Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe

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ABSTRACT: The Circular Economy (CE) has been identified as a sustainable alternative to the current linear economic model. Thus far, research on the circular economy has focused on methods for better conserving the value in material flows. As the CE is currently being adopted as a sustainable development strategy in, e.g., China and the EU, identifying and comparing the drivers of and barriers to CE implementation would be beneficial for the acceleration of the development path. To contribute toward this research area, we built on institutional theory via a multiple case study covering China, the US, and Europe. We analyzed each region as an institutional environment and considered manufacturer and integrator types of value chain actors due to their central role in CE implementation. As our key findings, we identified that the general drivers of the CE from each institutional environment support recycling as the primary CE action, while support for other CE types appears to be lacking. Regulatory measures have primarily driven increased recycling efforts on both the integrator and manufacturer sides. Similarly, identified normative indicators overwhelmingly point toward recycling, while increasing reuse faces cultural-cognitive barriers. Between regions, China differs due to its informal sector and strong regulative institutional support. We conclude that to improve institutional support for the CE and allow it to fulfill its potential as a sustainable growth model, diversified institutional support for reducing the products produced and materials used as well as increasing reuse are needed.

KEYWORDS: circular economy; institutional theory; regulation; norm; cultural-cognitive; case study

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1. INTRODUCTION

The Circular Economy (CE) approach refers to an economic system that is designed to be restorative and generative (Charonis, 2012); more specifically, the system maintains the value of products, materials, and resources in the economy for as long as possible, and the generation of waste is thereby minimized (European Commission, 2015). Accordingly, the CE approach has been receiving increasing attention recently as a step toward a more sustainable economic model. The CE theory suggests that increasing resource efficiency and waste reduction throughout the lifecycle of produced goods are, in fact, unexplored economic opportunities that have the potential for economic growth (Ghisellini et al., 2016; Witjes and Lozano, 2016). This fundamental linkage between environmental sustainability and economic potential has generated major interest in CE initiatives on a global scale (European Commission, 2015; Gang et al., 2012; Mathews and Tan, 2011).

Successful CE initiatives typically involve a broad variety of economic and societal stakeholders that need to work together in order to enable the circular flow of materials and related efficiency benefits (Geng et al., 2012; Preston et al., 2012). In particular, the literature has shown that implemented CE initiatives have often needed societal support, including legislative and financial subsidies (Fei et al., 2016; Levänen, 2015). Furthermore, recent research has increasingly highlighted the role of broader institutional issues such as norms and cultural aspects in shaping the transition toward more sustainable choices and the adoption of CE principles (Dai et al., 2015; Dubey et al., 2016; Levänen, 2015). However, the major focus of the CE literature has been on technical issues, such as material flows and technologies (Geng et al., 2009; Mathews and Tan, 2011), and thus the concept has been criticized for largely excluding the societal factors of sustainability (Murray et al., 2015).

Given the relevance of societal factors for CE adoption, we argue that the absence of an understanding of institutional drivers and barriers in mainstream CE analyses constitutes an important research gap. Although the extant studies have shown that diverse social institutions and legitimacy are relevant aspects of the transition to a CE (Ghisellini et al., 2016; Murray et al., 2015), our understanding of how these factors form the initiatives and drivers of as well as barriers to the CE are limited. The CE is an emerging global phenomenon, as China and the EU have simultaneously adopted it as a concept around which economically and environmentally effective future policy can be built (European Commission, 2015; Mathews and Tan, 2011). However, existing studies have focused mostly on single regions (e.g., Su et al., 2013) or have been limited to narrow sets of institutions, such as legislation (e.g., Sakai et al., 2011); thus, cross-regional comparisons that would suggest variations or offer a comprehensive picture of the phenomenon at a

global level are needed. Furthermore, a multitude of viewpoints exist about how to actually incorporate the CE into concrete actions at the firm level. The definition provided by the EU Commission (2015) gives very little direction toward concrete operations and, academically, the concept is rooted in industrial ecology (Yuan et al., 2006), industrial symbiosis (Geng et al., 2012), product-service systems (Tukker, 2015), remanufacturing (Linder and Williander, 2015), corporate responsibility (Murray et al., 2015), and sharing economy (Preston, 2012), just to name a few. However, comprehension of the general drivers of and barriers to CE is very limited, possibly due to the fragmentation of the field. We argue that the principal difference between the linear economy and the CE is that, in the latter, material flows are integrated back into circulation. Following the established value chain perspective of Porter and Millar (1985), the critical actors in enabling the transition to the CE would thus be integrators, i.e., actors integrating material flows back into circulation; and manufacturers, i.e., actors completing the integration by enabling new value cycles from material flows.

Thereby, we *analyze the general and region-specific institutional drivers of and barriers to CE initiatives across China, the US, and Europe as found in manufacturer and integrator companies.* To contribute to the abovementioned research gap, we adopt an explicitly institutional view. We build on studies that have examined how CE approaches are shaped by norms and cultural aspects (Dai et al., 2015; Dubey et al., 2016; Levänen, 2015) and utilize institutional theory (DiMaggio, 1997; North, 1990; Scott, 2008) to help us analyze the (institutional) legitimacy of technologies (see, e.g., Markard et al., 2016). Applying the framework of regulative, normative, and cultural-cognitive institutional pillars of Scott (2008) enables us to map in detail how different types of institutional indicators (e.g., laws, norms, and beliefs) hinder or advance the adoption of the CE approach. The empirical part of the study presents a multiple case study approach with insights from Chinese, US, and European CE initiatives, analyzing each region as a different institutional environment (see, e.g., Tatoglu et al., 2015) and highlighting industrial cases of CE application across regions. As our key contribution, we identify regulative, normative, and cultural-cognitive institutional drivers of and barriers to CE across regions and value chain roles and map regional difference and similarities. Taken together, our results provide valuable insights into both academic and practical understandings of the heterogeneous institutional environments for CE implementation.

The structure of the study is as follows. Section 2, the theoretical background of the research, includes a discussion of circular economy and institutional theory. Section 3 presents the research methodology and describes the case selection, data gathering and data analysis procedures used. In Section 4, the findings from the case analysis are shown and summarized. In Section 5, the findings are further discussed by comparing the findings and identifying region and case-type specific drivers and barriers. In the concluding section, the implications of the findings, the limitations of the study and potential future research avenues are discussed.

2. THEORETICAL BACKGROUND

2.1 Identifying Circular Economy initiatives

The CE has been receiving increasing attention from academia (Ghisellini et al., 2016), governments (e.g., the EC Working Package, China's CE Promotion Law), and companies (Ellen MacArthur Foundation, 2016) as an alternative to the prevailing model of economic development: the so-called "linear economy" (Andersen, 2007), otherwise known as the "take, make and dispose" model (Ness, 2008).

The CE is often discussed through the 3R principles: reduce, reuse, and recycle (Feng and Yan, 2007; Preston, 2012; Reh, 2013; Sakai et al., 2011; Su et al., 2013; Yong, 2007). The reduce principle implies using minimal inputs of energy, raw materials, and waste by, for example, implementing better technologies, simplifying packaging, and using more power-efficient appliances (Feng and Yan, 2007; Su et al., 2013). The reuse principle states that "products or components that are not waste are used again for the same purpose for which they were conceived" (The European Parliament and the Council of the European Union, 2008, p. 10); this principle refers to the use of fewer resources, less energy, and less labor than that required to produce new products from virgin materials or even to recycle and dispose of products (Castellani et al., 2015). The recycling principle refers to "any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and reprocessing into materials that are to be used as fuels or for backfilling operations" (The European Parliament and the Council of the European Union, 2008, p. 10). Recycling is often discussed almost synonymously with the CE, and waste policies have included a strong focus on improving recycling rates (see, e.g., The European Parliament and the Council of the European Union, 2008). Since the 3R principles capture the essential aspects of the CE, we have determined its institutional drivers and barriers by analyzing whether they support or inhibit the 3R principles.

The 3R principles and the implications for advancing them demonstrate that the manufacturing and waste management sectors are central industries in the CE. However, the sectors have differing attitudes toward 3R principles due to their position in the value chain. In the traditional value chain perspective (Porter, 1985), product manufacturers produce goods and products, while waste management (i.e., integrator) companies deal with their disposal. In a profit-maximizing logic, reduce, reuse, and recycle have different impacts on actors in different parts of the value chain. Manufacturers that implement CE initiatives which fulfill some or all parts of the 3R principles seek benefits in terms of competitive advantage, albeit indirectly, in, e.g., increased efficiencies (Knight and Jenkins, 2009). The reduce principle is well aligned with this approach (Ayres and Van

Den Bergh, 2005, p. 102), but designing and organizing reuse and recycling are not (Knight and Jenkins, 2009). In contrast, integrators, or waste management companies, seek to improve their processes with CE initiatives and direct business benefits, as they are structured in line with the 3R principles and thus have less conflicting business goals (Geng et al., 2009). For example, recycling is one of the central processes in an integrator's business, while for a manufacturer this represents an additional set of costs that need to be turned into competitive advantage, e.g., by actively communicating its efforts to relevant markets as a responsible business practice (Bocken et al., 2014).

2.2 Institutional Theory and the Legitimization of Sustainability Initiatives

Since our work builds on institutional theory, we begin by briefly discussing the key aspects of this approach. Institutional theory examines the established, resilient social structures that provide societal stability (Scott, 1987). Scott's (2008) framework of institutional theory suggests separating institutions into three pillars—*regulative*, *normative*, and *cultural-cognitive*—that are individually distinguishable but interdependently contribute to the resilience of the social structure. These pillars reveal through their indicators the rules, norms, and beliefs that impact social behavior and are reflected in activities, relations, and resources in a particular field, region, or community (Scott, 2008).

These institutional rules are generated by both agency-based and unconscious processes (Strang and Sine, 2002). In general, they seem to evolve from the regulative pillar, which involves mostly conscious decisions, to the culturally cognitive pillar, which involves mostly unconsciously adopted decisions. Different schools of theorists studying institutions focus on different areas: For example, in economic studies, where actors are usually seen as agents who actively influence the construction of institutions, the regulative pillar is often highlighted, whereas early sociologists stressed the influence of normative systems in imposing constraints on social behavior (Scott, 2008, pp. 51–55). Table 1 summarizes the principal dimensions of institutions, as described by Scott (2008, p. 51).

Table 1: Three Pillars of Institutions (Scott, 2008, p. 51)

	Regulative	*Normative*	*Cultural-Cognitive*
Basis of compliance	Expedience	Social obligation	Taken-for-grantedness Shared understanding
Basis of order	Regulative rules	Binding expectations	Constitutive schema
Mechanisms	Coercive	Normative	Mimetic
Logic	Instrumentality	Appropriateness	Orthodoxy
Indicators	Rules Laws Sanctions	Certification Accreditation	Common beliefs Shared logics of action Isomorphism
Affect	Fear, guilt/innocence	Shame/honor	Certainty/confusion
Basis of legitimacy	Legally sanctioned	Morally governed	Comprehensible Recognizable Culturally supported

Institutional theory has recently and extensively been used in explaining sustainable activities at both the firm and individual levels; likewise, the framework of the three pillars of institutions has established itself as a frequently used analytical tool. A range of studies on recycling and sustainable production, both central to the CE concept, have suggested ways that institutions shape the diffusion and adoption of sustainable business. The foci and key findings of these studies are displayed in Table 2.

Table 2: Use of Institutional Theory to Analyze the Diffusion of Sustainable Efforts

Authors (Year)	Sustainability	Institutions
Mac (2002)	Argues that purely economic and "rational" aspects are not sufficient for firms when managing environmental decisions.	Identifies institutional theory as an important contribution toward understanding how firms make decisions regarding environmental problems.
Coenen and Díaz López (2010)	Explores conceptual commonalities, differences, and complementarities among the theoretical frameworks of sectoral systems of innovation (SSI), technological innovation systems (TIS), and socio-technical systems (STS) as approaches to innovation and technological change for sustainable and competitive economies.	Considers institutions to be a distinctive feature of each of the systems approaches and acknowledges the three-pillar framework of regulatory, normative, and cultural-cognitive institutions. Identifies that, while in SSI and TIS, institutions primarily serve as guiding innovators; in ST Systems, institutions, as agents of institutional change and social learning, play an integral role in the transformation from one ST System to another.
Abreu et al. (2012)	Compares corporate social responsibility activities between textile firms in Brazil and China.	Uses the regulatory, normative, and cognitive pillars framework of institutional theory as the central analytical tool.
Pajunen et al. (2013)	Analyzes barriers towards the development of innovative residue based products, focusing on the Finnish domestic framework.	Focuses on analyzing institutional barriers that inhibit material cycles within the policy framework in Finland, and provides policy suggestions to reduce the barriers.
Dai et al. (2015)	Reports that doorstepping interventions can produce statistically significant increases in the recycling capture rate and analyzes why this is so.	Finds that social norms and emotions are important determinants and hints at the influence of normative institutions, despite not using the institutional theory approach.
Levänen (2015)	Analyzes the role of institutions in the development of industrial recycling in Finland.	Establishes an analytical framework categorizing institutions into formal institutions, which include the regulative pillar of the established institutional framework, and informal institutions, which include the normative and cultural-cognitive pillars.
Dubey et al. (2016)	Develops a theoretical model to provide insights into firms' sustainable consumption and production activities.	Adopts institutional theory as part of a model to explain the sustainable behavior of stakeholders in sustainable consumption and production (SCP) activities. Tests the significance of coercive, normative, and mimetic pressures on top management participation in sustainable activities. Finds that mimetic pressures and top management beliefs have a significant relationship with top management participation.
Miliute-Plepiene et al. (2016)	Analyzes what motivates households to recycle in Sweden and Lithuania.	Emphasizes norms as important determinants and finds almost all proxies for personal moral norm activation to be important and statistically significant in both countries. Does not explicitly use institutional theory.

Overall, existing studies indicate that the institutional environment both supports and inhibits the adoption of and transition to a CE. For example, the regulatory system of an institutional environment can support a CE by discriminating against wastefulness and motivating circularity, but it can also inhibit CE by, for example, denying the reuse of certain products. Similarly, the normative system of the institutional environment can be expected to support the CE (e.g., Dai et al., 2015; Miliute-Plepiene et al., 2016) through, for example, establishing recycling as more acceptable than landfilling. However, the normative system could also be misaligned with the ultimate goals of CE by, for instance, establishing the reduction of greenhouse gases as more virtuous than the increase of the circulation of materials. The cultural-cognitive system can also play a crucial role in the establishment of societal expectations and structures that guide ways of thinking about, for example, waste and why sustainability is important. These systems interdependently and mutually set the legitimacy of the CE in the institutional environment.

3. RESEARCH METHODOLOGY

Here, we will describe the research methodology used to examine the institutional drivers of and barriers to the CE in multiple regions. To study the combined research areas of the CE and institutional theory with relatively little preceding research, we adopted the case study as our research approach (Yin, 2003, p. 5). Qualitative case research is an established method for conducting explorative and theory-building research (Saunders et al., 2009, p. 146) and has also been previously used in the study of recycling and the CE (see, e.g., Mathews and Tan, 2011; Uiterkamp et al., 2011). To analyze the heterogeneous institutional aspects of the CE, we selected a multiple-case research design with six cases. Yin (2003, p. 53) argued that selecting a multiple-case design over a single-case design may be preferable because it reduces vulnerability to unexpected circumstances in the chosen cases and increases analytical benefits by providing multiple cases for cross-case analysis. In addition, the main driver for choosing a multiple-case design was our interest in examining and comparing different cases from multiple regions to yield a combination of institutional environments that would facilitate the identification of global and regional patterns.

3.1 Case Selection

Qualitative analysis is used in this study; thus, the purpose of the case selection was not to attain a sample from which to draw statistically meaningful results, but to follow purposive (Saunders et al., 2009, p. 237) and theory-based sampling (Patton, 1990, p. 177) so that the cases would provide as much information as possible about the connection between the CE initiative and the institutional environment. The selection of

the regions and the cases within each region followed maximum variation sampling (Patton, 1990, p. 172) in order to capture a wider picture of CE initiatives. Between regions, replication logic (Yin, 2003, p. 47) was used so that, even though case types differed across regions, each regional set of cases selected resembled the sets of other regions. Replication logic was used to increase the validity of the findings by comparing the drivers of and barriers to the CE in the institutional environments of the selected regions.

The case sampling proceeded in two phases. In the first phase, a range of cases were identified, and 10 cases were further evaluated for case selection. These cases were Huawei (CE recycling system for electronics), Dell (use of closed-loop plastics), Republic Services (recyclables separation in facilities after curbside collection), Ekokem (CE Village waste utilization concept), H&M (textile recycling), Renault (reuse and recycling of materials in the automotive industry), Suzhou (recycling of household waste in China), UPM (turning a company's own waste stream into a new product), Veolia (a CE-oriented waste management model), and Enevo (improving waste management efficiency through digitalization).

For each of these cases, an evaluation of the case value for the research agenda was conducted based on CE aspects and data availability. Using the criteria of different types of initiatives and institutional environments, a final set of six cases was selected. Thus, the final case sampling criteria were to select cases from three different institutional environments (China, the US, and Europe) and to select one integrator/waste management-oriented and one product-oriented case from each institutional environment. With this sampling, we were able to contrast product manufacturers' initiatives with integrators' initiatives in different institutional settings and seek common and differing themes within integrators and within product manufacturers regardless of their institutional environments. The selected cases, together with details of their selection criteria, are shown in Table 3.

Table 3: Cases Selected for Analysis

Case	Institutional environment	Company employees	Company revenue (MEUR 2015)	Industry	Case description
Huawei	China	170,000	54,400	Phones, network equipment	E-waste recycling and new processes to increase material circulation
Suzhou	China	Thousands in the informal sector*	Not available	Waste management	Recycling in the presence of the informal sector
Dell	US	101,000	51,700	IT	E-waste recycling organized by producer
Republic Services	US	33,000	8700	Waste management	All-in-One™ recycling solution with minimal source separation
UPM	Europe	19,600	10,100	Forest industry, energy	Creating products from waste and sidestreams
Ekokem	Europe	680	260	Waste management	Separating recyclables from mixed waste

**Based on Fei et al. (2016, p. 76)*

For China, Huawei was chosen as the manufacturer case due to the company's emphasis on the CE in multiple, recent, annual sustainability reports. The case of Suzhou's recycling system, an integrator, was included as the Chinese waste management case, primarily because it represented an opportunity to include an analysis of the informal sector in addition to the availability of prior studies on the subject. Dell was chosen as the manufacturer case from the US because the company has a closed-loop plastics program and, like Huawei, has recently promoted the concept of the CE. Republic Services was chosen as the waste management (i.e., integrator) case from the US because this company is a leading waste management and recycling operator in the region. The UPM case was chosen to show how a manufacturer can create end products from its own and customers'

operational waste. Industrial symbiosis in the form of UPM's use of waste from other companies as a resource was a major influence in the selection of this case. Finally, Ekokem, an integrator, represents a case of a CE initiative from an incumbent waste management industry. Together, the UPM and Ekokem cases cover the institutional environment of Europe. With these cases, multiple types of CE initiatives in a variety of regions can be addressed with comparisons between manufacturer and integrator businesses.

3.2 Data Gathering and Analysis

This study builds on a combination of primary and secondary data gathered from multiple sources. Secondary data have been established as a valid source of main data for a case study when using a broad range of publicly available data (e.g., Ritala et al., 2014; Rusko, 2011). As an example, Rusko (2011) analyzed strategic moves and competition in the Finnish forest industry using published historical accounts of the firms studied, newspapers, public material (e.g., annual reports), and archival documents (e.g., published research reports)—in other words, solely secondary data. Furthermore, using an extensive set of data gathered from multiple sources increased data triangulation (Yin, 2003, p. 34).

The major method of data collection in this study involved using the news search engine LexisNexis and documenting the dates of retrieval and the search terms used. The LexisNexis-acquired news data were then augmented with corporate annual reports, investor relations presentations, news articles from other established sources, and product details from the companies themselves (e.g., company websites). LexisNexis was selected specifically for its global news article search function, following the example of previous studies that have treated it as a reliable data source (Adams et al., 2009; Moynihan et al., 2000; Tankard, 2001; Zahra and Nielsen, 2002). In cases in which recent academic research material was available, academic papers were also used as secondary material for the cases. The major data were supplemented with two theme interviews for the European cases. The data sources and amounts of data for each case are shown in Table 4. Altogether, this study's extensive data set comprises 401 documents.

Table 4: Data Sources for Each Case

Case	*News Articles*	*Editorials/ Commentaries*	*Company Releases*	*Research Articles*	*Other Company Material*	*Supplementary Material: Interviews*
Huawei	4	1	7		8	
Suzhou	30	8	26	8	19	
Dell	22	12	2	1	12	
Republic Services	12	1	5		6	
UPM	12	7	98		27	1
Ekokem	12	3	35	1	20	1

The analysis of the data set was conducted in a structured way using Excel spreadsheets to identify indicators of the three institutional pillars in the case material of each case. The case analysis method followed the pattern-matching method, in which a theoretical framework is used to identify empirical patterns from data (Saunders et al., 2009). Therefore, following the key elements of the analytical framework, highlighting diverse institutional indicators (cf. Scott 2008), as shown in Table 5, manifestations were sought of such indicators from the data. For example, if the data for a given case mention that a law or rule restricted (or promoted) the case initiative in some way, this was listed in the regulatory pillar section of the case as a barrier (or driver) from the CE perspective. To determine if the institutional indicator served as a barrier or a driver, the institution's influence with respect to the 3R principles of CE—that is, supporting them (i.e., being a driver), inhibiting them (i.e., being a barrier) or neither—was assessed. As an example in the analysis and related qualitative assessments in the UPM case, the Profi products received multiple awards in design competitions due to the recycled materials of the product. This was identified as a normative indicator and a driver because of its support of recycling. To increase the reliability and quality of the study, researcher triangulation was used (see Flick, 2004), and all of the researchers conducted analysis, compared assessments and reached agreement on the findings. The most notable findings originating from this analysis are shown in the figures for each case.

Table 5: Framework used for case analysis

	Regulative	*Normative*	*Cultural-Cognitive*
Indicators	Rules Laws Sanctions	Certification Accreditation	Common beliefs Shared logics of action Isomorphism

We first conducted the within-case analysis for each of the six cases. These were followed by a cross-case analysis, which was conducted by pattern-matching the regional case sets selected using replication logic (Yin, 2003). The resulting common drivers and barriers

were grouped to determine which institutional drivers appeared to be similar or distinct across the six cases.

4. RESULTS

After identifying the institutional indicators of each case, the effects of the indicators were categorized as either drivers (if they supported the CE principles of reduce, reuse, and recycle) or barriers (if they inhibited these principles). The summaries of the results for each initiative are shown in the tables corresponding to each case. The most relevant findings are briefly described for each initiative.

4.1 CE Cases from the Chinese Institutional Environment

Manufacturer Case: Huawei

In 2013, Huawei set a goal to embrace a CE model across its operations. Since then, the company has been making annual efforts to reduce its landfill rates, CO_2 emissions, and product energy consumption, while increasing its manufacturing resource efficiency and seeking new business models that will enable new lifecycles for end-of-life products. For example, in 2015, the company redesigned its lifecycle management processes and started organizing auctions for optic cables and other end-of-life products that previously would have simply been discarded. A summary of the institutional environment identified in the case is shown in Figure 1.

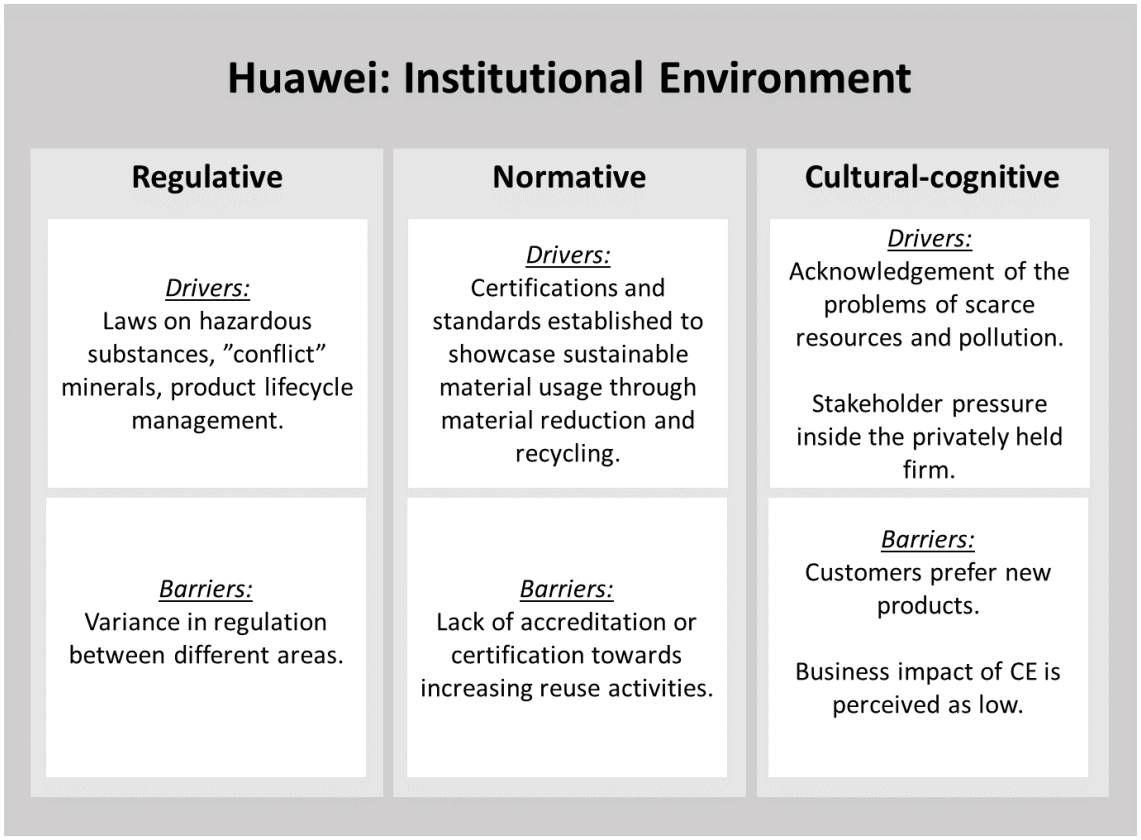


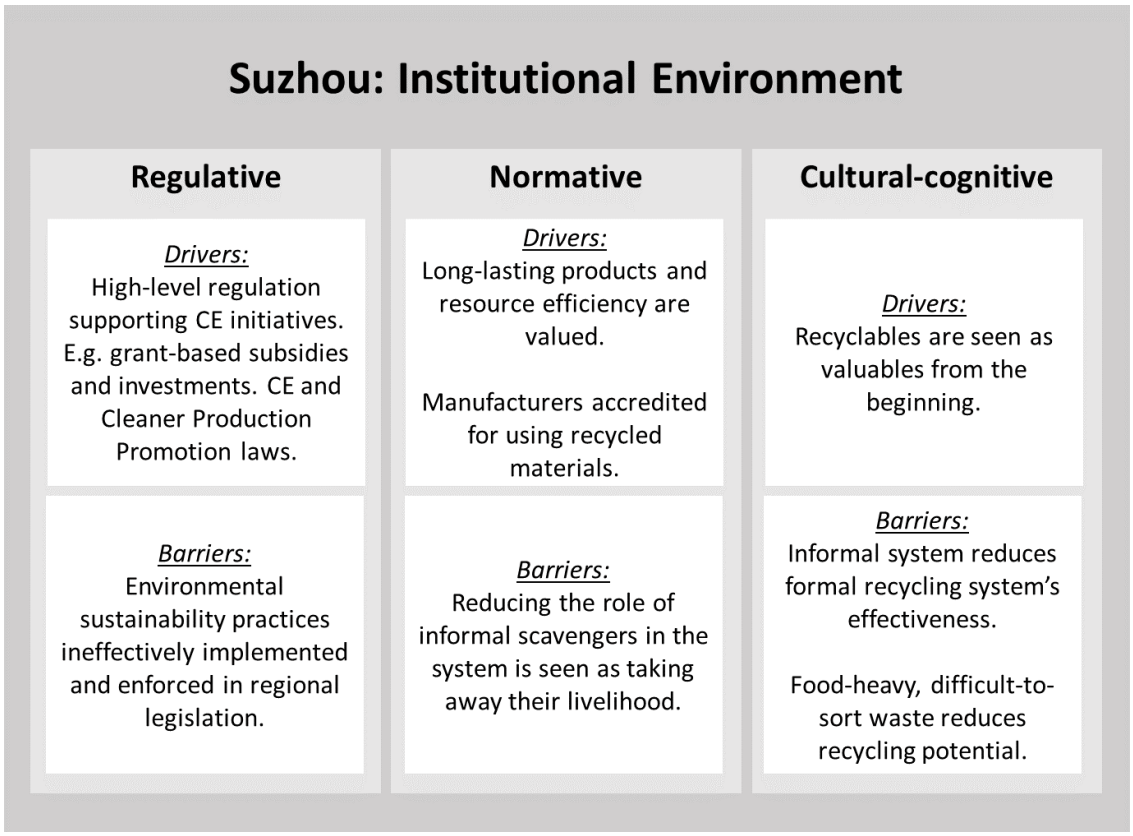
Figure 1: Summary of the Institutional Drivers and Barriers in the Huawei Case

In the Huawei case, the primary driver appears to be the pressure placed by company stakeholders on the privately held company to move toward the CE. Due to this pressure, over the last three years, Huawei has implemented a company-wide CE model and begun efforts to increase recycling capabilities for phones. The main reasoning for the stakeholder pressure appears to be the acknowledgement of scarce natural resources and the resulting need to use materials more efficiently. Thus, *cultural-cognitive pressures appear to be the primary driver for the case.* However, it can be argued that since *the company perceives the impact of CE to be low from the business perspective, normative and regulatory pressures contribute*. Still, mentions of regulatory pressures to implement such efforts as auctions for end-of-life equipment, certifications to reduce material usage in products, and the use of specifically recycled materials are scarce. *A major barrier to advancing the CE in the Huawei case appears to be low incentives for increasing the reuse of products.* While the company is required to *recycle* certain products, no mention of improving product *reuse* is mentioned.

Integrator Case: Suzhou

The Suzhou case discusses the recycling system of household waste in Suzhou. The recycling system is a combination of informal and formal sectors. The actors in the system acquire recyclables from multiple sources, separate them from other wastes, and then process them for use by local manufacturers. The case shows how recycling efforts work in an environment in which the recycling infrastructure is still developing and the

183 informal sector plays a major role in the creation of value through recycling. A summary
184 of the institutional environment in this case is shown in Figure 2.



185

186 **Figure 2:** Summary of the Institutional Drivers and Barriers in the Suzhou Case

187 While at first glance, the regulatory pillar appears to be the major driver for the Suzhou
188 initiative since China has implemented high-level laws like the Law on the Prevention
189 and Control of Environmental Pollution by Solid Waste, enforced in 1996 and revised in
190 2004, and the Circular Economy Promotion Law, enforced in 2009, it appears that the
191 low-level implementation and enforcement of this guidance are inefficient. Instead, it
192 appears that the major driver for recycling from municipal solid waste is the drive for *a*
193 *means of income* (Fei et al., 2016). Thus, there is a major *normative barrier* to
194 implementing a potentially more effective recycling system, as *this could strip thousands*
195 (Fei et al., 2016, p. 76) *of people from their access to small but necessary income.* The
196 legitimacy of the CE in the context of this case is, thus, especially interesting, since it
197 shows that enforcing legislations and implementing measures that would promote the use
198 of more advanced technologies is *sometimes perceived as illegitimate on the residential*
199 *level.*

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201

4.2 CE Cases from the US institutional Environment

Manufacturer Case: Dell

Dell is a leading US-based manufacturer of personal computers (PCs) and computer equipment. It is the third-largest PC manufacturer when measured by units shipped, with shipments of 10.2 million PCs in the fourth quarter of 2015, according to technology analyst Gartner Inc. Dell has also been a pioneer in enabling recycling for end-of-life computers and computer equipment. For example, Dell was the first in the PC industry to provide free computer recycling to consumers, and is now the first to launch a computer made of third party-certified, closed-loop recycled plastics. Thus, the analysis of Dell's recycling efforts and retake program provides insight into a leading CE initiative in the much-discussed area of e-waste. A summary of the institutional environment identified in the case is shown in Figure 3.

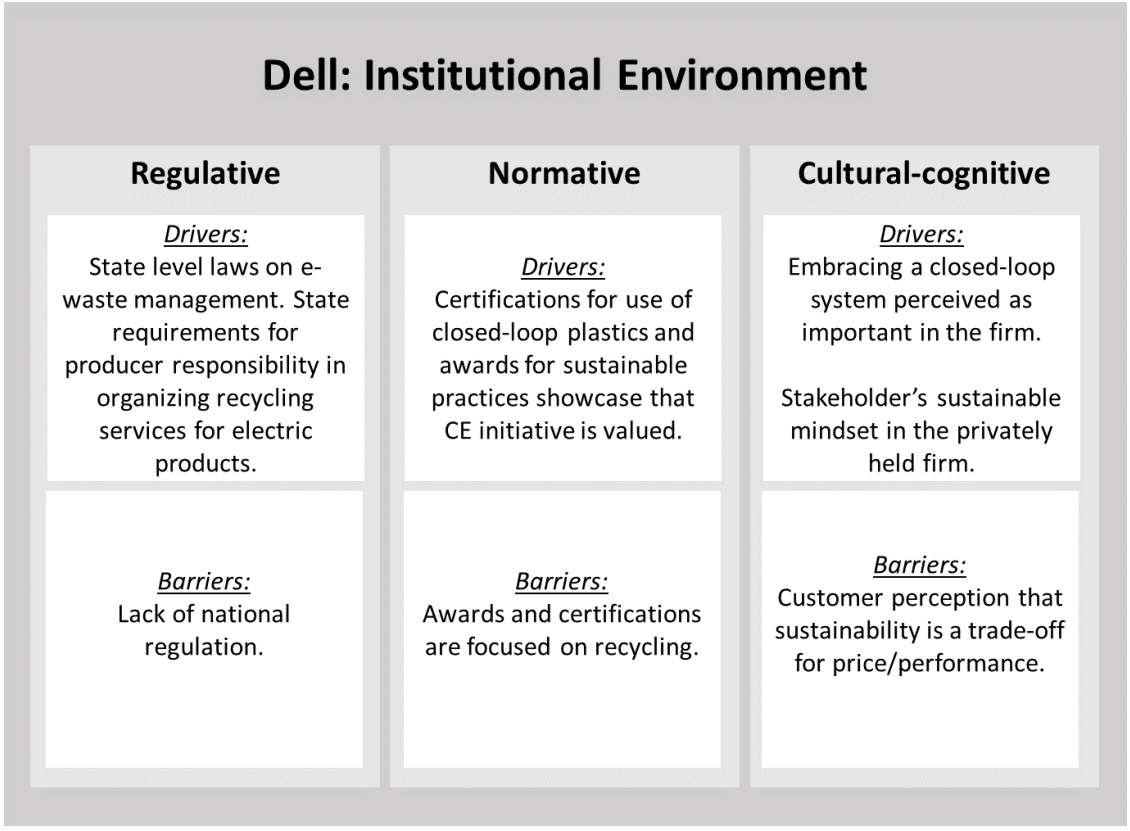

Figure 3: Summary of the Institutional Drivers and Barriers in the Dell Case

A key driver in Dell's CE initiative is *the requirement by key states, such as California, to arrange recycling for end-of-life products free of charge.* Another driver is *the acknowledgement that recycled materials can provide cost savings*. For example, Dell expects cost savings from its closed-loop recycling system, through which it reclaims plastics from recycled computers and combines these with other recycled plastics for use in products. Since this is linked to the market-based cost of recycled materials, it can be defined as a regulatory driver. Identified institutional barriers appear to reflect *a cultural-*

cognitive view that products that are made sustainably (e.g., with recycled materials) offer poorer price and/or performance, an issue that Dell explicitly argues does not apply to its products. The *normative institutional aspects of recycling* can also be seen as a barrier. Implementing recycling is seen as a valuable effort that is rewarded through certifications and sustainability awards, without a call to reduce material usage through other means or to implement reuse schemes.

Integrator Case: Republic Services

Republic Services is the second-largest waste management company in the US, with over 200 recycling centers nationwide. One of the company's main offerings is an "All-in-One™" recycling service. The company has both county/municipality customers and individual customers. Since the company's recycling service collects recyclables that are all placed in the same collection bin, its facilities have significant capabilities related to separating and sorting a wide variety of recyclables. After separating, sorting, and processing, most of the recycled materials are shipped to China. The institutional environment identified in the case is shown in Figure 4.

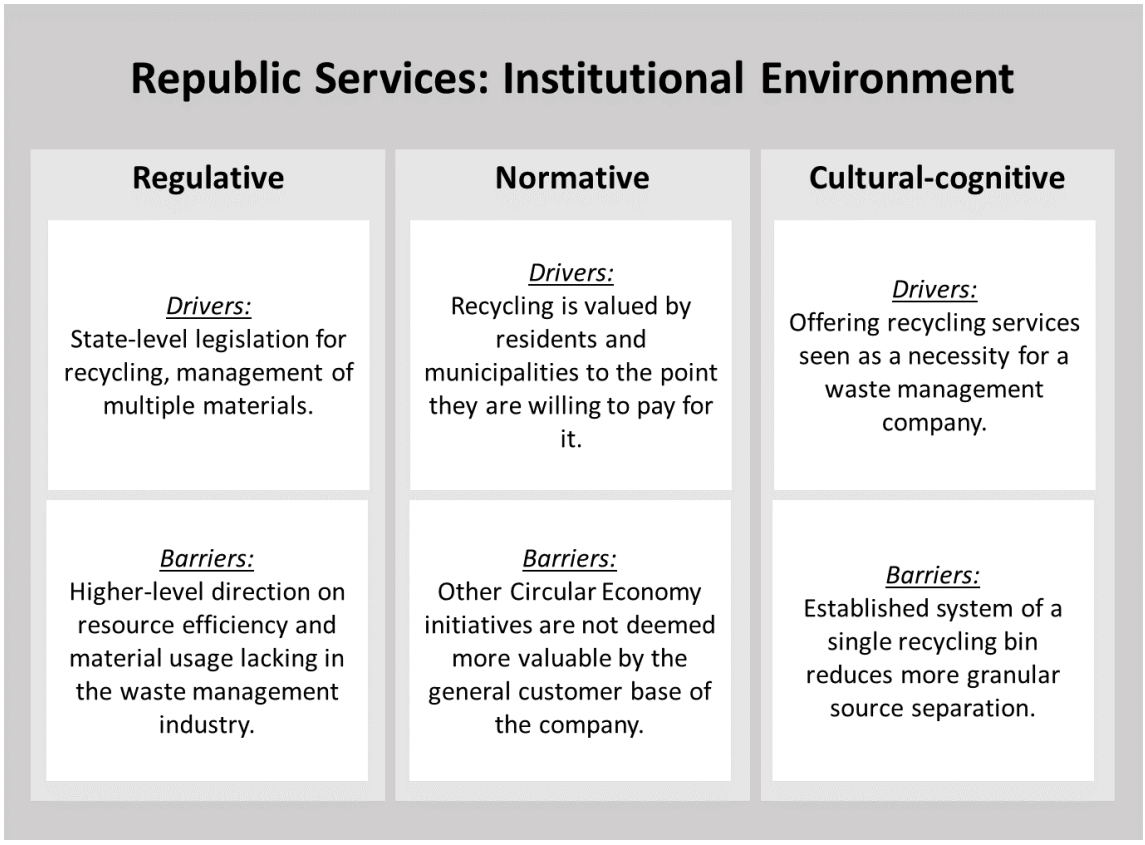

Figure 4: Summary of the Institutional Drivers and Barriers in the Republic Services Case

The primary driver of Republic Services' CE initiative appears to be *a combination of normative and cultural-cognitive aspects*. While it is not mandatory to arrange recycling in every state in the US, recycling is valued to the extent that it is necessary for a waste

management company to be competitive. Interestingly, recycling currently appears to provide few economic benefits: In its 2015 Annual Report, the company acknowledges that the value of the recycled materials no longer exceeds processing costs and, thus, that it is looking to shift some of the costs to customers through recycling fees. One potential contributor to the high processing costs is the low level of source separation, since many of the company's customers use a service in which all recyclables are placed in a single bin and separation is done at the facility level. Thus, *as processing costs are currently higher than the value that can be captured from the sale of recycled materials, the low level of source separation is a cultural-cognitive barrier for the CE.*

4.3 CE Cases from the European Institutional Environment

Manufacturer Case: UPM

The case of UPM ProFi, which manufactures biocomposite deck products from waste from label products generated in another business unit and by some customers of the company, is a case of using industrial waste from one operator as a resource for another operator in an industrial system. As such, it fits the description of industrial symbiosis, which has been discussed as a method of implementing the CE in the operation of industrial systems. A summary of the institutional environment in the case is shown in Figure 5.

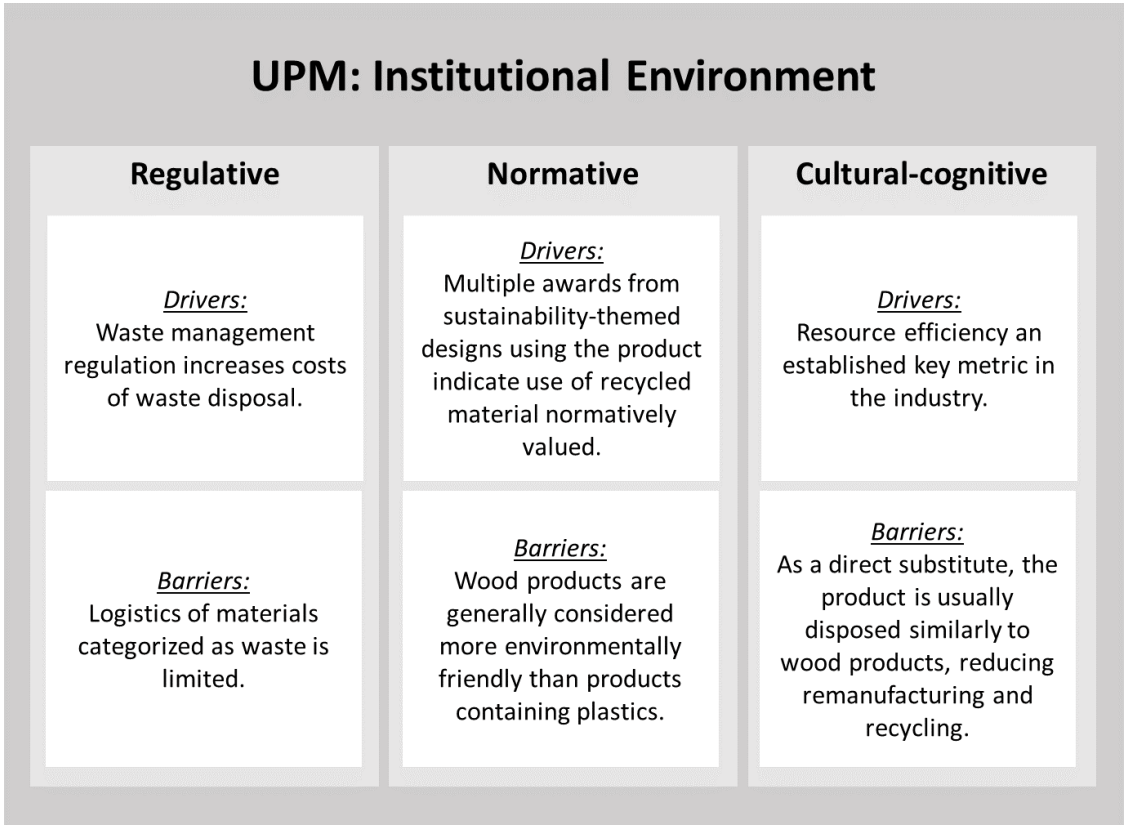

Figure 5: Summary of the Institutional Drivers and Barriers in the UPM Case

Increasing resource efficiency is a key objective in both the company and the industry. This goal can be seen as a central *cultural-cognitive driver* for this case, since the innovation behind the product is a result of developing methods to utilize company waste and sidestreams. From a regulative perspective, there are no direct barriers (e.g., laws). However, since firms are required to dispose of their waste in a proper manner, thus creating costs for the firm, the potential to reduce waste disposal costs can be seen as a *regulatory driver*. One other important driver for the initiative is *the normative value of being able to recycle waste*. Before the initiative, recycling the waste that is now used in UPM ProFi was not possible. Since the initiative, the company's new normative legitimacy has been recognized through design awards received by sustainability-themed projects at multiple global exhibitions and through the company's ability to recycle waste being used as a key selling point for the collection service the firm has set up to collect waste for ProFi from its customers. Barriers to the initiative's ability to advance the CE are mostly related to the product being a substitute for wood products, which reduces the product's ability to be recycled into new ProFi products, as the product can, and often is, disposed of through incineration.

Integrator Case: Ekokem

Ekokem, the company behind this case's subject, the CE Village concept, is a specialized waste management operator that has recently profiled itself as a CE company. Increasing the recycling and reuse of materials is high on the company's agenda. The Circular Economy Village is a system that, through a combination of three connected facilities, can produce recycled materials, biogas, and energy using mixed waste. The institutional environment of the case is summarized in Figure 6.

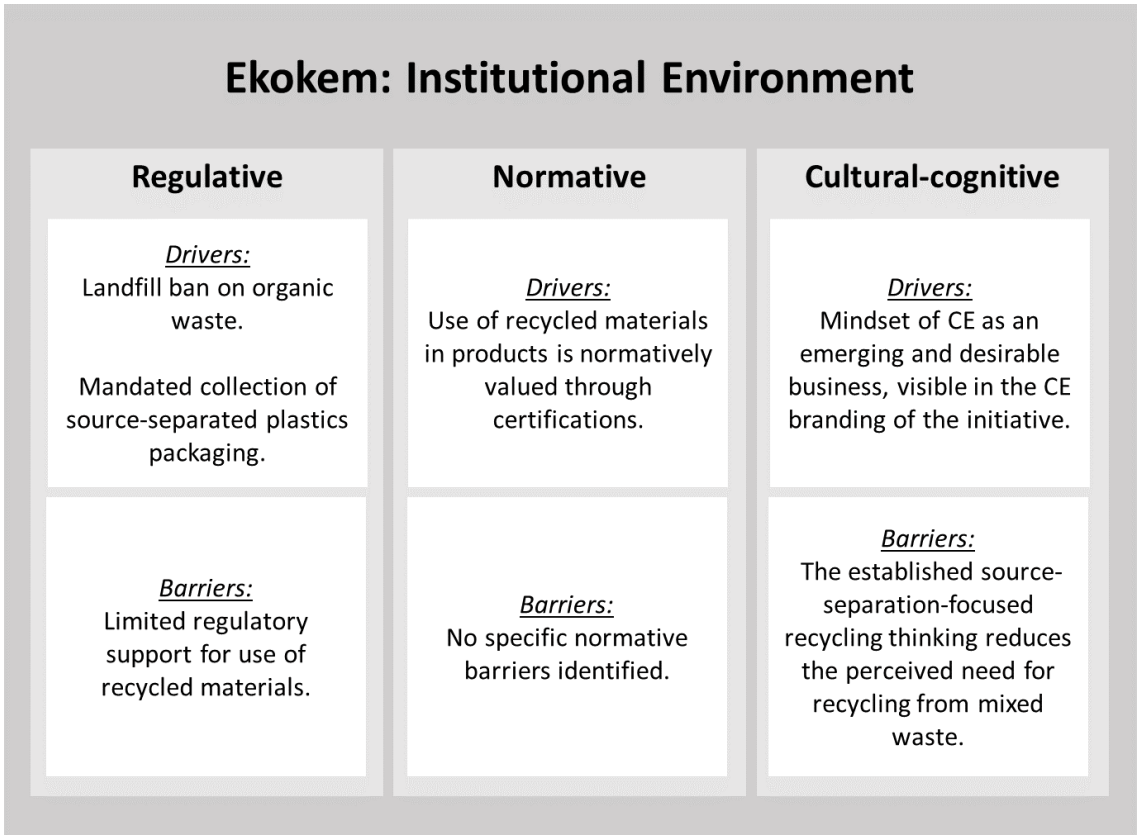

Figure 6: Summary of the Institutional Drivers and Barriers in the Ekokem Case

The regulative pillar of institutions appears to be one major driver for the CE Village. Several regulative developments have contributed to the need for such a facility. The *law banning the landfilling of waste that includes more than 10% organic material* directly supports the initiative, since the facility can separate organic parts from mixed waste and process it into biogas. The facility is also able to *match the recycling target of 65% for municipal waste* when source separation is taken into consideration. A *normative driver* for the CE Village is its ability to increase waste utilization rates, since *recycling is normatively valued in the institutional environment, as shown by, for example, high levels of source separation and the avoidance of landfilling.* The use of tried and tested technology already in use elsewhere in Europe can be seen as *a cultural-cognitive barrier in the sense of shared logics of action*, thus reducing the potential to use new and groundbreaking technologies. However, it must be noted that the technologies are combined in a way specific to the CE Village in order to address the constitution of local waste and enable the separation of, for example, plastics from the municipal waste; thus, it seems that the shared logics of action have not been particularly inhibiting in this initiative.

4.4 Comparing Institutional Environments and Their Institutional Drivers and Barriers

During the within-case analysis phase, we emphasized more detailed findings that offer clues to the effects of institutional drivers and barriers of specific cases. However, combining two cases from different industries can provide a more general outlook of the drivers and barriers of each institutional environment. The results of the individual case studies are summarized in Table 6. The cross-case comparison reveals similarities and differences between the cases with regard to the institutional environment and value chain actor type, enabling the identification of emerging patterns.

315 **Table 6:** Summary of Indicators of CE Barriers and Drivers in the Institutional Environment for Each Case

	China Huawei Product-oriented	**China** Suzhou Integrator	**US** Dell Product-oriented	**US** Republic Services Integrator	**Europe** UPM Product-oriented	**Europe** Ekokem Integrator
Regulatory	Laws limit the use of hazardous substances in products and mandate product lifecycle management (e.g., recycling services)	Multiple high-level laws with varying success in enforcement	State-level laws mandate organization of product recycling	State-level laws; however, no national laws mandating recycling	Waste disposal regulation	Landfill ban on organic waste
Normative	Certifications awarded for using sustainable materials	Creating income for living valued over environmental practices	Use of recycled materials and closed-loop materials rewarded with certifications and awards	Customers value recycling over other means of waste management and are willing to pay for it	Use of recycled materials rewarded with certifications and awards	Recycling preferred over other means of waste management
Cultural-cognitive	Stakeholders of the privately held firm acknowledge the problem of scarce resources and pollution. However, customers generally prefer new products.	Recyclables are seen as valuable from the beginning. The informal sector is considered ordinary and reduces the efficiency of the formal recycling sector. Food-heavy waste streams are difficult to sort.	Stakeholders of the privately held firm have a sustainability-focused mindset and have been pressured toward implementing, e.g., closed-loop systems. However, consumers still perceive that sustainability is a trade-off between price and performance.	General customer base sees recycling services as a must for a waste management firm. Established single recycling bin system inhibits source-separation.	Resource efficiency is an established key metric in the industry. However, as the product substitutes a wood product, the end-of-life disposal goes through similar channels, reducing recycling of the product.	The general perception of CE as an emerging opportunity, visible in the CE branding of the initiative.

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In China, there is a surprisingly large variance between the manufacturer and integrator cases. A common factor in both is a *cultural-cognitive, shared understanding of recyclables as valuable from very early on*. In Suzhou, recyclables already generate value for scavengers who collect them from residents or streets, and Huawei has started to organize auctions for end-of-life equipment, such as optic cables. In the US, a common trait seems to be that *recycling is normatively valued and is arranged even when not mandated by state-level laws*. However, a common barrier in the US is the processing costs of recycling, since, in both cases, *recyclables like plastics are sent to China for further processing and manufacturing.* In the European cases, the *push to increase material utilization is a common driver*. Ekokem has increased its utilization of waste by combining multiple processes, and UPM uses waste and sidestreams to create new products to avoid the generation of waste for disposal.

5. DISCUSSION

Comparing the institutional environments of China, the US, and Europe after consolidating them through their two different cases facilitates the identification of general CE drivers that are shared across different regions. This also allows the identification of region-specific drivers and barriers, which is crucial when discussing advancing the CE in a global economy. Figure 7 shows the most notable emerging institutional drivers and barriers identified from the case analysis, clustered between value chain roles and the institutional environments. The general drivers and barriers have been identified according to the value chain role, linking them to concrete implementation and further highlighting the requirement of a holistic institutional approach for advancing the CE.

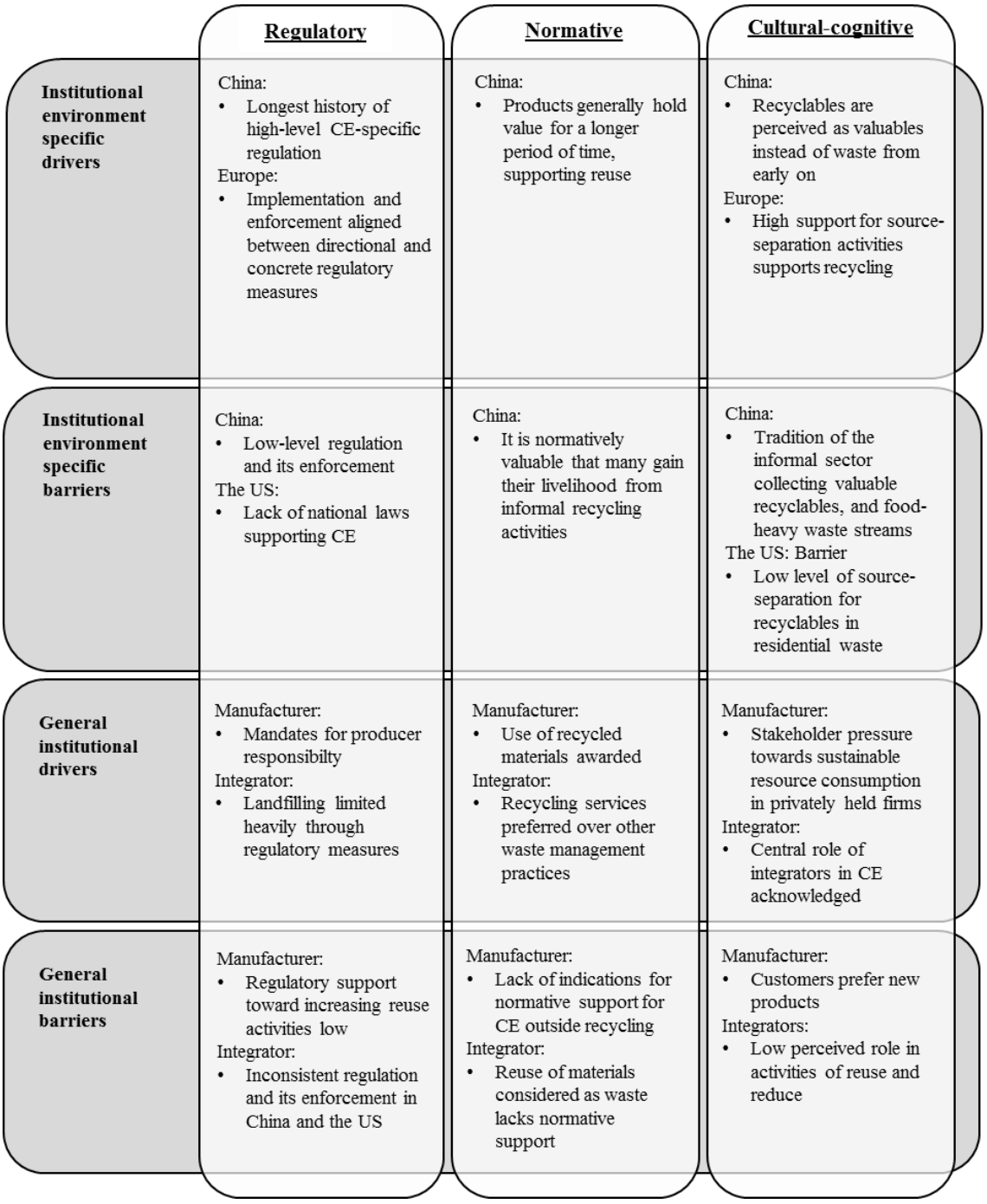

Figure 7: Emerging patterns of institutional drivers and barriers between institutional environments and value chain actors.

With regard to individual regions (i.e., institutional environments), our cross-case analysis reveals different *region-specific drivers and barriers*. In China, from the regulative perspective, a region-specific CE barrier appears to be the difficulties of implementing and enforcing CE laws on a local level. While the country has had high-level CE laws since at least 2009 (e.g., the CE Promotion Law), the implementation and enforcement of these laws vary, thus reducing the positive effects of CE support. Income for low-income residents who collect and sell recyclables appears to be normatively

valuable, which could explain the difficulties in enforcing the regulatory support for the CE. However, since the informal sector still participates in recycling efforts to quite a large degree removing recyclable materials from the waste streams early on, and the waste streams generally are food-heavy and difficult-to-separate, the waste management system's ability to increase material circulation efficiently appears to be low; thus, China also displays a cultural-cognitive barrier toward implementing the CE. Based on the cases, however, the most influential factor in this region seems to be the normative legitimacy of the informal sector, which could inhibit the regulatory drivers for the CE.

In the US, in particular, certain cultural-cognitive influences appear to be specific to the institutional environment. First, recyclables are generally minimally separated at the source, such that the recycling system takes care of most of the separation. The Republic Services case from the US was also the only case in which it was acknowledged that the value of recycled materials could no longer cover processing costs. In this case, the solution was to start shifting the costs toward the customer through recycling fees, due to the single-collection-bin approach to the collection of recyclables. However, it must be noted that there is no evidence that increasing source separation would necessarily reduce recycling costs, and, in fact, such a result is unlikely in a system not designed for this approach. Finally, in Europe, the clearest institutional environment-specific institutional effect is the cultural-cognitive acknowledgement of a high level of source separation of waste, which increases utilization.

As our key contribution, *general drivers and barriers* of the CE were identified from each of the institutional pillars. All institutional environments displayed a hierarchical regulatory structure of high-level directives and region-specific legislation focused on improving the utilization of waste. With respect to the normative pillar, it is clear that landfilling is being avoided and replaced by other waste management methods in each of the institutional environments. This is visible in the certifications for using recycled materials by manufacturers, and in the preference of other waste management methods over landfilling by customers of the integrators. When analyzing the general barriers to the CE, the lack of institutional support for other CE principles outside recycling is notable in each of the institutional pillars. While high-level directives are starting to embrace other methods, such as reuse (e.g., European Commission, 2015), current regulations offer very little support. Similarly, while recycling is normatively valued, and certifications and awards for implementing recycling measures exist for both manufacturers and integrators, such benefits are rarely realized for initiatives that reuse products or components. One major cultural-cognitive barrier to reuse also seems to be customer preference for new products. Thus, the *general barrier* for the CE could be said to be the emphasis on recycling, which concurrently resonates with the lack of institutional support for reuse.

6. CONCLUSIONS

The purpose of this study was to identify general and region-specific drivers of and barriers to the CE in China, the US, and Europe. Institutional theory was used to analyze the drivers and barriers, following earlier studies using theory in the context of the implementation of other sustainability efforts (e.g., Brammer et al., 2012; Campbell, 2007), its recent adoption in analyzing waste management issues (Dai et al., 2015; Levänen, 2015), and its ability to extend the analysis of CE initiatives to more holistically cover all relevant environmental, social, and economic aspects (Murray et al., 2015). Using this approach, we retraced both the general drivers of and barriers to the CE that influenced the studied institutional environments, as well as region-specific drivers and barriers. This approach specifically answered the call to analyze the institutional drivers of and barriers to the CE and showcased emerging regional perspectives, efforts, and opportunities for the advancement of the CE.

A recurring theme among the cases, from the perspective of institutional theory, was the support of the regulative pillar in all institutional environments. However, this study's research also showed that the strength of the normative and cultural-cognitive pillars was surprisingly high and could negate the effect of the regulatory pillar. Whereas much of the previous literature has focused on the relation between regulative efforts and CE advances (Geng et al., 2009; Mathews and Tan, 2011; Yuan et al., 2006), our findings support the use of institutional theory to extend this perspective. Our results are in line with the school of thought in institutional theory literature that the regulative pillar alone is not capable of supporting sufficient change in the institutional environment (Edelman et al., 1999; Scott, 2008). In other words, the legitimacy of any given initiative is decided through a holistic combination of all institutional pillars.

Our study has several implications for further CE research and practice. First, although prior research on ways to advance the CE has focused on the regulative policies of different regions, our study has identified that while the support of the regulative pillar is important, this alone is not sufficient for CE success. Thus, future research in this area should widen the scope to include research on the extent to which normative and cultural-cognitive conditions in different regions support or hinder the efforts implemented through regulative processes. Second, non-regulative methods for influencing the normative and cultural-cognitive conditions of the institutional environment should be researched further. Based on the findings of this study, a holistic vision of the CE, including all of the 3R principles (i.e., reduce, reuse, and recycle) is being inhibited by an overemphasis on recycling and an underutilization of the other principles. Potentially fruitful future research avenues, therefore, would include research on why principles other than recycling are underutilized and what should be done to improve the legitimacy

of these principles. This stream of research seems especially important given that this study also shows that recycling can generate a kind of negative value if the value of recyclables is lower than the cost of producing them. While this study provides some general guidelines about the legitimacy of the CE, more detailed research embracing the institutional theory perspective is necessary.

By analyzing the legitimacy of the CE in multiple institutional environments, together with its general drivers and barriers, this study offers practical implications for both policymakers seeking to support the CE and firms deciding whether and how to implement it. Based on our results, the effective implementation and consistent enforcement of high-level CE regulation needs to be improved in China, where the informal sector appears as especially problematic for establishing an effective CE system. In the US, acknowledgment of the CE in national regulation would be beneficial for further establishing its legitimacy. In terms of increasing recycling efficiency, increased source separation appears to be the beneficial route toward utilizing value in waste flows, and thus should be further pursued in the US and China.

Even more importantly, general support for the CE favors recycling, while leaving reuse efforts, especially, unsupported. To accelerate transitioning to the CE, policymakers of each analyzed region should extend support for reuse schemes and take-back programs enabling reuse. This could be done through establishing requirements for the reuse of products and incentivizing emerging reuse efforts. Since normative and cultural-cognitive support for the CE remains similarly recycling-focused, increasing awareness of the other CE methods through, e.g., increasing their visibility in education and establishing certification schemes similar to those in the area of recycling, is equally as important as legislative measures. For firms, the implications of these findings are two-fold. First, since recycling appears to be the most legitimate way to implement the CE at the moment, it is also the most beneficial CE channel for firms. However, the influence of the normative and cultural-cognitive pillars was identified as strong; thus, firms should also direct their attention to alternative aspects when making decisions about the CE.

This study was explorative in nature, showcasing the general drivers and barriers for the institutional environments of China, the US, and Europe. Since our case selection and selection of institutional environments were purposeful, some limitations are acknowledged; therefore, the cases cannot cover the entirety of the industries where the CE is increasingly relevant. The selection of waste management companies could also have created a bias toward recycling, which may have manifested in the results. However, since the focus on recycling was clear in the product-oriented cases, we believe that our overall findings are valid. The case selection was carefully planned: Firstly, two cases were selected for each environment using a replication logic of one producer-oriented case and one integrator/waste management-oriented case. Secondly, even though only China, the US, and Europe were covered, each of these regions exhibits global variation: the US and Europe are highly developed regions with established waste management

466 infrastructures and comparably high waste utilization rates. By contrast, China has been
467 implementing the CE as a development model for over a decade (Yuan et al., 2006).
468 Despite these limitations, our findings can provide global implications in terms of
469 potential development opportunities to pursue and pitfalls to avoid in different regions.

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