









depletion/utilisation, thus the published literature covers dimensions of resource preservation (Gabriela-Cornelia et al., 2015), energy conservation (Pin & Hutao, 2007) (Pan et al., 2015), resource efficiency (Hu et al., 2011) (Schulte, 2013), and resource recovery and reutilisation (Gregson et al., 2015) (Singh & Ordonez, 2015) (Li et al., 2013). Scholars also examine the interplay of **environment and economics systems** (Ghisellini et al., 2016) (Anderson, 2007) (Boulding, 1966) by looking at low carbon economy models (Duan et al., 2011), and examine the **policy implications** in terms of process analysis (Ghisellini et al., 2016), model of economic growth (George et al., 2015) (Bartl, 2015) and zero emission policy (Liu et al., 2012). In recent developments of the research, the focus has been on **strategies** utilised for the implementation of CE; such as 3R [reduce, reuse, recycle] (Xuan et al., 2011), 6R [reduce, reuse, recycle, recover, redesign, remanufacture] based closed-loop material flow (Jawahir & Bradley, 2016), business process reengineering approach (Schulte, 2013), green virtual enterprises (Romero & Noran, 2015), urban circular economic system (Tong & Tao, 2016), pricing strategy (Zhilei & Wei, 2011), landfill reduction (Scharff, 2014), leapfrog development (Geng & Doberstein, 2010), and waste to energy (Pan et al., 2015). Researchers have also explored the **implementation models** by exploring cultural model of Hakka Living (Liu, 2012), biogas project (Duan et al., 2011), systems dynamics and multi-objective programming model (SDMOP), and eco-industrial parks/ village (Wenbo, 2011) (Duan et al., 2011) (Wenbo, 2011). Some methods and tools to **analyse** (Jian & Kun, 2011) are waste input-output analysis (Li, 2012), life cycle assessment (Strazza et al., 2015), and two life cycle assessment (Scheepens et al., 2016).

**China** has widely adopted the concept of CE and many publications are focused on the driving forces for CE in China (Park et al., 2010) (Xinan & Yanfu, 2011), the implementation process and results at regional level (Lihong & Hui, 2011) (Junjie et al., 2011) (Guo-gang, 2011) (Geng et al., 2009) (Qing et al., 2011) (Xue et al., 2010) (Guohui & Yunfeng, 2012), methods to critically evaluate and analyse (Su et al., 2013) (Lee et al., 2014) (Wenbo, 2011) (Liu et al., 2012) (Wu et al., 2014) (Guo-gang, 2011) (Chun-rong & Jun, 2011) (Li & Su, 2012) (Xu et al., 2009) (Jiao & Boons, 2015) (Pin & Hutao, 2007) (Qing et al., 2011) (Xiong et al., 2011) (Li, 2012) (Geng et al., 2012), implementation challenges, constraints, and barriers (Naustdalslid, 2014) (Zhu et al., 2010) (Geng & Doberstein, 2010) (Li et al., 2010), action programs and counter measures (Qiping, 2011) (Shen & Qi, 2012) (Zhijun & Nailing, 2007), and public industry awareness of the concept of CE (Liu et al., 2009) (Liu & Bai, 2014).

At **Industrial** level, researchers have explored CE's implementation in the paper making industry (Li & Ma, 2015), electric power industry (Zeng & Zhang, 2011), mining (Zhao et al., 2012) (Ru-yin & Xiao-ting, 2009), agriculture (Zabaniotou et al., 2015) (Jun & Xiang, 2011) (Junjie et al., 2011) (Xi, 2011) (Xuan et al., 2011), oil & gas (Kun & Jian, 2011) (Jian & Kun, 2011), RO desalination (Landaburu-Aguirre et al., 2016), construction industry (Smol et al., 2015), iron and steel industry (Ma et al., 2014), chemical industry (Liguori & Faraco, 2016) (Li & Su, 2012), leather industry (Hu et al., 2011), animal husbandry industry (Liang et al., 2006), tourism (Ping, 2011), two life cycle assessment – water tourism (Scheepens et al., 2016), and automotive industry (Despeisse et al., 2015). Researchers have further explored the concept of manufacturing and re-manufacturing (Li et al., 2013) (Lieder & Rashid, 2016) (Kurilova-Palisaitiene et al., 2015), product service systems (Tukker, 2015), process engineering (Reh, 2013), consumer acceptance of CE (Weelden et al., 2016), and how to optimise industrial structure (Lihong & Hui, 2011). Few articles also explore the important role of CE towards sustainable **supply chain management** (Pan et al., 2015) (Genovesa et al., 2017) and the necessity to develop circular models of supply chain (Velis, 2015).

The above mentioned research avenues covers the broad spectrum of product/ service and related business aspects. They have received considerable attention by scholars and it would be correct to say that more research would come to surface soon to develop further understandings.

#### **4. Circular Economy and its implementation in the Logistics Sector**

While conducting the search using the string words "*Circular Logistics*" to search for journal articles/conference papers and the word "Logistics" within the journal articles on the topic of CE, only 21 article were found, discussing the implications of CE in the Logistics sector. These 21 articles (summarized in Table 1) are part of the total 107 selected articles for this paper and are discussed below.

If we look at the historical perspective, scholars have focused their attention towards Logistics and Supply Chain Management at the same time as the world's attention has focused on environmental aspects. The important role of supply chain, which includes Logistics, is an inevitable choice while attempting to make a business sustainable (Park et al., 2010). Recent trigger of attention being focused on the correlation between CE and Logistics (Guihua, 2013) highlight the importance and urgency to develop new models of logistics in alignment to CE (Kai et al., 2010). The concept of Circular Logistics is also linked with Green system (Guo-shen et al., 2010) (Gui-hua, 2010) and is believed

to be at the core of CE (Rong, 2014), as well as with 3PL (Yuan & Xi-long, 2009) and is considered as value increment multiplier being the core value in a recycling economy (Zhongzhi & Haochen, 2011).

Table 1: Literature published on the topic of Circular Logistics

No	Author	Title	Paper Type
1	Rao Zhao; Da-wei Hu; Lan Zhu; (2015)	Design of Supply Chains with Integration of Reverse Logistics of Automobile Parts	Conference
2	Zhao Rong (2014)	Study on the Sustainable Development of Logistics for Circulation Economy	Conference
3	Joachim Kuhn (2015)	End-to-end supply chains: The solution?	Conference
4	Zheng Kai, Wang Ruijiang, Ru Yihong (2010)	Analysis on economic and environmental benefits of circular construction products logistics system	Conference
5	Xin Zou, Mengqin Zhang, Huaitao Chen (2015)	Analysis on the Connotation of Green Logistics	Conference
6	Kai Zheng ; Yihong Ru ; Ruijing Wang ; Yu Zhu (2012)	Research on Model of Circular Construction Products Logistics System	Conference
7	Tuanying He (2012)	Tripartite strategy selection based on non-cooperative game theory for circular logistics system of automotive industry	Conference
8	ZHENG Guo-shen, LIAO Fu-lin, QI Xin-hua (2010)	Study on the Development Model of Industry Ecologicalization Based on Green Logistics	Journal
9	YANG Zhongzhi, SUN Haochen, (2011)	Value Law and Government Roles of Industrial Chains Formation in Recycling Economy	Journal
10	YUAN, YANG Xi-long, (2009)	Logistics Operation Based on Circulation Economy	Journal
11	Victor-G. Aguilar-Escobar; Pedro Garrido-Vega; María-del-Mar González-Zamora, (2016)	Applying the theory of constraints to the logistics service of medical records of a hospital	Journal
12	Kee-hung Lai; Sarah J. Wu; Christina W. Y. Wong, (2013)	Did reverse logistics practices hit the triple bottom line of Chinese manufacturers?	Journal
13	YU Wen-wu, (2012)	Research on Constraints and Policy Recommendations of Development of Circular Logistics	Journal
14	WANG Gui-hua, (2010)	Study on the Operation Strategy of Circular Logistics Based on the Sustainable Development	Journal
15	LIU Zhao-jun; WANG Xiu-rong, (2013)	Research Automotive Loop Logistics System Based on Circular Economy	Journal
16	SONG Yu; RU Yi-hong; ZHENG Kai, (2010)	Research on Model of Construction Product Circular Logistics System: a Case Study of Earthwork	Journal
17	Wang Guihua, (2013)	Study on Mutual Influence and Synchronized Development of Circular Economy and Circular Logistics	Journal
18	ZHANG Zhongqiang, (2012)	Study on Technology Promotion and Construction of Circular Logistics System Based on Low Carbon Economy	Journal
19	Nicole van Buren, Marjolein Demmers, Rob van der Heijden, Frank Witlox, (2016)	Towards a Circular Economy: The Role of Dutch Logistics Industries and Governments	Journal
20	Liewn Zheng, Juan Zhang, (2010)	Research on Green Logistics System Based on Circular Economy	Journal
21	Jiang Ying; Zhou Li-jun, (2012)	Study on Green Supply Chain Management Based on Circular Economy	Journal
22	Blandine Laperche, Delphine Gallaud (2016)	Circular Economy, Industrial Ecology and Short Supply Chain	Book

Two major highlights with regards to logistics in the purview of CE are Reverse Logistics (Lai et al., 2013) and short supply chain (Gallaud & Laperche, 2016). While short supply chain implementation has so far been successful in the agricultural sector, its effective utilisation may not always be practically feasible for other industrial sectors, therefore businesses must focus their efforts to design effective reverse logistic system to collect any defected, used, and end of life products, to reverse them in circular system to be reutilised as raw material (Lai et al., 2013) or if not then to be disposed in a careful manner. Reverse Logistics not only plays a strategic role in implementation of CE, but it also is considered as strategic weapon and competitive advantage of good corporate citizenship (Chan & Chan, 2008).

#### 4.1 Implementation strategies and sectors

Tuanying He (2012) discusses the circular logisitcs model for the automotive industry and suggests to develop a game theory model to monitor the establishment of ciruclar logisitcs. Rao Zhao (Zhao et al., 2015) utilises reverse logisitcs and proposes a multi-period, multicommodity and closed loop supply network for the automotive industry. Other researchers suggest the model of customer focused supply chain with end to end focus (Kuhn, 2015) and highlight the need for further research to develop frameworks for circular logistics in the automotive industry (Zhao-jun & Xiu-rong, 2013).

Another major focus of CE based on logistics systems is in the construction industry to make it resource saving and environment friendly by integrating the logistics of construction material and solid waste created (Zheng et al., 2012). A new model of CPCLS (Construction Product Circular Logistics System) was developed by mingling CE concept with Project Management to optimize resource utilisation and efficiency (Yu et al., 2010).

The current published literature listed in Table 1 is categorized and illustrated in Figure 4 with reference to articles discussing CE within the context of Logistics. Indeed it is a ground breaking effort to highlight the need and possibilities of further research for Circular Logistics, and it would not be correct to criticise the shallowness of the current published literature, except to the extent that further research is needed to explore its depth and to develop the roots of Circular Logistics in the current context.

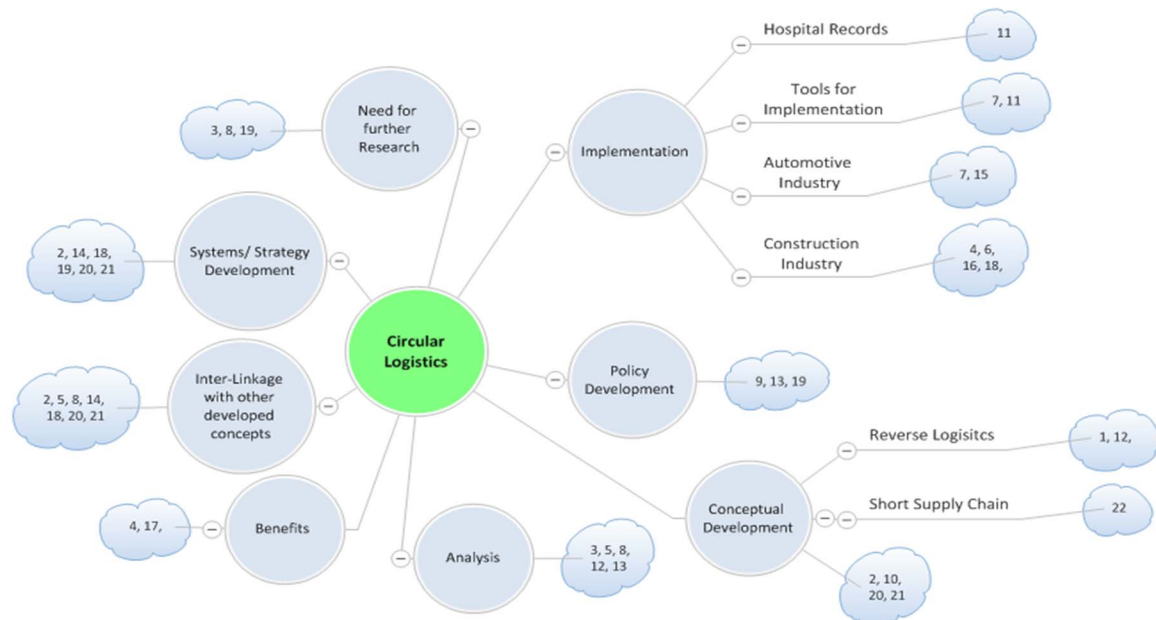


Figure 4: Dimensions explored in published literature on the topic of Circular Logistics

#### 4.2 Barriers and Enablers of CE

While many organisations like Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2015), WRAP (WRAP, 2016), Circle Economy (Circle Economy, 2016), McKinsey and Company (McKinsey & Company, 2016), Capital Institute (Capital Institute, 2016), Zero Waste Scotland (Zero Waste Scotland, 2016), ARC21 (ARC21, 2016) are attempting to promote the implementation of CE, there are some barriers/challenges to such implementation. In the context of China, Geng & Doberstein, (2010) describes three barriers/challenges as: Policy, Technology, and Public Participation. Dutch researchers further add more aspects which can be considered as sub-aspects of the earlier mentioned barriers: Institutional Barriers, Economic Barriers, Social and People-related barriers, and professional barriers (Buren et al., 2016).

In one form or another, these weaknesses/barriers in the implementation of CE are in fact drivers, so once strengthened the implementation of CE would be enhanced. The three barrier mentioned above – Policy, Technology, and Public participation; are key aspects for the succesful implementation of CE (Buren et al., 2016). Within the context of China, scholars analyse the Logistics sector in the light of CE and highlight the need for policy development as a key to implement CE in the Logistics sector (Gui-hua, 2010) (Wen-wu, 2012), and information system and technology to enable the realistic development of Circular Logistics (Gui-hua, 2010) (Zhongqiang, 2012).

As Webster (2013) defines it in the words of Buckminster Fuller, that “*You never change things by fighting against the existing reality. To change something, build a new model that makes the old model obsolete*”. A complete redesign of logisitcs system is necessary for its alignment with CE. By redesign the authors do not intend to point at redesigning the structural framework – although that too is coming with the devlopement of technology (e.g self-driven and energy efficient vehicles); but the necessity of thought pattern, policy development and integrated approach while planning and designing the CE implementation.

## 5. Conclusions

Circular Economy has massive potential and is a budding solution to the present day challenges of fast resource depletion, effective and efficient utilisation of resources, and waste management. In its broad spectrum, every dimension of business needs careful analysis for effective implementation of CE. One of the major dimensions of business is 'Logistics'. At present, the amount and depth of research for CE's implementation in Logistics sector is minimal and shallow, but is a good ground breaking effort to further instigate research and exploration of possible developments. This paper has presented the knowledge about Circular Economy in broader spectrum, based on up-to date published literature and has further explored the published literature with CE's implementation in Logistics sector. The scholarly contribution is acknowledged without any criticism as these papers are the first ones to explore the dimension of logistics from this prospective. Authors strongly believe that more research is needed to gird the logistics sector as one of the main contributor in establishing Circular Economy, globally.

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