in rural areas and facilitating their transition to more sustainable and resilient practices.

The data is incorporated into the S2CP platform or a connected platform, allowing farmers undertaking tests to follow up their measurements over time and identify changes to and the potential needs of their soils. The platform also allows farmers to compare their results with those from other farms, communicate with other farmers, facilitating knowledge exchange and best-practice generation.

Policy framework – To facilitate the implementation of Citizen Science monitoring systems, policy- and related decision-makers, in particular as representatives of an essential audience for Citizen Science as key stakeholders, could then positively develop in the facilitation, communication and funding of projects and initiatives. There are positive social and economic impacts of involving policymakers with citizen science, but this is hindered by a lack of awareness of both citizen science in general, and of specific projects and initiatives. Citizen scientists have the knowledge needed to address the issues communities are facing locally and globally, while policymakers have the authority to address the issues. And so, collaborating with them on the issues that citizen science addresses can be beneficial in addressing challenges for local and international levels.

Having policymakers more deeply involved in project delivery, beyond just being the funder, leads to increased policy impact, whilst the inclusion of decision and policy makers, scientists, and public authorities assists ensuring the sustainability and legitimacy of the governance process.[46] Turbé et al. (2019) identify that

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[46] Understanding the Citizen Science landscape for European environmental policy, Turbé A. et al. in Citizen Science Theory and Practice, December 2019

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The S2CP could, among other things, raise awareness of citizen science amongst key stakeholders and facilitate the implementation of citizen science monitoring systems for rural areas. The platform is populated with carefully created resources and tools that are accessible to all stakeholders. The provision of resources, tools, guidelines and training modules enable a wider understanding of the state of rural areas and value of citizen science, and facilitate the implementation of citizen science monitoring systems. The platform is made accessible to different stakeholders, ranging from interested citizens to scientific institutions, up to politicians and public media, and aims to facilitate citizen science on a broader scale.

In this way, the project empowers practitioners in working closely with policymakers and demonstrate the benefits of enhancing and utilising citizen science and among policy and policymakers. There are many barriers to engaging policymakers with citizen science including, but not limited to, knowing who to talk to and how to make initial contact, maintaining long-term relationships with policymakers, timescale of citizen science projects may not align with policy-making timescales, and the need to overcome doubts that policymakers may harbour related to data quality. To address these the platform signposts users towards resources for developing strategies to engage policymakers.

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