

## **EXPLORING THE ROLE OF THE INTERNET OF THINGS IN FACILITATING THE IMPLEMENTATION OF CIRCULAR BUSINESS MODELS IN DIVERSE INDUSTRIAL SECTORS**

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### **Introdução**

Circular business models (CBMs) are based on creating, delivering, and capturing value by slowing down and closing material and energy cycles. The Internet of Things (IoT) helps to implement productive processes that optimize resource consumption and minimize waste. The IoT can facilitate the implementation of CBMs through five capabilities: tracking, monitoring, control, optimization, and evolution in design. However, it is not clear what are the necessary conditions and requirements for this transition to CBM to occur and how IoT can facilitate this process in organizations.

### **Problema de Pesquisa e Objetivo**

The acceptance of technology is successful in companies to the extent that it is understood how its capabilities can improve operational performance. IoT and CBM research is in its initial phase, many articles present conceptual discussions and theoretical models, but there are few empirical works. This research aims to answer the following question: How can the adoption of IoT facilitate the implementation of CBMs in different industrial sectors? This study aims to elucidate how the use of IoT can support the implementation of CBMs in strategic industrial sectors for the circular economy.

### **Fundamentação Teórica**

Ellen McArthur Foundation suggests that six different operational actions enable CBMs, grouped under the acronym “ReSOLVE”: regenerate, share, optimize, circularize, virtualize, and exchange. The use of the IoT can be an important component in the creation and development of CBMs through monitoring processes for efficient use of resources, product lifecycle tracking, and optimization of the reuse and recycling process. IoT can facilitate the implementation of CBMs through five capabilities applied to internal processes: tracking, monitoring, control, optimization, and design evolution.

### **Metodologia**

This article, through a qualitative and exploratory approach, used secondary data extracted from the IoT ONE database, which lists successful implementations of IoT solutions in organizations of different sizes and industrial sectors. First, the cases were analyzed and related, through content analysis, to at least one of the six CBMs proposed by the ReSOLVE framework. Subsequently, the Crisp-set Qualitative Comparative Analysis (csQCA) approach was used to identify and compare how different combinations of IoT capabilities influence the level of operational impact in CBMs.

### **Análise dos Resultados**

Circular optimization practices were implemented in 92% of cases, exchange and regeneration were implemented by 6.7% respectively, virtualization was implemented by 2.7%, and sharing and circularization were implemented by 1.3% respectively. The csQCA result points out that IoT solutions embedding the combination of IoT capabilities monitoring and tracking ensured broad operational impacts in CBMs. IoT solutions seem to favor more upstream activities (e.g. energy efficiency, reduction in resource consumption) than downstream activities (e.g. integration with suppliers) in organizations.

### **Conclusão**

This study aimed to elucidate how the use of IoT can support the implementation of CBMs in

strategic industrial sectors for the circular economy. The results show that IoT is predominantly used by companies to optimize internal processes and conserve resources, indicating that adopters may not fully exploit the potential of IoT to transition to CBMs. Furthermore, monitoring is found to be an essential capability of the analyzed IoT solutions, and companies that have adopted this technology to monitor and track their production lines have achieved comprehensive operational impacts.

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