Extended Data Pipeline for Circular Economy Monitoring

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Extended Data Pipeline for Circular Economy Monitoring

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ABSTRACT

Circular economy (CE) and sustainability are high on the political agenda of governments nationally and internationally. Governments are developing instruments to stimulate the CE, but without monitoring in place, these measures can be subject to abuse, failing to achieve the desired effects. CE monitoring, however, is still a nascent topic in academic literature. In this paper we propose the concept of the extended data pipeline to support CE visibility. Governments, but also banks and auditing firms can use this visibility to monitor CE flows to design and evaluate instruments and measures to enhance the CE.

CCS CONCEPTS

• **Information systems**; • **Information systems applications**; • **Enterprise applications**;

KEYWORDS

Circular economy, Government, Digital infrastructures, Visibility, Data pipeline, Supply chain, Monitoring

1 INTRODUCTION

Circular Economy (CE) and sustainability have become high on national and international political agendas. Governments play a key role in developing instruments to stimulate businesses and citizens to move into the direction of CE. For these instruments to be effective, it is essential that proper monitoring mechanisms are put in place to prevent misuse. Recent scandals with plastics exported for recycling ending up being burnt as waste illustrate this need for CE monitoring. While it is crucial for governments to monitor

CE flows and the proper implementation of CE instruments, there is scarcity of research on that topic.

2 CIRCULAR ECONOMY (CE) IN THE INFORMATION SYSTEMS (IS) AND EGOVERNMENT RESEARCH

A review of the IS and eGovernment literature reveals that so far limited attention has been paid to the topic of CE. A recent paper by [1] in one of the top IS journals calls for mobilizing IS scholars for CE research. In the eGovernment literature the topic gained initial attention in a stream of CE-related research, predominantly linked to the ICEE conference in 2010 and 2011. However, in the last decade limited follow-up research has been published on this topic. We do see an emerging interest in the general topic of sustainability in the eGovernment community[1], but monitoring CE is a largely unexplored area.

3 CE SYSTEMS AND DIGITAL TRADE INFRASTRUCTURES

Circular economy can be defined as "an industrial system that is restorative and regenerative by design. It rests on three main principles: preserving and enhancing natural capital, optimizing resource yields, and fostering system effectiveness" [4, p. 32]. The Ellen MacArthur Foundation developed a key model for understanding the CE flows which is widely used in academia and in business [4, p.32]. This model captures two loops, one related to the finite materials and one to the renewables, and the aim is to minimize waste. This can be done via stock management of the finite material flows (from prolonged use to refurbishment and recycling) and through renewable flow management in an environmentally-friendly way. While the model helps to understand the CE processes, it does not go into aspects of how to ensure visibility of CE flows in order to enable governments to monitor these flows.

As positioned by [1] digital technologies and data analytics hold potential to enable CE visibility but limited IS research has focused on CE so far. There is even less research focusing on CE monitoring by governments. Nevertheless, over the last decade, extensive academic research in the area of international trade has focused on digital trade infrastructures and data pipelines ([2]; [5]; [3]; [6])

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[1]Dgo2020 panel of Kim Normann Andersen, Jungwoo Lee and B. Joon Kim. Smart Cities at a Cross Road?, as well as, the DGo'21 track on Digital Government and Sustainable Development Goals(http://dgsociety.org/dgo-2021/tracks/ chaired by Medaglia & Misuraca)
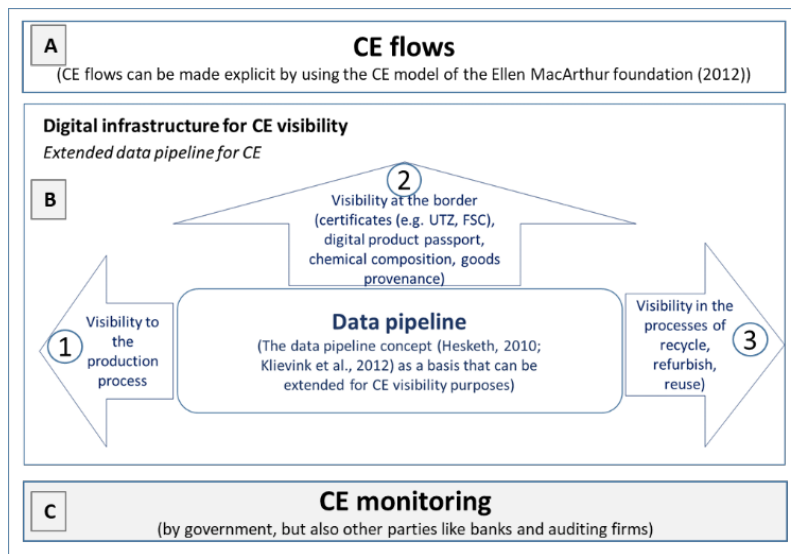
Figure 1: A framework for extended data pipeline for CE monitoring

that allow governments to access business supply chain information (provided on a voluntary basis by businesses) for government control purposes. The data pipeline is a sort of internet for logistics, allowing governments to access business data from the initial source and to have access to rich additional business data that they can use for monitoring and control purposes (such as customs control when crossing borders). Although the data pipeline concept as developed so far covers only a limited part of the flows (mostly the flows between the seller and the buyer and not the processes of production and post-use), it can serve as a basis for a framework for monitoring CE flows, if extended to cover more processes, as discussed in the next section.

4 EXTENDED DATA PIPELINE FOR CE MONITORING

In Figure 1 we illustrate how the data pipeline concept ([2]; [3]) (at the center of Figure 1, indicated with B) can be extended to support CE monitoring. In our framework we extend the scope of the data pipeline taking the CE flows into account (top part of Figure 1, indicated with A) and adding the objective of CE monitoring (bottom part of Figure 1, indicated with C). Subsequently, we propose three extensions to the original data pipeline concept to capture additional visibility on the CE flows.

These extensions call for adding:

(1) data on the production process (e.g. the use of materials for manufacturing which is important for creating circular or closed material loops);

(2) data needed for customs control at the border crossing by using e.g. certificates, digital product passports, goods providence, and data on chemical composition;

(3) data on the processes of recycle, refurbish and reuse.

These extensions to the original data pipeline concept allow for visibility of the CE flows that can be used by governments for CE monitoring purposes. Other parties such as banks that offer green

loans, as well as auditing firms can also use this enhanced visibility for their own CE monitoring purposes.

5 CONCLUSIONS

The topic of CE monitoring has so far received limited attention in academic IS and eGovernment literature. In this paper, we propose the concept of an extended data pipeline for CE. By including relevant data on CE flows, the extended data pipeline offers data visibility that enables governments, but also other actors such as banks and auditing firms to monitor the CE flows. The enhanced data visibility can support the development, implementation and evaluation of CE instruments to achieve CE targets.

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