Citizens' engagement in smart cities for promoting circular economy. A Knowledge based framework

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Abstract. Smart Cities can be considered as one of the most challenging topics within the last decades. Overcoming the well analysed debate about the digital devices and infrastructures needed for supporting the emergence and viability of Smart Cities, the paper aims at investigating how citizens' engagement in Smart Cities can be used for promoting positive attitudes and behaviours towards Cities Circular Economy (CCE). Building upon a managerial perspective the paper aims at depicting preliminary conceptual reflections about antecedents and conditions able to influence citizens' engagement in Smart Cities functioning. The paper proposes a Knowledge Management based framework for supporting both policy makers and managers in better understanding on which levels to act for ensuring a participative approach to the definition of a Circular Economy Logic in Smart Cities ecosystems.

Keywords. Smart Cities (SC); Circular Economy (CE); Cities Circular Economy (CCE); Knowledge framework; Citizens' engagement.

1 Preliminary reflections

In the last few decades, managerial and social studies have shown an increasing interest in the topics of digital and green transition as possible ways trough which address social and economic behaviours toward an inclusive and sustainable development ([19], [4], [50], [52]). Because of this, multiple research streams have been progressively defined with the aim to propose theory ([66]), models ([27]), and instruments ([44]) able to support researchers and practitioners in defining new approaches for managing digital and green dimensions of ongoing transition.

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Reflecting upon the multiple contributions that have been provided about the topic under discussion, it is possible to note the above cited dimensions (green and digital) are usually approached as independent topics that are only partially combinable due to their heterogenous nature and contents ([48]).

With the aim to provide a possible contribution about the green and digital relation in the ongoing transformational scenario, the paper uses the interpretative lens provided by the Knowledge Management (KM) ([18], [11], [17] [12]) for depicting a new approach to sustainability and sustainable development in which 'digital' and 'green' dimensions are strongly related as interconnected drivers trough which it is possible to ensure the cognitive and informative alignment required for ensuring the emergence of inclusive and sustainable paths for development ([31]). In such a direction, the challenging domain of Smart Cities (SC) ([8], [58], [13], [46]) - as intriguing conceptual and empirical field in which citizens are strongly engaged for ensuring the achievement of common purposes - is used for depicting possible levers on which act for involving actors in sustainability based paths and strategies ([10]). In such a direction, the managerial model of Circular Economy (CE) is used as foundational framework for reflections due to the strong correlation among its potential functioning and the actors' engagement ([14], [56], [24]).

Because of the proposed conceptual combination, possible levels on which act for supporting the emergence of a Cities Circular Economy (CCE) are identifying for addressing policy makers, researchers, and practitioners in defining models and guidelines aimed at ensuring sustainable development through an effective combination of 'green' and 'digital' dimensions.

According to the proposed conceptual flow, the rest of paper is structured as follow: the section 2 will briefly summarize the theoretical framework for explaining 1) how knowledge management can support a better understanding of digital and green transition, 2) the potential contribution of CE in better understanding how to facilitate actors' engagement in sustainable paths and strategies, and 3) in which way SC and citizens' engagement can support the definition of models for promoting an inclusive digital and green transition. The section 3 will describe how the proposed conceptual model for CCE has been build. Finally, the section 4 will propose preliminary conclusions, implications, and future directions for research of reflections herein.

2 The theoretical framework

2.1 A knowledge-based view of digital and green transitions

The emerging so called Society 5.0 defined as "an information society built upon Society 4.0, aiming for a prosperous human-cantered society" ([29: 10]) through which "further the potential of the individual-technology relationship in fostering the enhancement of the quality of life of all people through a super smart society" ([55]) is underling the need for a radical change in perspective in the ways and views trough which market and social relationships are approached and managed ([18]).

The widespread diffusion of new technologies and the dominant role of digital dimension in the emergent Society 5.0 are completely redesigning all consolidated functioning models in all social and economic environments ([23], [51]). Building upon

the possibility for collecting, organizing, and using date in large scale processes new trends for value creation are emerging ([21]). All the economic sectors are showing an increasing interest about the opportunities offered by the Big Data technologies and analytics ([41]) for better understanding market's expectations and needs with the aim to support firms in influencing and addressing them ([33]). In nutshell, digital transition is enhancing the emergence of a new drivers for value creation in firms-market relationships: the *information* ([39]).

Information is not a new driver in managerial and social reflections about value creation but its centrality is today undoubted due to the power offered by the ongoing digital transition ([43]). Despite its – still unimaginable – power, the focus on the information as a 'domain' for creating value through the definition of innovative and highly spread knowledge management practices seems to be still underestimated ([5]). All the opportunities offered by the applications of new technologies in the knowledge field seems to be restricted to 'small domains' affected by a high specialization while the 'real value' seems to be related to the large-scale processes and activities ([67]). Focusing the attention on this point, the managerial literature about KM listed several phenomena such as the knowledge hiding ([15]), the knowledge speculation ([40]), and the knowledge brokerage ([30]) that formalize the multiple obstacles able to influence knowledge sharing also in presence of digital and technologies innovations without providing a clear explanation about the reasons for which these phenomena influence actors' relations ([9]).

With reference to the point, a possible cause of above mentioned difficulties could be identified using the concept of cognitive distance in which the cognition is defined as "cognition denotes a broad range of mental activity, including proprioception, perception, sense making, categorization, inference, value judgments, emotions, and feelings, which all build on each other" ([42: 1017]). Such a 'distance' influences the ways in which actors involved in knowledge processes approach the information flows with the consequence that, in the case in which un unclear and/or unexpected element emerges, they prefer to protect their individual position damaging the process or the configuration in which they are involve.

Recognizing the key role that the summarized process can have in affecting the success of the collaborative networks on which digital transition is based and with reference to which Society 5.0 defines its fundamental premises, it is needed to identify possible paths for overcoming the related barriers. From this perspective, useful reflections can be derived pointing the attention on the other 'dimension' of the ongoing transition: the *green* one ([53]).

In such a vein, the green transformation as "a long-lasting process with many direct and indirect impacts and consequences, not only on countries and their economies, but also on households, individuals, and their well-being ([6: 71]) can be considered as the consequence of the required radical change in perspective trough which multiple actors and interests can identifies a common purpose toward which address their efforts and energies ([38]). The green transformation offers the opportunities to all the actors to 'see and touch' phases and processes trough which it is possible to build a more sustainable and inclusive society offering the opportunities for overcoming individual resistance in sharing knowledge and information required for ensuring the success of the path ([35]).

With reference to the point, [54] have speculated that how actors involved in green transformation processes are more oriented to share personal information and data while [6] have shown that - in case of 'green engagement' - actors are less interesting in defending their privacy.

Following the traced conceptual flow, is possible to state that digital and green dimensions can be considered as interconnected elements than cannot be divided in the light of knowledge practices because while digital dimension offer the supports to efficiently ensure the emerge of Society 5.0, the green dimension permits to have the needed cognitive alignment that is needed as a precondition for an efficient and inclusive digital transition.

2.2 The contribution of circular economy for promoting actors' engagement in sustainable paths and strategies

Among the multiple managerial models defined and proposed in the recent years for supporting a widen understanding of sustainability and sustainable development, the intriguing framework on which the CE is based seems to offer multiple interesting stimulus for reflections ([16]).

Defined for explaining the interlinks between environment and economic activities, the proponents of CE have underlined the advantages of a closed-loop material flow for facing the challenges of environmental degradation ([45]). As well stated by the [20], the CE defines a model "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized"

Over the time, the model of CE has been enriched focusing the attention on the technical ways trough which it can be realized ([49]), on the instruments for supporting its success ([64]), and on its influence on market's perceptions ([61]) among the others. Anyway, despite the high relevance of all this investigates domain one of most challenging dimension of CE - in the light of the perspective adopted in this research - is related to the strong collaboration among the actors that this model requires for ensuring an effective and sustainable management of the whole (product and firm) life cycle.

With reference to this, among the several contributions provided with reference to the relevant role of collaboration among multiple stakeholders for ensuring the success of CE approach ([1]) and the need for a multi- and trans-disciplinary framework able to ensure a combination among different (and sometimes) divergent perspectives ([37]), [47] have identified 'six pillars' on which found an holistic approach able to ensure the synergies required by CE logic: 1] Governmental dimension; 2] Economic dimension; 3] Environmental dimension; 4] Behavioural dimensions; 5] Societal dimensions; and 6] Technological dimensions.

According to the authors, for ensuring a suitable approach to CE it is needed to define a *governmental approach* able to address individual behaviours trough the definition of clear and strong rules, to rethink the *economic dimension* to overcome the simplistic 'profit' view, to stimulate *alternative and more efficient ways* in the use of energy and raw materials, to stimulate *responsible behaviours* offering more information about products and brands life cycles, to ensure a *collaborative, inclusive and participatory use*

of available resources within societal dimensions, and to promote an *equal access and use of technologies*.

By focusing the attention on such pillars, it is possible to understand how the CE logic is strongly based on the collaborations among multiple actors that – inspired by a common purpose – can overcome their individuality for ensuring a collective and inclusive development.

2.3 Smart City and citizens' engagement as drivers for promoting an inclusive transition

As summarized in previous sections, the increasing attention to the digital domain provoked by the fast widespread of new technologies has produced multiple effects on several socio-economic domains ([63]). Among the others, the government of cities and municipalities seems to be one of the most challenging topics due to the increasing attention that the concept of 'smart city' has produced both in scientists' and practioners' communities ([2]).

Despite the concept of Smart City has been formalized more than 20 years ago ([60]), for a long time it has been considered a research stream of interest only by computer scientists for which it represented an 'empirical field' in which test the applicability and the usability of new technologies and digital devices ([59]).

More recently, the topic has attracted the interest of managerial and social scientists intrigued by its potential usability as a path for promoting e-public government and citizens participation in policy makers decisions and plans ([34]). With reference to the point, [26] - focusing the attention on the 'smartness' – explain that "Integration is a key dimension characterizing smartness in government. Integration and inter-organizational information sharing in government agencies allow for better communication, response, coordination, and service provisions for citizens, making the government smarter" opening to a wide debate with reference to which several researchers and practitioners have contributed proposing instruments ([25]) and practical evidences ([65]) for supporting citizens' integration in new models for city management ([32]).

Following the conceptual flow traced by [26] and summarizing the extensive managerial literature provided in the last years about the models of smart city ([62]) and their contribution in stimulating and ensuring citizens' participation ([22]), it is possible to identify in the Anttiroiko et al.'s studies about smartness ([3]) a valuable support for depicting the six levels on which SC act for ensuring citizens' participation: 1] governmental; 2] socio cultural; 3] logistic; 4] productive; 5] ecological; and 5] semantic.

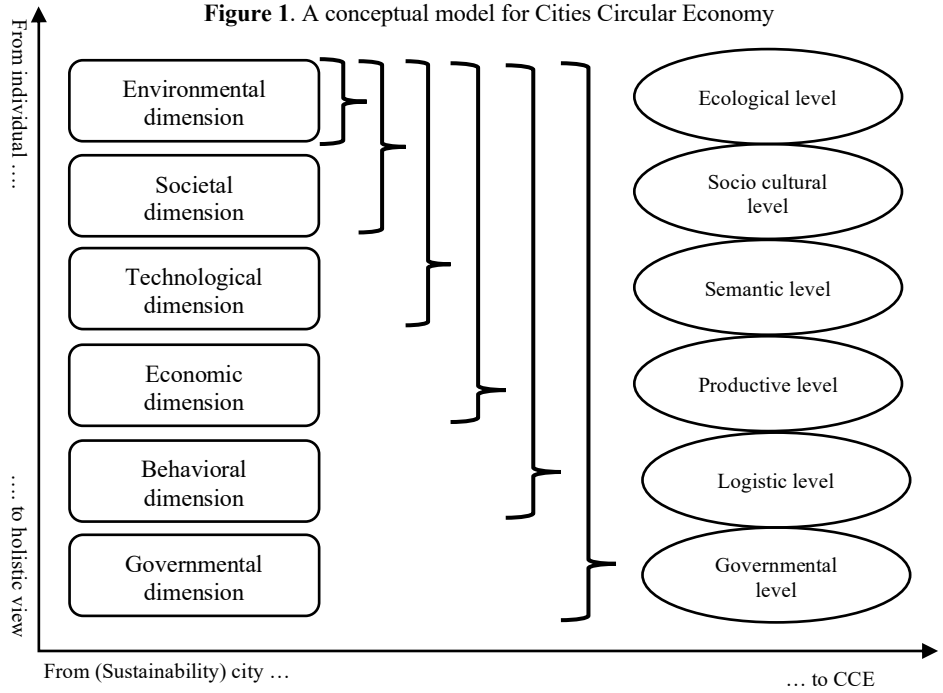
More specifically, the identified framework offers the possibility for stating that citizens' participation in SCs' activities and plans is made possible by the definition of *governmental approaches* interested in ensured an *equal socio-cultural participation* in which the *logistic infrastructures* is planned and managed for supporting *productive activities* inspired by an *ecological shared view* possible thanks a full and transparent communication flow.

3 A conceptual model for Cities Circular Economy (CCE)

According to the proposed theoretical framework, digital and green faces of ongoing transition cannot be more considered as separate and independent domains, but they should be considered as interconnected elements both required for ensuring an effective, inclusive, and suitable development for all ([48]).

Following the reflections herein reported, it is possible to speculate that digital and green dimensions can be combined for building a conceptual model able to support policy makers, researchers, and practitioners in stimulating actors' engagement in sustainability based path within highly interconnected domains ([57]). In such a vein, the city can be considered as a stimulating field for reflections due to the high number of relations on which it is based, the multiple stakeholders' perspectives with reference to which it is managed, and the key roles that citizens' engagement have in affecting their function and survival over the time ([36]). Because of the adopted perspective, the concept of Cities Circular Economy (CCE) is formulated for depicting the levels on which act for promoting sustainability paths in every kind of ecosystem based on the relationships among multiple and divergent perspectives. As summarized in the following Figure 1, city - as a socio-economic organization - can evolve toward a 'sustainability' configuration when the six dimensions proposed by [47] are managed through a holistic approach while such a configuration 'evolve' toward a 'circular' configuration when the dimensions are approached and managed identifying the different levels of actions as classified by [3], each of them finalized to achieve a specific aim.

Figure 1. A conceptual model for Cities Circular Economy



Source: Authors' elaboration

More in detail, the Figure 1 shows that a city can be considered as 'sustainable' when all the six dimensions are joint planned and managed to ensure the combination of multiple and divergent perspectives and purposes. Such a configuration seems to be a utopia due the (actual) impossibility to ensure the contamination among dimensions affected by a strongly cognitive distance.

Such theoretical configuration can 'evolve' towards a 'circular' modelling when the dimensions are approached and managed following a planned approaches defined in the light of expected outcomes. With reference to the point, it is possible to state that:

- The *Ecological level* only considers the environmental dimension due to its key role for ensuring socio-economic organizations' survival over the time.
- The *Socio cultural level* in which environmental dimension is enriched with societal dimension for explaining how the actors approach and use available recourses.
- The *Semantic level* in which the technological dimensions is added for explaining how actors are interrelated and they share information within socio-economic organizations for using available recourses.
- The *Productive level* in which economic dimensions is included for explaining advantages obtained by the actors interrailed inside the city ecosystem.
- The *Logistic level* in which behavioural dimension is considered as a way for explaining how the relationships among the actors inside the city ecosystem can be effectively realized through a structural combination among the available resources.
- The *Governmental level* where governmental dimension is finally added for explaining rules, logics, and holistic perspectives that should guide and address actors' behaviours and decisions inside city ecosystem.

4. Conclusions, implications, and future directions for the research

For a long time, green and digital dimension of ongoing transition have been considered as separate and incompatible constructs not conciliable under a common interpretative framework useful for explaining and addressing sustainability and sustainable development. With the aim to overcome this reductionist view, the paper uses the conceptual framework provided by the KM for explaining that a sustainable and inclusive development is possible only in the case in which all the actors are cognitively aligned toward a common purpose. In such a direction, the 'green' dimension of ongoing transition is identified as the level trough which each actor can understand the need for converge toward a shared sustainable development.

Enlarging the perspective, the 'digital' dimension of ongoing transition is approached for explaining how the collective interest towards 'green' purposes can be transformed in effective and sharable path.

Thanks to the proposed conceptual framework the topic of SC is analysed as an evolving domain from which an ecosystem configuration can emerge from the combination of digital and green dimension supporting – in this way – a renovate model named CCE.

The CCE aims at representing a general conceptual model replicable in each ecosystem characterized by an intensive relational configuration among multiple

different actors. Thanks to this model, policy makers, researchers, and practitioners can understand on which level act for supporting the 'evolution' toward a new ecosystemic configuration in which green and digital dimensions can be effectively combined for ensuring citizens' engagement in sustainability-based paths and processes.

Reflections herein should be considered as a first step of a longer research path in which conceptual elaborations require to be tested and validated trough empirical studies and observation for verifying its applicability and validity in multiple socio-cognitive configuration.

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