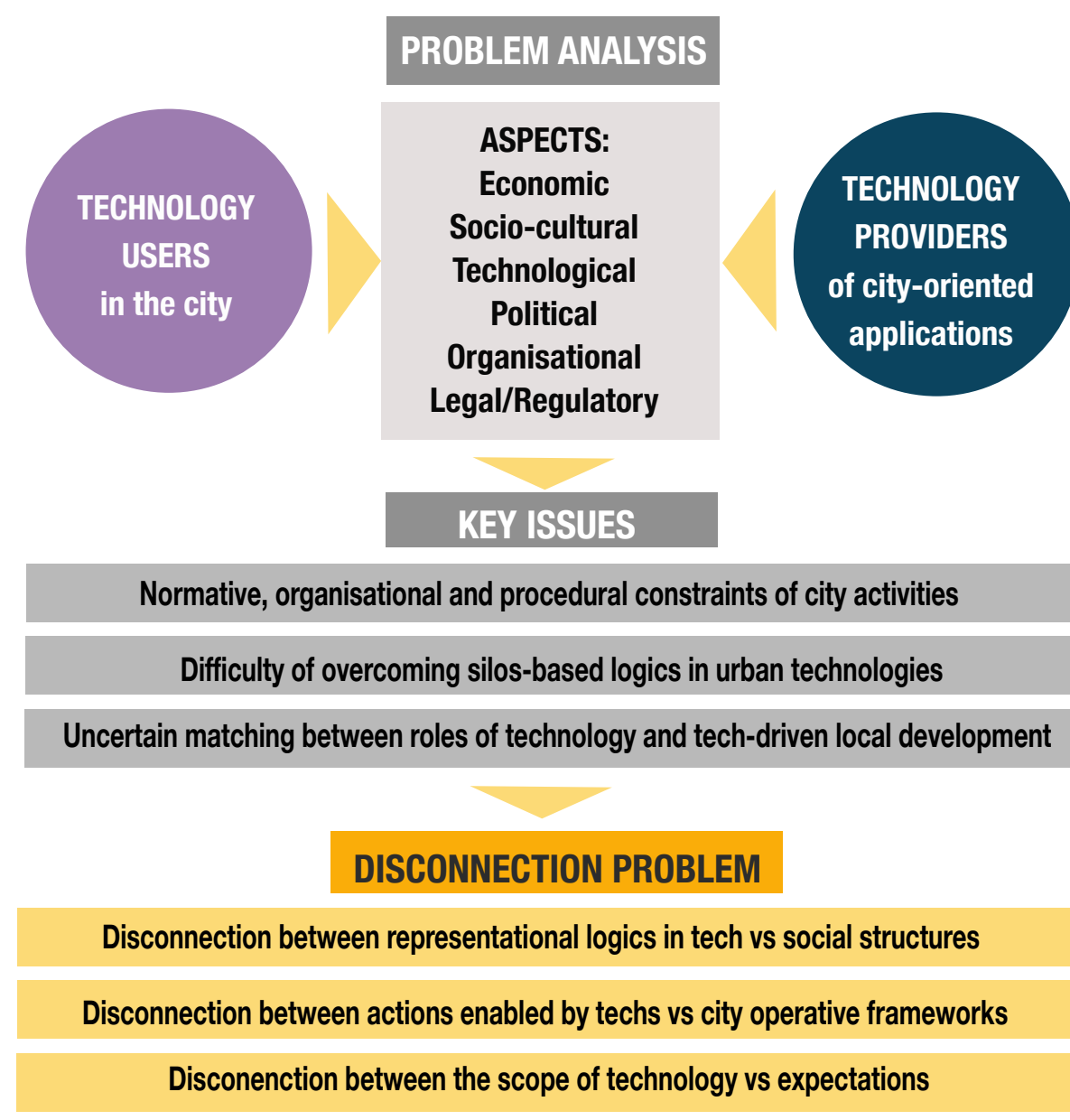
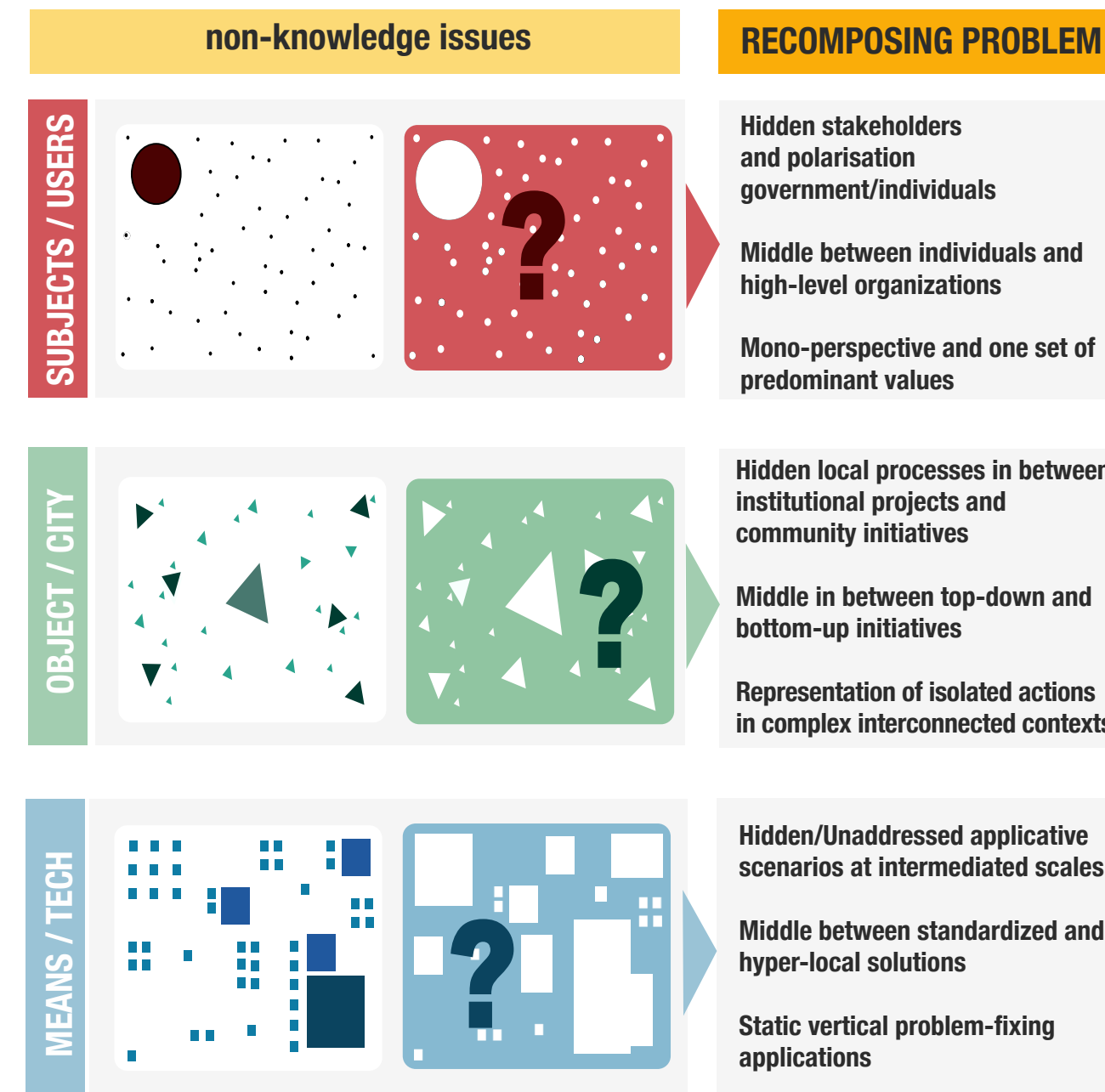


REAL WORLD PROBLEM: THE DISCONNECTION PROBLEM

The problem driving the research is the marginal impact of current information technologies in improving synergies among the actions of the diverse stakeholders operating in the city. The analysis of the problem had been structured by applying a consolidated framework for exploring complex multi-dimensional problems such as the PESTLE framework (partially modified), and combined with an extended SWOT analysis referred to the aim of the research. The analysis of the problem had been performed by considering the perspectives of technology users and providers, as emerging by institutional and informal sources. The resulting key issues had been reformulated by using the analytic lens of "People", "City" and "Technology". This led to defining the problem of the marginal impact of information technologies on city activities as a problem rooted on the disconnection between social structures, urban activities, and local applications from their representation mediated by current platforms.

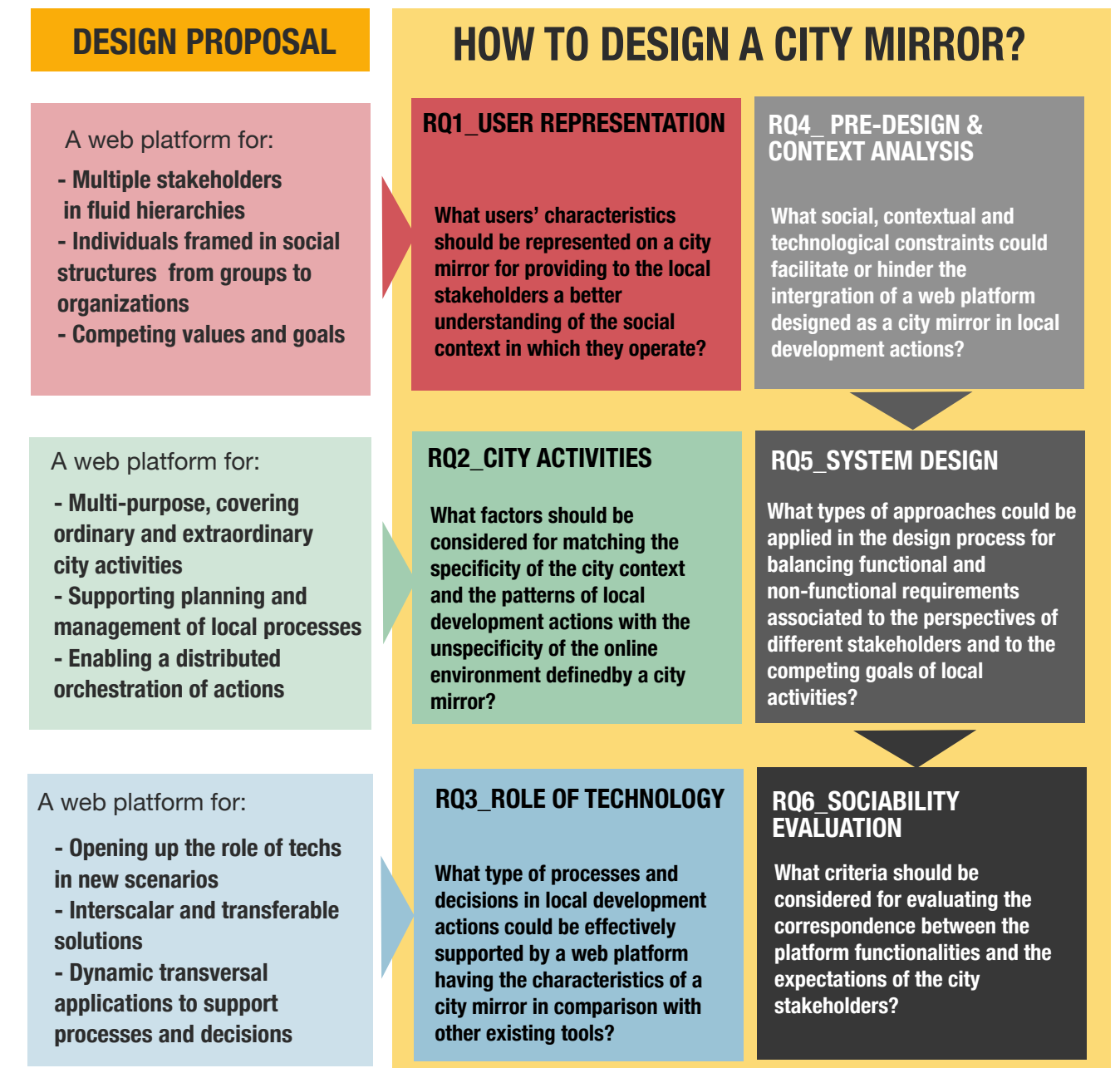


KNOWLEDGE PROBLEM: THE RECOMPOSING PROBLEM



The "Disconnection Problem" is transformed into a knowledge problem, the "Recomposing problem" by generalising the lens of People, City and Technology and identifying: - the Users as Subjects acting in the City through technology - the City in itself as Object and space of actions supported through technology - the Technology as a Means to act in the City and to interact with the city. The resulting research problem is aimed to understand how recomposing the disconnections highlighted before by studying what is in the intermediate spaces between: - individuals and high-level organisations usually - top-down institutional projects and bottom-up local initiatives - global and hyper-local technological solutions all overrepresented in current techs respect to ordinary city dynamics.

DESIGN PROBLEM: THE CITY MIRROR PROPOSAL



A possible alternative development for information technologies aimed to improve their integration in city life is associated to the needs of having new platforms representing the complexity of the city social structures, urban activities and the different scales of actions of the local development. On this basis, the Recomposing problem is reformulated as a Design problem because of the lack of existing artifacts that are multi-stakeholder, multi-purpose, and multi-scale. The City Mirror model is a design proposal aimed to explore alternatives to the current technology for understanding to what extent local development actions could be better orchestrated through the use of shared platforms among city stakeholders.

MIRRORING THE CITY

Toward Web Technologies to Support City Stakeholders in the Orchestration of Local Development Actions

ABSTRACT

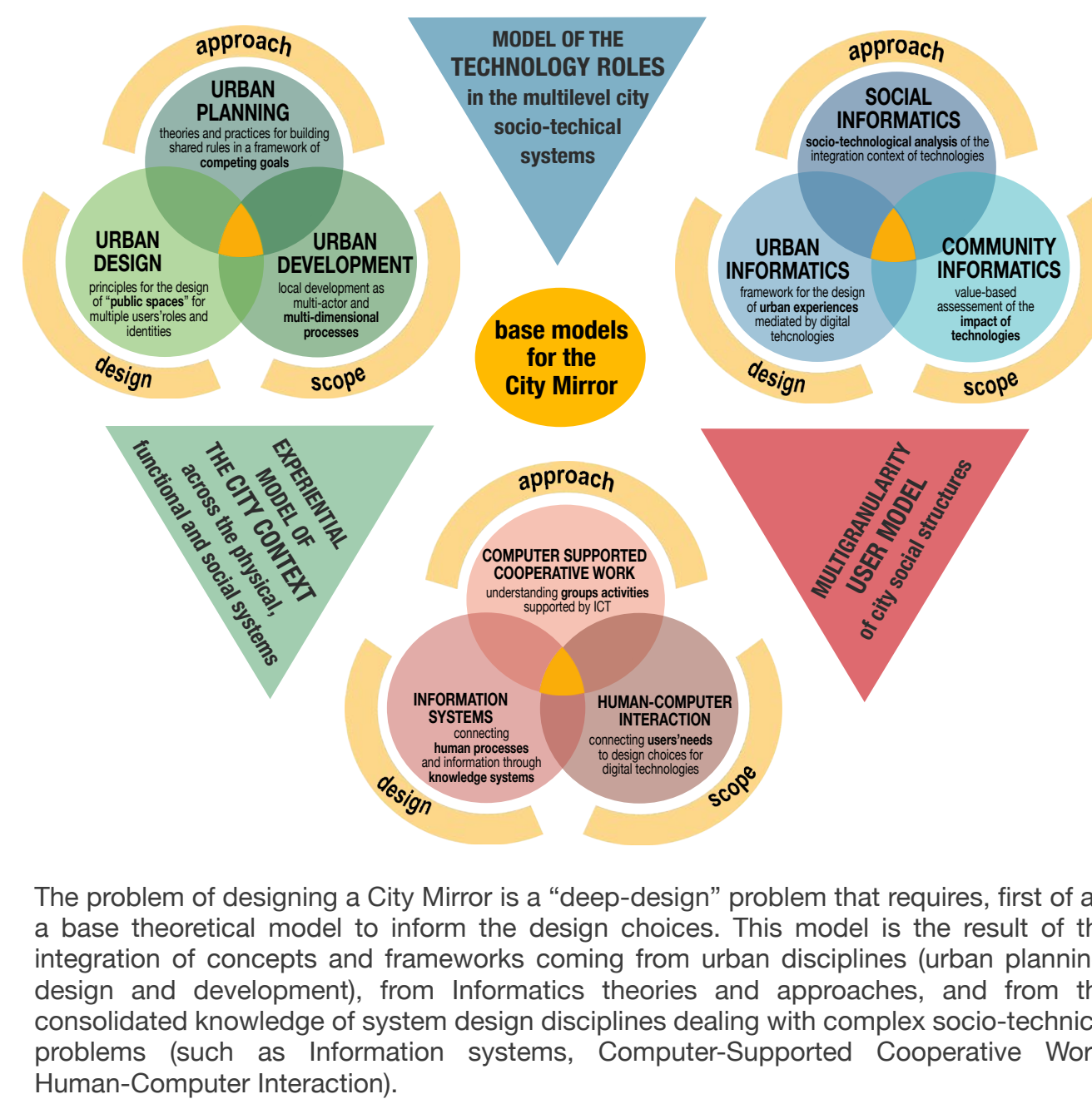
Despite massive investments and high expectations associated to the integration of smart city technologies into the city life, their support to everyday activities, initiatives, and projects of public institutions, companies, third sector organisations, and citizens groups is still marginal, and the promise of a technology-driven local development is far from being fulfilled. Among them, city-oriented web technologies do not reflect urban dynamics because they are focused on individual users or on the dichotomy between local governments and customers/citizens/voters, hiding the plurality of social structures and relationships among city stakeholders. Moreover, the silos logic to deal with urban problems on existing digital platforms contrasts with the ecosystemic nature of the city characterised by a tight interdependence between built-unbuilt environment, local activities, social norms and practices.

By focusing on web technologies because of their accessibility, scalability, versatility, and low cost, this research is aimed to understand how to design future technologies enabling city stakeholders in understanding better the complex context of their actions, making better decisions on the use of local resources, and activating inter-sectoral synergies among urban initiatives. To address this challenge, the work explored the integration between approaches, methods and theories in urban planning, design, and development with informatics and system design disciplines, within a transdisciplinary research process adapting the TIPS framework to the specificity of a complex design problem.

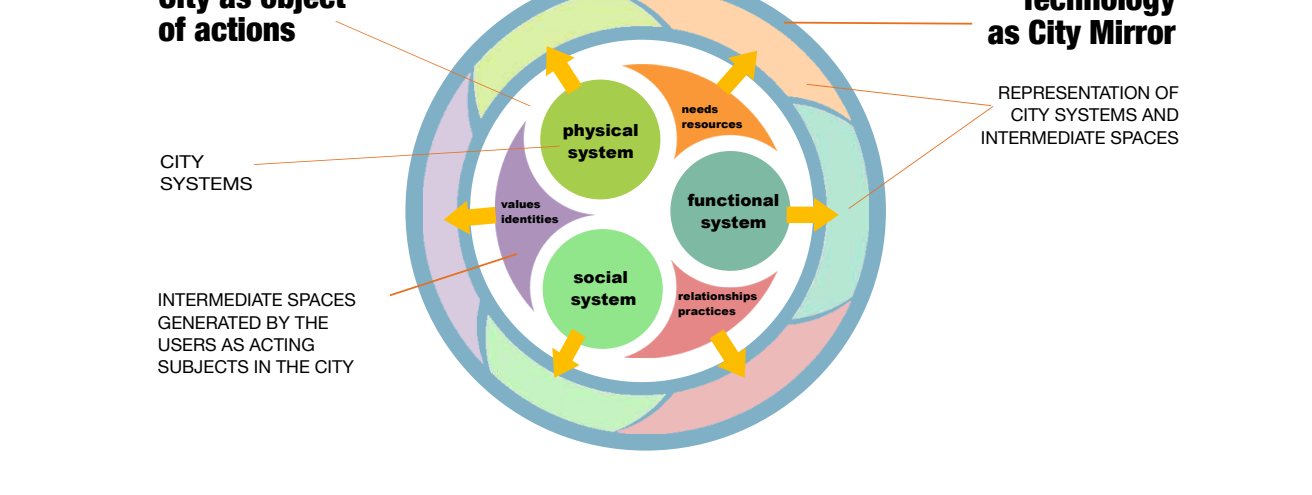
The analysis and progressive conceptualisation of the link between design choices in web platform development and the implications for the technological support of local actions implemented by city stakeholders have been elaborated throughout three years of field activities. Three case studies centred on the development of web platforms (a civic social network, a collaborative urban governance platform, and a city data portal) provided the opportunity to explore limits and potential applications of a new class of digital tools imagined as multi-stakeholders, multi-purpose, and multi-scale for reflecting how cities work by providing a virtual environment coherent with the reality of the City. Action research methods combined with participatory design techniques have been applied during the development of the three prototypes to face the contextual constraints of real working environments in different domains of urban activities.

The lessons learned from these experiences provided a deep understanding about the system requirements defining a meaningful and acceptable representation of social structures and urban actions in a shared digital space oriented to mirror city dynamics, as well as insights on the contextual and technological factors to be considered under the perspective of the different types of stakeholders. At the end of the third case study, still on-going, the set of applicative scenarios synthesising the information gathered through the entire process will be analysed by using a grounded theory methodology. The goal is to systematise the findings across the three case studies in a theoretical framework of web technologies mirroring the city and operational guidelines for designers and decisions makers intended to build or adopt them in local initiatives.

INTEGRATION THROUGH CONCEPTS

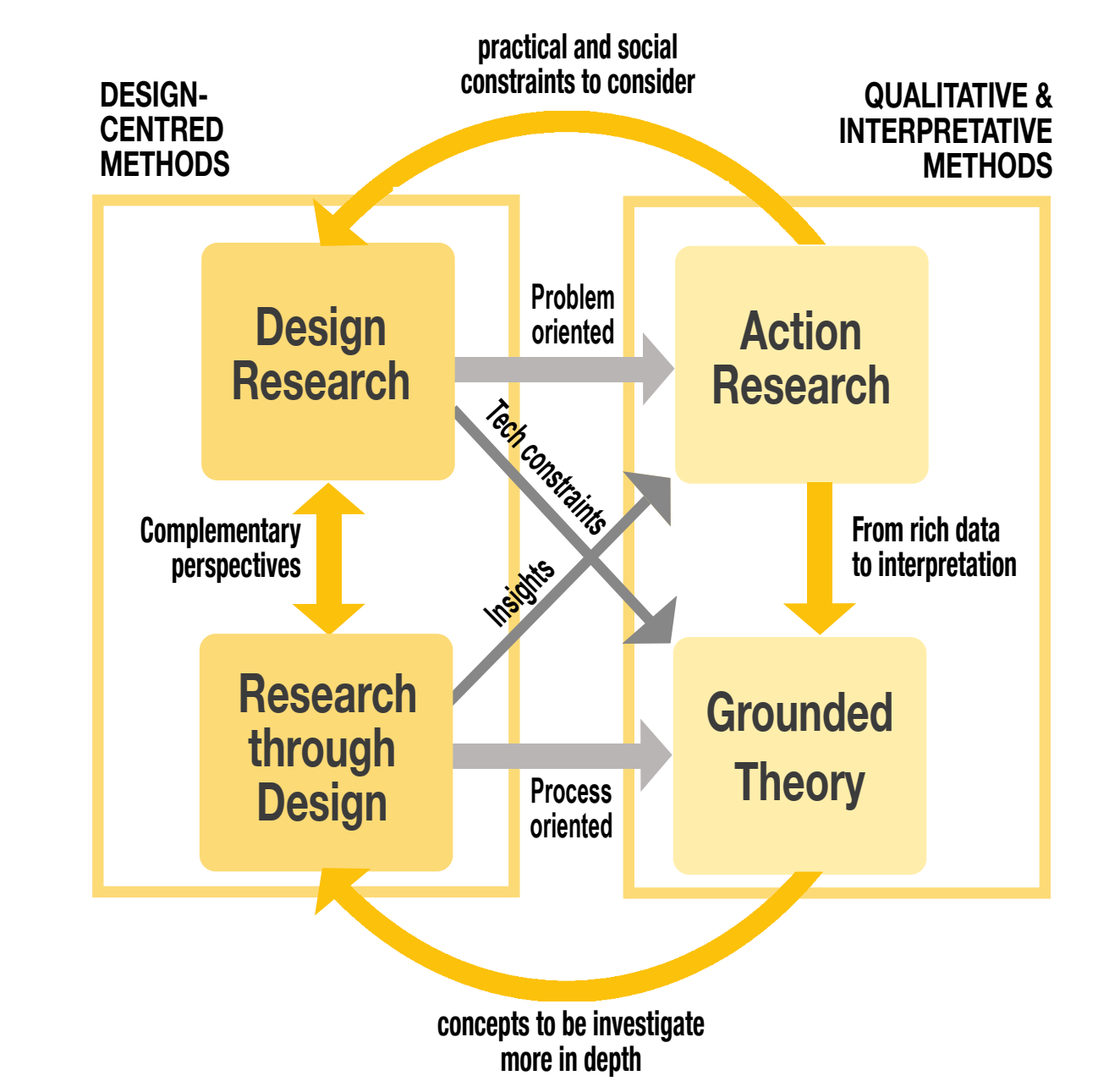


The problem of designing a City Mirror is a "deep-design" problem that requires, first of all, a base theoretical model to inform the design choices. This model is the result of the integration of concepts and frameworks coming from urban disciplines (urban planning, design and development), from informatics theories and approaches, and from the consolidated knowledge of system design disciplines dealing with complex socio-technical problems (such as Information systems, Computer-Supported Cooperative Work, Human-Computer Interaction).

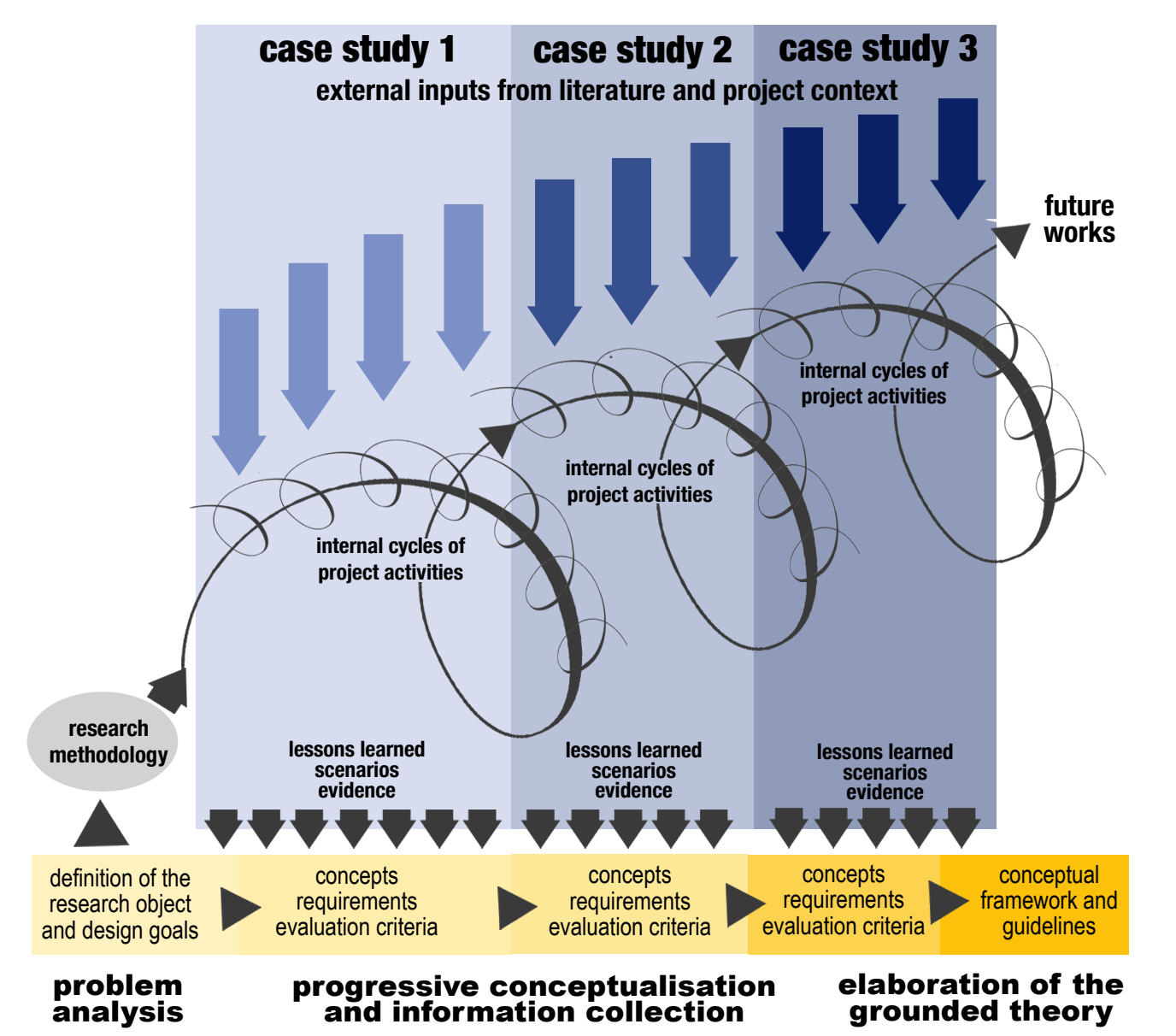


INTEGRATION THROUGH METHODS

The research adopted a multi-methods investigation approach, based on qualitative and interpretative methods intertwined with design methods. The methods of Design Research and Research through Design had been combined during the research relying on the fact that there is a methodological convergence both in urban disciplines and informatics in considering the "design as a way of knowing". The Design Research, oriented to develop specific solutions for the artefact to be produced, had been associated to Action Research and participation techniques to involve city stakeholders in the elaboration of problems and system requirements starting from their applicative scenarios and needs. The inputs coming from this process had been conveyed into critical reflections on web technologies and city dynamics made visible by using the design object as tool of enquiry, and then progressively stratified, assessed, systematised and refined by using Grounded Theory methods.



INTEGRATION THROUGH ARTIFACTS

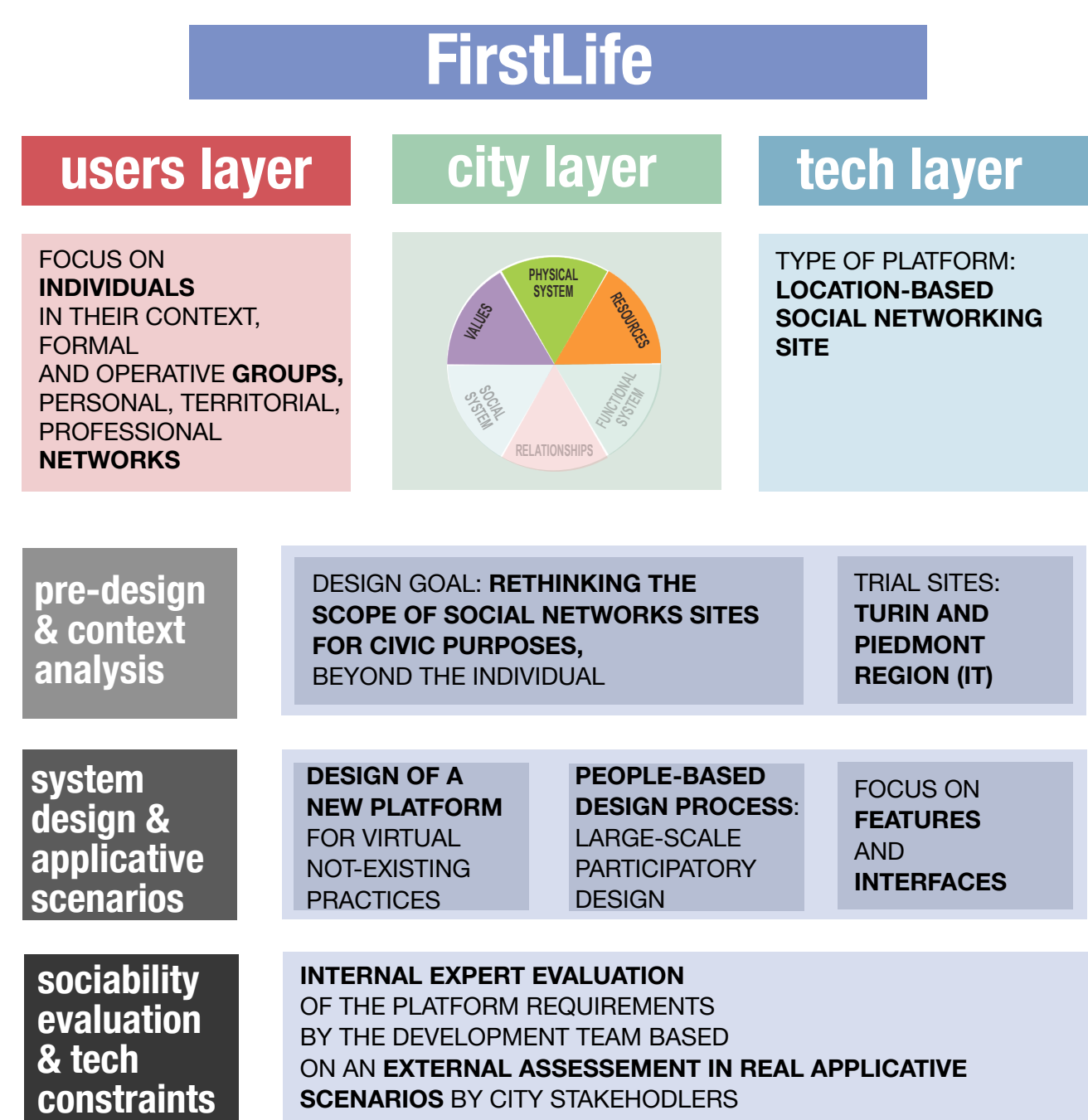


The research strategy had been structured on the implementation of three subsequent case studies consisting of the prototyping of web platforms that follow the City Mirror Model, and therefore intended to be Multi-stakeholder, Multi-purpose and Multi-scale. Every case study centred on the design of a specific instantiation of the model in a technological artifact internally advanced through local cycles combining action, analysis, design, and conceptualisation of contextualised findings (linked to the case study and the performed activities). The external inputs came from: - theories, analytic frameworks, and consolidated knowledge on one or more aspects emerging from the design process - studies and applications related to the type of platform under design (e.g. social media tool, gov-platform, open data portal) - the collaboration with local stakeholders in their projects - the topics explored through field activities (e.g. welfare services, urban regeneration, cultural initiatives).

CASE STUDIES

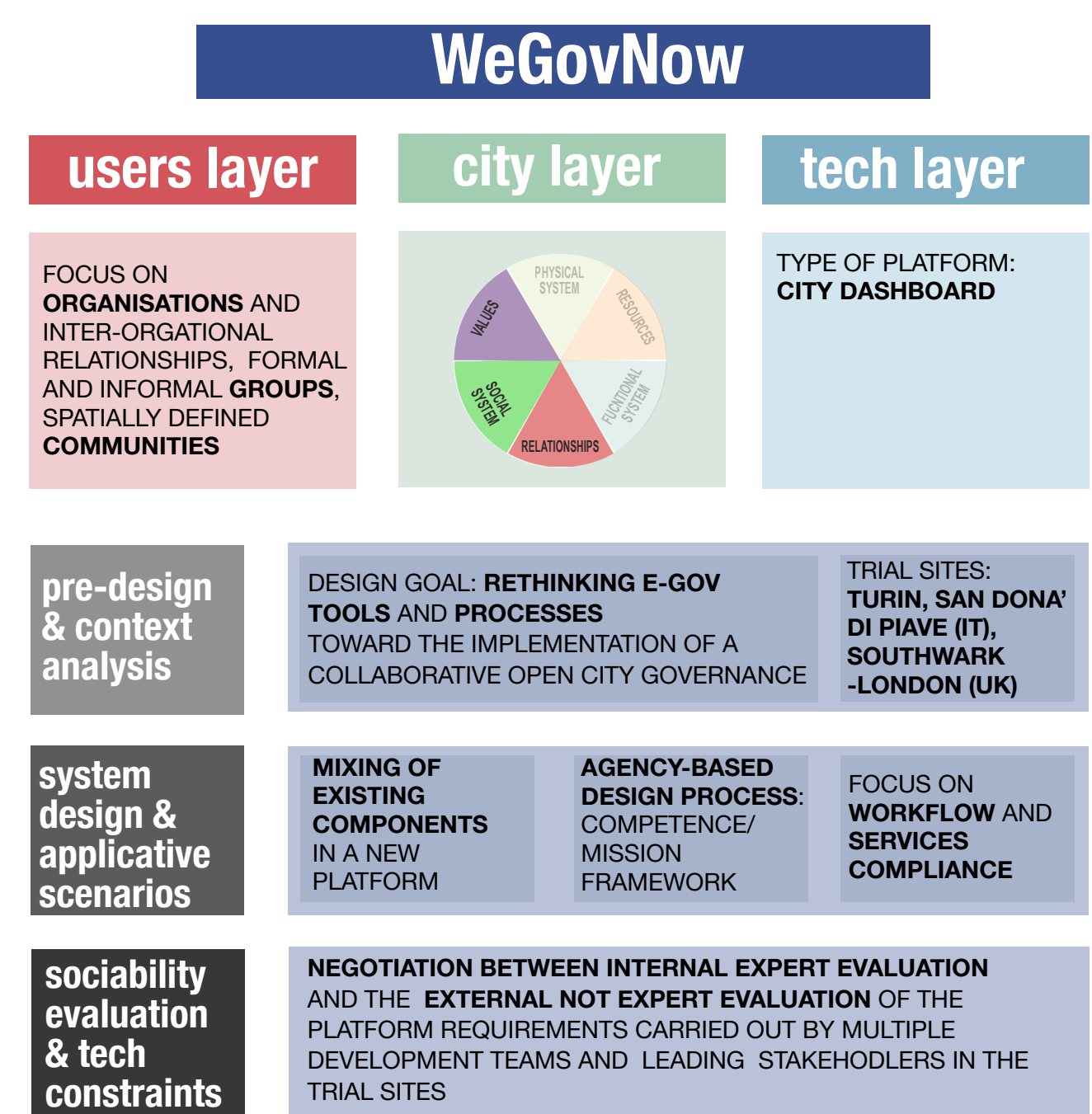
CASE STUDY 1 CRAFTING A CIVIC SOCIAL NETWORK

FirstLife is a map-based crowdsourcing platform developed at the Department of Computer Science at the University of Turin (IT) by the "Social Computing" Research Group. The research activities connected to this case study had been carried out from March 2016 to January 2018, through the engagement of several civil society organizations, institutions and private citizens in defining functionalities and applications of a civic social network during the development process of the platform.



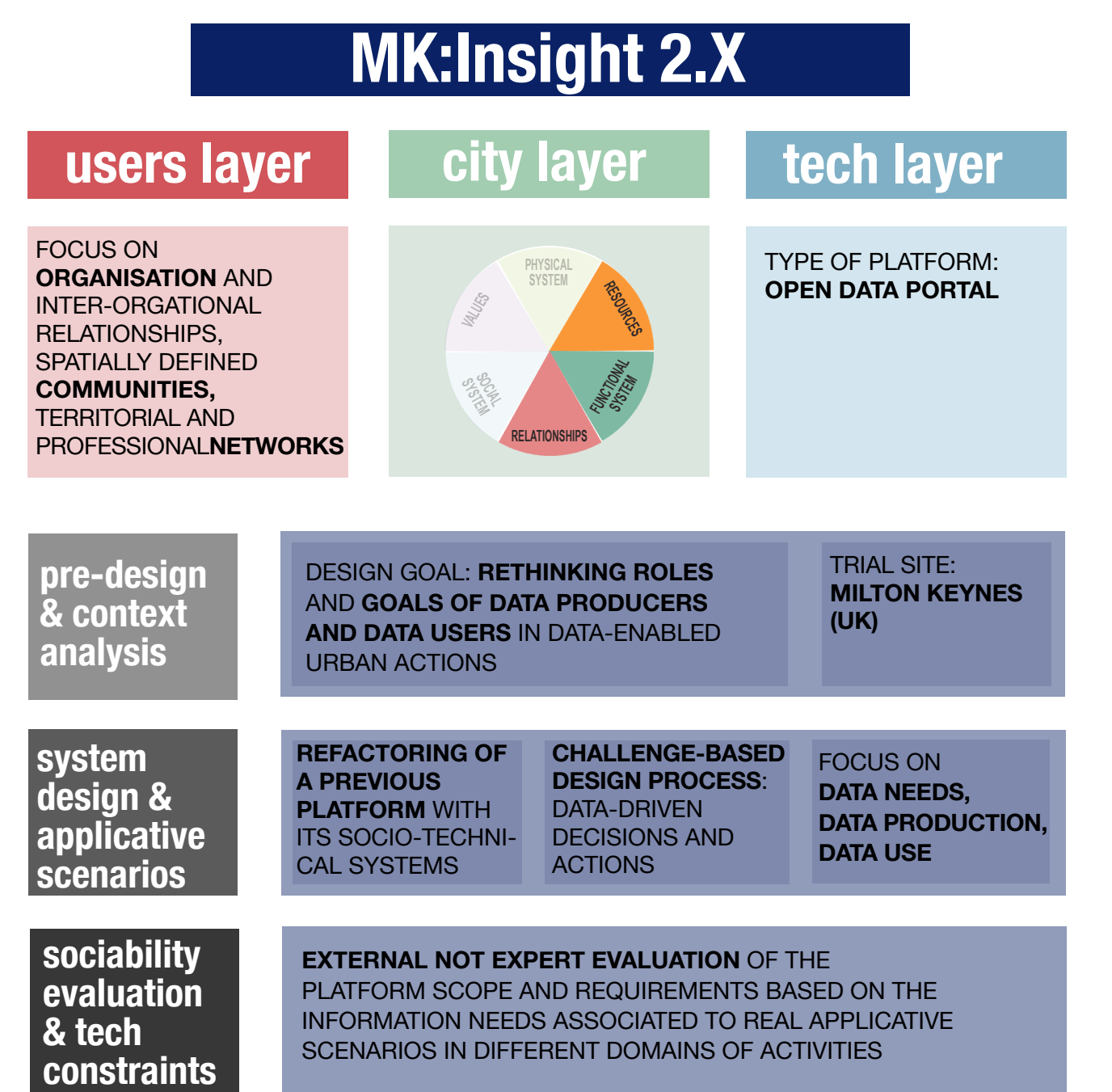
CASE STUDY 2 ASSEMBLING AN URBAN GOVERNANCE PLATFORM

WeGovNow is a European H2020 project for developing a unified citizens engagement platform aimed to lead the transition from e-government to w-government models by integrating seven consolidated technologies for citizens reporting, digital participation, shared planning and co-production activities and open data analysis. The project started in February 2016 and will end in January 2019, and the research activities connected to this case study had been implemented from October 2016 to September 2017.

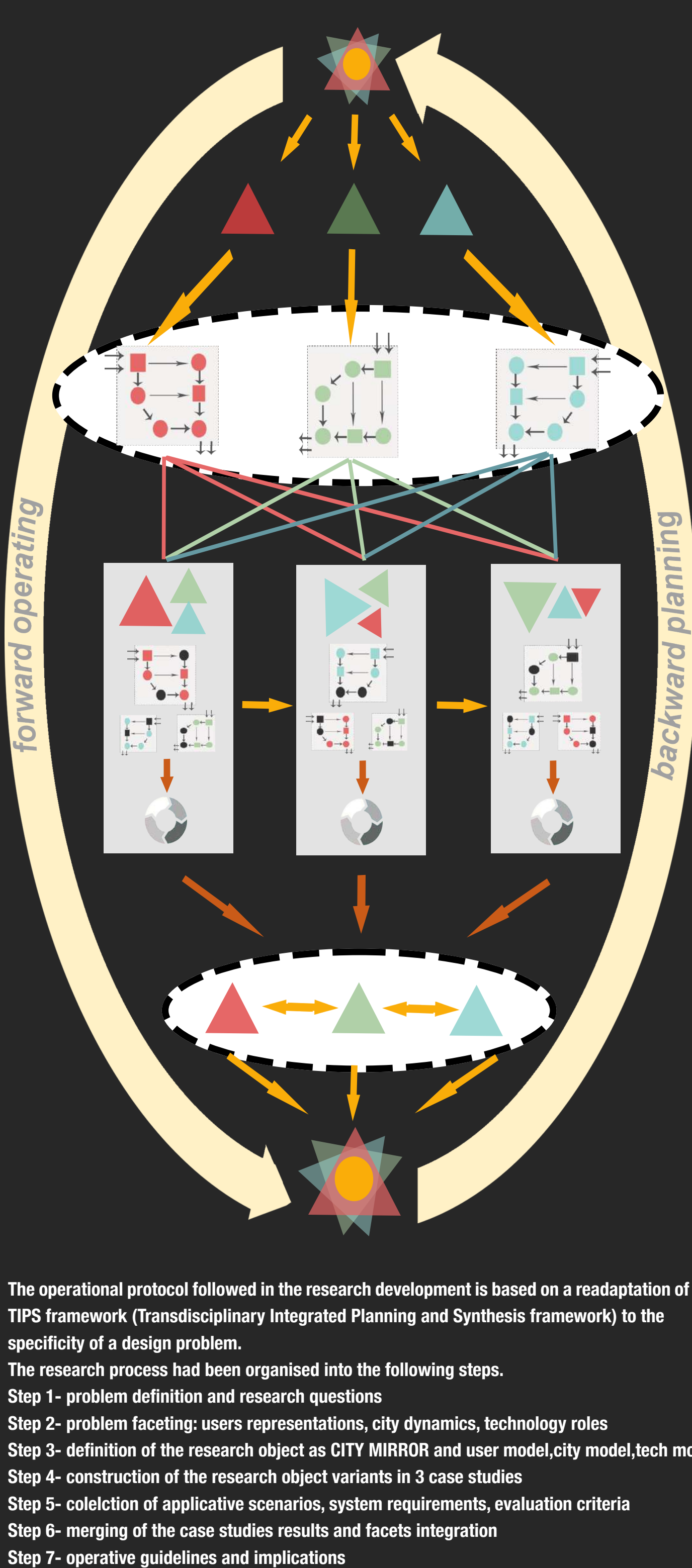


CASE STUDY 3 BUILDING AN OPEN CITY DATA PORTAL

MK:Insight 2.X is the redesign project of the Milton Keynes Open Data portal carried out by the Smart Cities and Data Science research group at the Knowledge Media Institute, The Open University (UK). The goal of the process is to design a city data portal opened to new forms of production, use, and interaction with data aimed to transform publicly available information into operational sources for the local actions of city stakeholders. The research activities associated to this case study started in February 2018 and will end in July 2019.

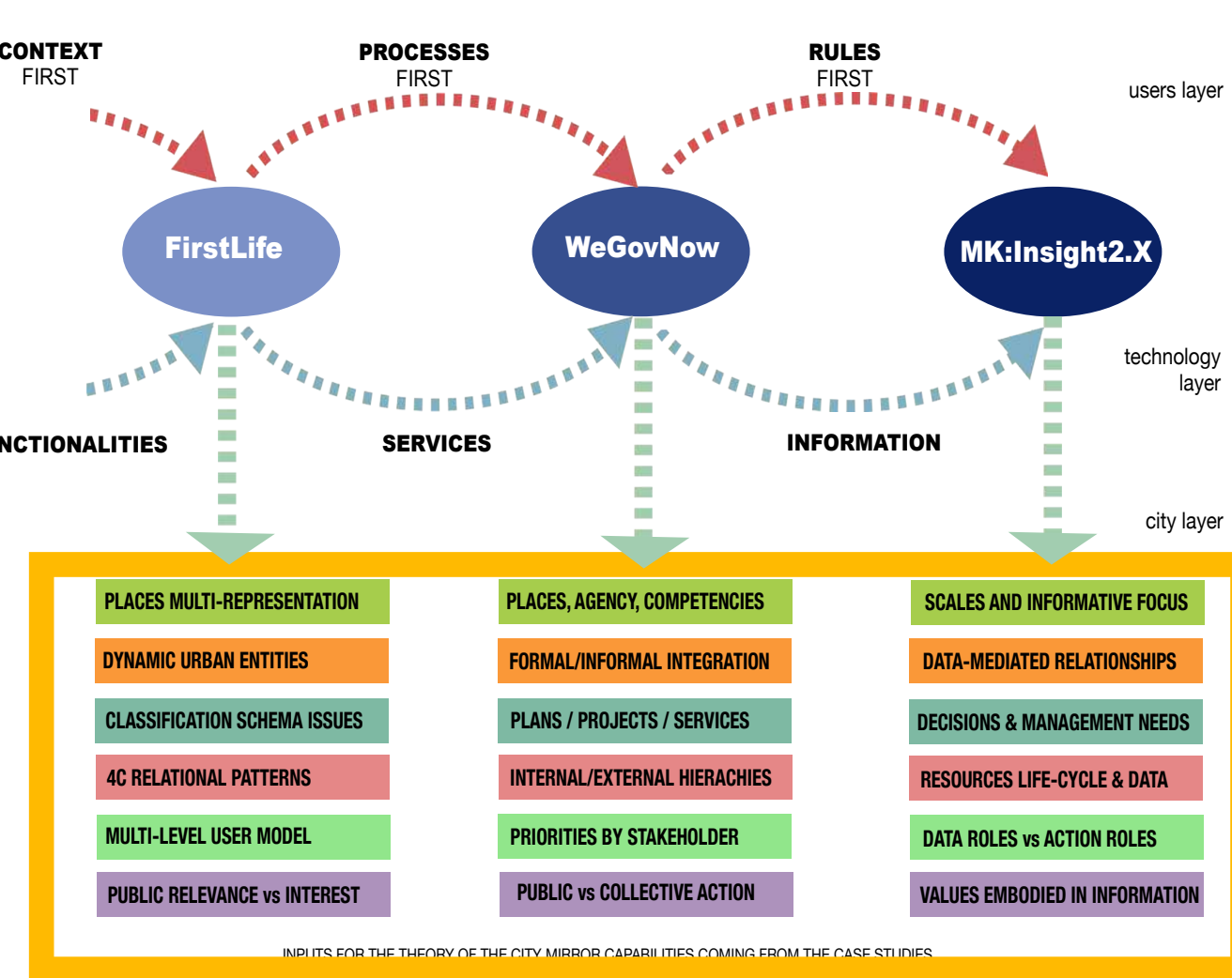


RESEARCH PROCESS



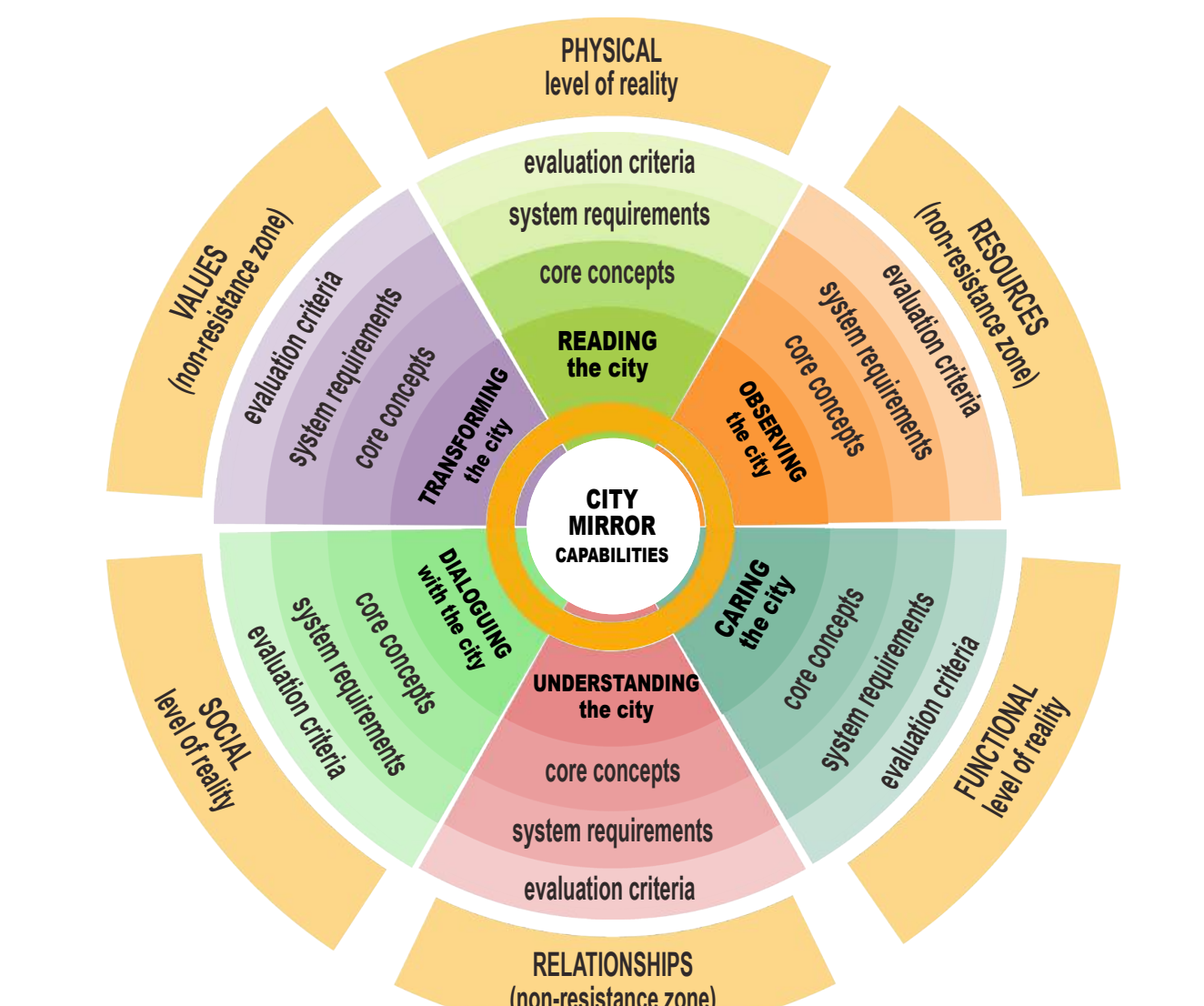
The operational protocol followed in the research development is based on a readaptation of the TIPS framework (Transdisciplinary Integrated Planning and Synthesis framework) to the specificity of a design problem. The research process had been organised into the following steps: Step 1- problem definition and research questions Step 2- problem factoring: users representations, city dynamics, technology roles Step 3- definition of the research object as CITY MIRROR and user model, city model, tech model Step 4- construction of the research object variants in 3 case studies Step 5- collection of applicative scenarios, system requirements, evaluation criteria Step 6- merging of the case studies results and facets integration Step 7- operative guidelines and implications

CONSTRUCTING A GROUNDED THEORY THROUGH A CROSS-ANALYSIS OF THE CASE STUDIES



The sequence of the three case studies allowed to progressively move the focus of the research from the analysis of the contextual factors impacting on the relationship between web technologies and city dynamics, to the analysis of the processes to be supported, and then to the rules to put in place to make the system work into a complex social environment. Similarly, the object of design expanded from the platform functionalities, to the services and then to the structure of the information ecosystem. The results led to extract relevant elements concerning the modelling of the city systems on a platform informed by the model of the City Mirror.

THEORY OF THE CITY MIRROR CAPABILITIES CONCEPTS - REQUIREMENTS - EVALUATION CRITERIA



As last step, the elements collected through the empirical investigation across the three case studies is systematised and made functional to the integration of the city model, user model and technology model organised through a set of key concepts connecting these dimensions in a theoretical design framework, and in more concrete operational guidelines and evaluation criteria for practitioners and decision-makers that will have the responsibility to design and choose the appropriate web technologies to foster synergic development processes.

ANSWERING TO THE OVERALL RESEARCH QUESTION

How to design a web platform to support the orchestration of local development actions implemented by different stakeholders?

Designing a platform able to support city stakeholders in: - LIGHTING on the richness of places where they live by READING THE CITY - MONITORING shared material and immaterial resources by OBSERVING THE CITY CHANGE - KNOWING what is on-going by DIALOGUING WITH OTHER CITY STAKEHOLDERS - NAVIGATING across practices, services, and connections to UNDERSTAND THE CITY FUNCTIONING - BEING AWARE of evolving local needs to TAKE CARE OF THE CITY - CREATING a dialogue space for competing values to TRANSFORM THE CITY.

Designing a platform in which city stakeholders can find a real support for their decisions and actions through information and relationships contextualized in city dynamics.

The ORCHESTRATION OF LOCAL DEVELOPMENT ACTIONS is the potential outcome of: - Mediating the meanings, the projections and the priorities of city transformers and their inhabitants - Enhancing the social capital in the city to better exploit local resources and opportunities - Supporting coordination, cooperation and collaboration mechanisms across different social structures - Enabling new practices, services, social norms reactive to local changes - Opening up new governance models to address local needs - In a shared virtual space where each stakeholder can make evident its contribution to the city development.

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