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Conceptualising a Circular Economy—an Enquiry into Circular Economy Conceptual Metaphors

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Abstract

Numerous academic scholars argue for a radical transformation of the economy towards a circular model, in response to pressures from planetary and social issues such as energy, climate change, inequality, and resource depletion. This study examines how the academic community perceives the concept of a circular economy in comparison to traditional economic discourse, through the lens of conceptual metaphors. Conceptual metaphors are systematic properties that reflect one's understanding of abstract phenomena like a circular economy. Through a structured review of the literature, seven dominant conceptual metaphors were identified that shape the understanding of traditional economics. The study also conducted a textual analysis of the ten most frequently cited academic papers on the circular economy. The analysis revealed that certain dominant metaphors from traditional economics have been influential in shaping discourse on the circular economy. The most common metaphors were the machine metaphor, competitive metaphors, the journey metaphor, and ecological metaphors. Each conceptual metaphor has its own strengths and weaknesses, which may include poorly explained areas or missing dimensions. These two aspects are referred to as misconceptions and blind spots, respectively, and the paper reflects on the implications of these for the current academic discourse on the circular economy.

Keywords Circular economy · Rhetoric · Conceptual metaphor theory

*All metaphors are capitalised when they are used in the context of a sentence.

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Introduction

Over the past 10 years, academic publications on the concept of a circular economy have seen significant growth, with a pronounced increase in peer-reviewed publications since 2015 [1]. One central focus of this academic discourse is the need for a transformation of current economic systems towards circularity [5, 19, 44, 62]. This transformation entails moving away from a linear “take-make-waste” conventional economic model and transitioning to a circular economy that emphasises value retention.

According to Lumley [41], conventional economics discourse is a form of rhetoric, as arguments are presented in language intended to convince others of certain assumptions about human nature, such as rationality, predictability, and self-interest [52], or the existence of economic equilibrium [37]. Corvellec et al. [13] express concerns about the influence of conventional economics discourse on the current circular economy narrative. Understanding the extent to which the rhetoric of conventional economics permeates the circular economy discourse is crucial when conceptualising this phenomenon.

One approach that facilitates the exploration of rhetorical discourse is through conceptual metaphors. Metaphors are part of human thought processes, and this has been emphasised by rhetoricians, philosophers, and others for hundreds of years [23]. Conceptual metaphors were introduced via the development of the field of cognitive linguistics by Lakoff and Johnson [32, 33] in their book *Metaphors We Live By*. This work and publication are key in the development of this paper, because in this field, conceptual metaphor theory provides important insights into the interactions of embodiment, language, thought, and culture [23].

The research in this paper uses the format TARGET DOMAIN.... AS/IS.... SOURCE DOMAIN to express conceptual metaphors as prescribed by Lakoff and Johnson [32, 33]. To clarify this format, an example of a conceptual metaphor is LOVE IS A JOURNEY through which English speakers sometimes make sense of their relationships. In this instance, “love” can be considered the target domain and “a journey” can be considered the source domain.

Examples of expressions related to this conceptual metaphor, LOVE IS A JOURNEY, are as follows: *We’re headed in opposite directions.* and *Our relationship is at a crossroads.* as elaborated upon in the work of Gibbs [22], p. 531). These expressions should not be considered as clichéd idioms expressing literal meaning, but they reflect, and are (partially) motivated by, the conceptual metaphor [23]. Therefore, conceptual metaphor can be considered (part of) a rhetorical strategy [7]. It could potentially be unhelpful if conventional economic rhetoric and metaphors are part of the way of talking and thinking about a circular economy if the intention is for this idea to lead to economic transformation. The introduction of a new rhetoric, containing new conceptual metaphors, might thus be needed. This aspect is at the core of this paper.

Background

This research will use conceptual metaphor theory to explore the nature of conventional economics in comparison with current mainstream circular economy discourse. Metaphors help make sense of abstract ideas by drawing parallels between some of the phenomena or features. The word metaphor is derived from *metaphora* which is established by “meta” a

prefix that often indicates a change of some sort and “phora” which means carry. Metaphora literally means “carrying across” or transference from one point (the source domain) to another (the target domain) [38].

Conceptual metaphors are a way to understand and describe how humans think and make sense of abstract concepts [32, 33]. Conceptual metaphors are systematic and help structure language and reasoning [23]. Therefore, they reveal insights about thoughts and ideas [14], and language is in this case secondary [34]. However, not all idiomatic expressions are based on conceptual metaphors [23].

Conceptual metaphors are also pervasive. When a sentence is framed according to a certain conceptual metaphor, it can be reinforced in the neurological circuitry [35]. Repetition reinforces the conceptual metaphor which makes it more likely to be accepted [32, 33]. This makes conceptual metaphor also highly cultural in our understanding of abstract ideas and phenomena. It can also be considered a powerful tool for communication. Plato even identified metaphors as dangerous—a rhetorical device for deceiving [20]. Aristotle had a more optimistic stance and viewed metaphors as an effective teaching tool [54].

Methodology

This research consists of two parts. The first part aims to identify the dominant conceptual metaphors from economics discourse through a systemic literature review. This will indicate how this phenomenon has been studied to date [63]. This part will result in a list of conceptual metaphors that inform economic discourse, including examples and how often these have been defined and identified in literature within the domain of conceptual metaphor theory.

The second part of the research explores what conceptual metaphors dominate circular economy discourse through the method of qualitative textual analysis. Textual analysis is a transdisciplinary method that can be used to understand the influence of external variables to the text [55]. Through the so-called Metaphor Identification Process, designed up by Steen et al. [57], this method can be used to find metaphor in natural discourse. This second part of the research, the textual analysis, will result in an overview of identified conceptual metaphors in the selected texts.

Systematic Literature Review

A systematic literature review was deployed to identify the main conceptual metaphors that inform the understanding of the economy. This literature review draws predominantly from the fields of linguistics, neuroscience, communication science, psychology, media studies, and human sciences. An initial body of literature is compiled from the search results returned by Google Scholar and iDiscover for search terms related to “metaphor*” and “economic*” and “economy”. A search string of “allintitle: metaphor* AND economy OR economic*” results in 123 results. All results are accessed and scan-read for relevance. After the scan-read, 59 papers were excluded due to not mentioning conceptual metaphor(s). The second round of review assessed all the remaining 64 papers in detail on all the inclusion and exclusion criteria (Table 1).

The final 64 papers were reviewed in detail. In total, 48 conceptual metaphors were identified and proposed in 18 papers. Another 4 metaphors were identified from 2 papers through snowballing. All conceptual metaphors were provided with an initial code and

Table 1 Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Content	Needs to present, observe, or synthesise a metaphor for the economy. These can be defined through the Metaphor Identification Procedure [50] or equivalent procedures An example of the metaphor in practice must be provided, coherently with Conceptual Metaphor Theory	Any metaphors presented, observed, and synthesised that are not conceptual metaphors, such as isolated single expressions
Publication date	Work published after 1980 (when Conceptual Metaphor Theory was established)	Any work before 1980
Language	English-written work	Non-English publications
Geographical context	Any geographical context	
Data collected	Peer-reviewed journal papers and conference papers that present literature review, qualitative, and quantitative data	Grey literature, books

clustered according to conceptual overlap. The original authors named the conceptual metaphor as they identified this as a pattern in their studies. After a review of all the conceptual metaphor names, clusters emerged where these naming conventions overlapped.

For example, within the domain of ECONOMY AS MACHINE, we have the work from White [67] referring to ECONOMY AS MECHANICAL PROCESS and Telibasa [61] addresses the same observations as ECONOMY IS A MECHANISM and Gustafsson [24] names this conceptual metaphor ECONOMY IS A MACHINE. All conceptual metaphors underwent such a review process after which an umbrella name was generated in line with TARGET DOMAIN AS/S SOURCE DOMAIN as indicated in Table 2, column 2. This resulted in seven dominant conceptual metaphors for the economy in Table 2.

Textual Analysis

Table 2 and the understanding of the systematicity of the seven identified conceptual metaphors form a framework through which a textual analysis was conducted. Because of the nature of framing (repetition means the reinforcement of the metaphor) [32, 33], it is expected that the most-cited circular economy papers provide the conceptual metaphors that are dominating mainstream scholarly circular economy discourse. Therefore, the textual analysis consists of the most cited papers with “circular economy” in the title. All sentences consisting of “circular economy” or “CE” have been analysed for the pervasiveness of the conceptual metaphors identified in the literature review.

The conceptual metaphors in the papers have been identified by the Metaphor Identification Procedure, developed by the Praggeljaz Group [50]. Through a systemic approach as described, the Metaphor Identification Procedure allows the observation of the patterns of conceptual metaphors through the procedure below [50], p.3). The Metaphor Identification Procedure refers to lexical units. This research looks at frequent recurrent uninterrupted strings of words as lexical units [15].

1. Read the entire text-discourse to establish a general understanding of the meaning.
2. Determine the lexical units in the text-discourse.
3. (a) For each lexical unit in the text, establish its meaning in context, that is, how it applies to an entity, relation, or attribute in the situation evoked by the text (contextual meaning). Take into account what comes before and after the lexical unit.
 - (b) For each lexical unit, determine if it has more basic contemporary meaning in other contexts than the one in the given context. For our purposes, basic meanings tend to be:
 - More concrete [what they evoke is easier to imagine, see, hear, feel, smell, and taste.];
 - Related to bodily action;
 - More precise (as opposed to vague);
 - Historically older;

Basic meanings are not necessarily the most frequent meaning of the lexical unit.

- (c) If the lexical unit has a more basic current-contemporary meaning in other contexts than the given context, decide whether the contextual meaning contracts with the basic meaning but can be understood in comparison with it.

4. If yes, mark the lexical unit as metaphorical.

The criteria for the selection of the lexical units are as follows:

Table 2 Seven conceptual metaphors used to make sense of the economy

[1] Identified features	[2] Conceptual metaphor	[3] Number of occurrences	[4] Identified by	[5] Explains	[6] Examples	[7] Misconceptions and blind spots
Equilibrium-seeking	ECONOMY AS PATIENT	14	Imani et al. [27], Besomi [2], Boers and Demecheleer [6], Charteris-Black [10], Gao [18], Mutari [45], Norazit [46], Olivera and Pedro [48], Qin [51], Reinert [53], Stronach et al. [58], Teilbasa [61], Wang et al. [65], White [67]	The health metaphor emphasises the importance of activity. Illness or injury undermines the patient's health and results in low activity. The economy is conceptualised as a body or soul that needs to be cured to get back to its original active state	<p>"The economy is healthy or strong."—Gao ([18], p. 2636)</p> <p>"Industries are the backbone of the economy."—Teilbasa ([61], p. 139)</p> <p>"Monopolies are diseases"—Imani ([27], p. 8)</p> <p>"Economic depression"—Teilbasa ([61], p. 139)</p> <p>"Think about the economy as a beating heart, circulating resources that are needed to sustain life"—Mutari ([45], p. 10)</p>	<p>"As long as companies or industries are 'healthy' (i.e. active and making profits) there is no need for interference of any kind"—Boers and Demecheleer ([6], p. 124)</p> <p>"it creates an important illusion among economists that they have control over events, and this reflects in the doctor-patient metaphor system."—Wang et al. ([66], p. 175)</p>
Competitive, strategic, protective	ECONOMY AS WAR	9	Boers and Demecheleer [6], Gao [18], Gustafsson [24], Imani et al. [27], Norazit [47], Olivera and Pedro [48], Qin [51], Stronach et al. [58], White [67]	The war metaphor makes sense of the relationship between businesses within the economy or a common enemy such as inflation or a political enemy	<p>"The competition between businesses is fierce."—Gao ([18], p. 2634)</p> <p>"The battle for control of the market."—White ([67], p. 134)</p> <p>"It seems unlikely that they [government] will intervene in the battle of the tax cuts."—([51], p. 3)</p>	<p>"The metaphor clearly highlights the conflicting aspects of different ideologies, and it leaves potential common or compatible aspects in the dark."—Boers and Demecheleer ([6], p. 126)</p> <p>"...war metaphors are notable for the fear that they evoke and their tendency to frame adversarial relationships."—Flusberg et al. ([16] p. 5)</p>

Table 2 (continued)

[1] Identified features	[2] Conceptual metaphor	[3] Number of occurrences	[4] Identified by	[5] Explains	[6] Examples	[7] Misconceptions and blind spots
Reductionist, mechanistic, deterministic	ECONOMY AS MACHINE	8	Boers and Demecheleer [6], Gustafsson [24], Lagueux [31], Mixon [43], Mutari [45], Pessali [49], Telibasa [61], White [67]	<p>The machine metaphor conceptualises the economy as an accumulation of inputs (means) that go into the machine and outputs (ends). The machine follows “inexorable and amoral” laws to allow this [45]. Within this machine, the human is conceptualised as homo economicus, operating like a calculator [48]</p>	<p>“You need capital to fix business.”—Telibasa ([61], p.138) “Growth is the driving force for societal development.”—Gustafsson ([24], p. 201) “Germany remains the main engine of growth” —White ([67], p. 142) “The flow of money” —Lagueux ([30], p. 16)</p>	<p>“There is no real role for human agency, that is self-conscious action within a particular context.”— Mutari ([45], p. 3) “The market institutions that constitute “the economy” are treated as separable from society, social factors are treated as exogenous variables.”—Mutari ([44], p. 3)</p>

Table 2 (continued)

[1] Identified features	[2] Conceptual metaphor	[3] Number of occurrences	[4] Identified by	[5] Explains	[6] Examples	[7] Misconceptions and blind spots
Evolving, goal-oriented	ECONOMY AS JOURNEY	5	Boers and Demecheleer [6], Cibulskiene [11], Gao [18], Imani et al. [27], Qin [51]	The metaphor of a journey is set as an action overcoming difficulties along the road on the way to the destination [18]. The logic of a path is goal-oriented. Therefore, activities that serve a clear purpose are positively valued [6]	<p>“Companies will be on the forefront of this journey.”—Imani et al. ([27], p. 9)</p> <p>“The housing market remained a hurdle.”—Gao ([18], p. 2633)</p> <p>“Obama barricaded the investment.”—Gao ([18], p. 2633)</p>	<p>The metaphor of “a journey” is a way to avoid making specific and substantive commitments ([42], p. 825)</p> <p>“It is usually the shortest and quickest path to one’s destination that is considered the best.”—Boers and Demecheleer ([6], p. 121)</p> <p>“vague measuring tool and a justification for small actions without accompanying big action...”—Berry ([3], p.232)</p>

Table 2 (continued)

[1] Identified features	[2] Conceptual metaphor	[3] Number of occurrences	[4] Identified by	[5] Explains	[6] Examples	[7] Misconceptions and blind spots
Ecological, growing, evolving	ECONOMY AS GARDEN	5	Cortes de los Rios [12], Mixon [43], White [67], Charteris-Black [10], Telibasa [61]	The garden metaphor allows for a more long-term view of the economy. The government is conceptualised as the gardener and this metaphor suggests humility, but not inaction [43]. It is focused on bringing together the right system conditions for the economy to thrive	<p>“Reaping the benefits of the financial environment.”—Cortes de los Rios (12), p. 43</p> <p>“Growth pushes up all sectors”—White ([67], p. 137)</p> <p>“Flourish, weed out, spread, growth, to put down roots, to soar, to blossom, fruitful are all frames supporting the garden metaphor”—Telibasa ([61], p. 139)</p>	<p>“This alternative metaphor points out the longer-term (and uncertain) nature of policy actions.”—Mixon ([43], p. 297)—and therefore does not explain short-term radical decisions leading towards instant gratifications</p>
Equilibrium-seeking	ECONOMY AS VICTIM OF NATURAL DISASTER	3	Norazit [46], Besomi [2], Stromach et al. [58]	This metaphor presents a negative situation that is unavoidable and unforeseeable. The origin of the disruption is given to an external factor. When this is over, the economy will return to its previous state	<p>“The government is avoiding further meltdown”—Norazit ([47], p.218)</p> <p>“The storm will gradually pass”—Besomi ([2], p. 77)</p> <p>“Relief flooded in”—Stromach et al. ([58], p. 321)</p>	<p>These metaphors allow a depersonification of the crisis and conceal the ones responsible for it. The phenomenon is described as natural and is not attributed to human action [58]</p>

Table 2 (continued)

[1] Identified features	[2] Conceptual metaphor	[3] Number of occurrences	[4] Identified by	[5] Explains	[6] Examples	[7] Misconceptions and blind spots
Competitive, strategic	ECONOMY AS SPORT	2	Gao [18], Norazit [47]	Alike the war metaphor, the sports metaphor is used to make sense of the relationship between businesses in the economy	<p>“Japanese messaging app aims to rival Facebook.”—Gao ([18], p. 2633)</p> <p>“Shares kicked off this week on a solid platform.”—Norazit ([47], p. 222)</p> <p>“The company is on a winning streak”—Norazit ([47], p. 222)</p>	<p>“[referring to a fighting metaphor] serve the ulterior survival motive that is conceptualised in antagonistic terms, as competition and struggle rather than cooperation and mutual benefit.”—Koller ([28], p. 216)</p> <p>“...an important limitation of sports metaphors is their cultural resonance: Metaphorical “handoffs,” “touch-downs,” “punts,” and “fumbles” are meaningful only to people who know the basics of American football.”—Flusberg et al. ([16], p. 5)</p>

- The lexical unit contains either “circular economy” or “CE”.
- The lexical unit needs to be grammatically correct.
- In the lexical unit, “circular economy” or “CE” is not part of a list.
- The lexical unit is excluded when it uses “circular economy” or “CE” to refer to a group of individuals.
- The lexical unit explains a component of the circular economy (for example, by putting it in relationship with another component or through the selected verb).
- The lexical unit is not a quote.
- The lexical unit is not a table or figure name, nor a title or header of a section.

An example of a lexical unit would be *This will empower innovators in the business to fully capture the business potential of the circular economy* [5], p.315). In this case, *capturing the potential* reveals a conceptualisation that the idea of a circular economy is there to enhance the strategic performance of the company, in line with competitive metaphors.

The scope of the textual analysis was determined by reaching the data saturation point, “when new incoming data produces little or no new information to address the research question”. [17], p.2). The cut-off point was ten papers since no new dominant conceptual metaphors were detected in paper 11.

Results

Systematic Literature Review

The table below elaborates on the insights from the literature review. After clustering, seven distinct conceptual metaphors for the economy have been identified in the literature. For each of these conceptual metaphors, features have been identified, the number of occurrences has been identified, and an explanation of the conceptual metaphor has been provided. This is supported by a series of examples from the original papers and an elaboration of misconceptions and blind spots as they were identified in the literature.

It was clear from the number of mentions per conceptual metaphor in Table 2 that some were more prevalent than others. Table 3 shows the frequency of mentions of each conceptual metaphor identified in the literature.

The most prevalent conceptual metaphor in the systematic literature review was ECONOMY AS PATIENT, with equilibrium-seeking features.

Textual Analysis

Some of the conceptual metaphors shown in Tables 2 and 3 were recognised in the textual analysis of the ten most-cited papers that mention “circular economy” in the title. Due to the strong similarities shared between CIRCULAR ECONOMY AS WAR and CIRCULAR ECONOMY AS SPORT, these “competitive” metaphors have been put together as one in the data collection. These are referred to as “SPORT/WAR (including other competitive metaphors)”.

A similar broader cluster was developed for CIRCULAR ECONOMY AS GARDEN, since it was not possible to definitively identify all metaphors with ecological or eco-systemic features as part of the garden metaphor. For example, a lexical unit in Geissdoerfer

Table 3 Conceptual metaphor prevalence in the literature review

	PATIENT	WAR	MACHINE	JOURNEY	GARDEN	VICTIM OF NATURAL DISASTER	SPORT
Number of identifications	14	9	8	5	5	3	2

et al. [19] refers to the cross-fertilisation of the concept of circular economy with other schools of thought. In this case, cross-fertilisation could relate to the metaphor of a garden or other ecological metaphors such as a forest or a farm. Therefore, these metaphors are referred to as “GARDEN (including other ecological metaphors)”.

Table 4 provides an overview of how many conceptual metaphors have been identified in each of the analysed papers.

The machine metaphor was most often identified in the selection of papers. Competitive metaphors, the journey metaphor and ecologic metaphors were identified in most papers, and these have been elaborated upon in Table 5.

Discussion

The aim of this research was to explore the extent to which metaphors in conventional economics currently permeate the circular economy discourse. In eight out of ten of the Circular Economy papers that were part of the textual analysis, the machine metaphor was the dominant conceptual metaphor. Competitive and journey metaphors were most pervasive after the machine metaphor. It was noticeable that CIRCULAR ECONOMY AS PATIENT was the least identified conceptual metaphor, even though ECONOMY AS PATIENT was found most often in conventional economics literature. No new metaphors or clusters of metaphors emerged during the textual analysis. This section reflects on the conceptual metaphors that were most pervasive in the analysed texts.

The Machine Metaphor

How the conceptual metaphor of the machine was used in circular economy discourse can be found in Table 5. This conceptual metaphor finds its origins in physics and exact sciences [49], especially Newtonian mechanics [45]. Capra and Luisi [8] identifies that the influence of exact sciences and Newtonian mechanics resulted in a more pervasive “mechanistic worldview” which aims to seek understanding by removing complexity and focusing on the detail, simplifying. This can be regarded as a reductionist approach, which is the opposite of a holistic approach (understanding by looking at the bigger picture and the relationships between different entities).

Literature also identified limitations of the conceptual metaphor of the machine. Mutari [45] reflects on when using the machine metaphor to understand economics, there is no role left for human agency: self-conscious action within a particular context. They also reflect on the disconnection between “the machine” and its surroundings. They mention that the institutions that constitute the economy are treated as separable from society and social factors [45]. The lack of attention to the social dimension in the current circular economy discourse has also been identified by Corvellec et al. [13] as well as Murray et al. [44] who argue that the circular economy is “virtually silent on the social dimensions” and is concentrating only on the redesign of manufacturing and service systems.

Some authors have also observed and named the reductionist nature of parts of the circular economy discourse, Murray et al. ([44], p. 23) reflect on this: *over-simplification arises both from reductionist thinking and from mathematical modelling, wherein we remove most variables in order to produce manageable concepts*. When engaging with systems that have complex features, a balance between simplicity (reductionism) and complexity (holism) is necessary [65].

Table 4 Results from the textual analysis

	MACHINE	SPORT / WAR (including other competitive metaphors)	JOURNEY	GARDEN (including other ecological metaphors)	VICTIM OF NATURAL DISASTER	PATIENT
Geissdoerfer et al. [19]	19	17	4	6	0	1
Ghisellini et al. [21]	23	18	5	14	2	0
Kirchherr et al. [28]	18	6	5	2	0	0
Korhonen et al. [30]	29	21	6	4	1	2
Bocken et al. [5]	11	14	11	0	1	0
Murray et al. [44]	24	12	5	1	0	0
Lieder & Rashid [39]	3	2	1	0	0	0
Stahel [56]	6	3	0	0	0	3
Tukker [64]	4	1	0	0	0	0
Su et al. [59]	27	22	0	2	3	0
Total	164	117	37	29	7	6

The Sports and War Metaphor (Includes Other Competitive Metaphors)

Other often-used conceptual metaphors in circular economy discourse is the cluster of competitive metaphors. They refer to businesses that compete within a market or to business that needs to overcome an external challenge such as supply disruption. There is also a discourse in which the concept of a circular economy needs to compete with alternative sustainability ideas, can be “popularised” and even be “trending”. Finally, there is a discourse around the idea of a circular economy which aims to defeat its opponent which includes waste and pollution.

This conceptual metaphor lends itself particularly well when the author is mostly concerned about relevance in the marketplace and staying ahead of the competition as indicated in Table 5. However, this leaves little room for pre-competitive collaboration, establishing and sharing common infrastructure, and open sourcing of information and intellectual property. It emphasises “us” versus “them” thinking and has a blind spot for interdependent and reciprocal relationships [26], especially in the context of business in a circular economy. However, when the understanding of business in the economy is deepened, there are many inter-relational, networked, cooperating, and symbiotic behaviours that happen, which cannot be explained by such competitive metaphors only [6].

The Journey Metaphor

The journey is often used to explain the change that the economy will undergo. This is often expressed as “the move to a circular economy” [5]. Also, many governments, businesses, and regions have developed or are developing “roadmaps” for their change towards a circular economy. How this conceptual metaphor is used in the current discourse is described in Table 5. However, there are concerns about the use of a journey to express this change. First, it makes it seem like there are already-established roads that businesses can follow in their journey as if a circular economy is not context-driven. Milne et al. [42] add that the conceptual metaphor of a journey is a way to avoid making specific and substantive commitments towards positive societal and environmental outcomes. Also, Berry ([3], p. 232) observed that the journey metaphor within sustainability discourse was used as a *vague measuring tool and a justification for small actions without accompanying big action...* It seems that through this conceptual metaphor, a well-coordinated and managed, gradual accumulation of different steps, one happening at a time, ultimately helps to achieve the goal. This may be unrealistic and potentially problematic when rapid and wider-system change is needed to allow a circular economy to emerge.

The Garden Metaphor (Includes Other Ecological Metaphors)

The fourth most frequently occurring cluster of conceptual metaphors that is used in the circular economy discourse is ecological metaphors. Out of the 29 identified lexical units that follow the logic of ecological metaphors, 14 came from Ghisellini et al. [21]. They occurred far fewer times in the other texts that were analysed. One part of the discourse that uses ecological metaphors discusses the idea or concept of a circular economy growing and evolving. The other part of the discourse refers to how a circular

Table 5 Conceptual metaphors in circular economy discourse

Conceptual metaphor	Number of occurrences	Used by	Explains	Insights from the source domain	Example of lexical units
CIRCULAR ECONOMY AS MACHINE	164	Geissdoerfer et al. [19], Ghisellini et al. [21], Kirchherr et al. [28], Korhonen et al. [30], Bocken et al. [5], Murray et al. [44], Lieder and Rashid [59], Stahel [56], Tukker [64], Su et al. [59]	The circular economy is the sum of resource inputs and outputs	<p>The purpose of the machine is to turn inputs into outputs efficiently</p> <p>Flows of throughput run through the pipework of a machine</p> <p>Fuel is the driving force of a machine</p> <p>The aim is to maximise outputs</p>	<p>"CE-type arrangements of the physical flows of materials and energy would reduce virgin inputs to the system and waste and emissions outputs from the system."—Korhonen et al. [30], p. 40</p> <p>"They proposed a closed-loop of material flow in the economy, which was named, circular economy"—Su et al. [59], p. 215)</p> <p>"[They [business models] are the driving force in the shift towards [CE]—Kirchherr et al. ([28], p. 228)</p> <p>"In a circular economy, the objective is to maximise value at each point..."—Stahel ([56], p. 436)</p> <p>"Most authors conceptually simplify the circular economy to resource input, waste and emission output"—Geissdoerfer et al. ([19], p. 765)</p> <p>"Circular economy is constructed from societal product-consumption systems."—Korhonen et al. ([30], p. 39)</p> <p>"The material flow released from the economy to nature should be in a form in which nature can utilise them in its own functions."—Korhonen et al. ([30], p. 40)</p> <p>"These policies, in turn, inspired China to install the Circular economy as its major framework for delivery of increased growth but with decreased environmental damage."—Murray et al. ([44], p. 11–12)</p> <p>"The new paradigm of a circular economy requires new concepts and tools to describe and support this paradigm."—Bocken et al. ([5], p. 309)</p>
			A machine is constructed from parts that enable throughput		
			The machine and the environment not embedded but disconnected from each other		
			A machine is or components of the machine are installed with a single purpose		
			A machine can be put together and maintained by tools		

Table 5 (continued)

Conceptual metaphor	Number of occurrences	Used by	Explains	Insights from the source domain	Example of lexical units
CIRCULAR ECONOMY AS WAR/SPORT (including other competitive metaphors)	117	Geissdoerfer et al. [19], Ghisellini et al. [21], Kirchherr et al. [28], Korhonen et al. [30], Bocken et al. [5], Murray et al. [44], Lieder and Rashid [39], Stahel [56], Tukker [64], Su et al. [59]	The relationship between businesses in a circular economy is only competitive	<p>The aim is to increase performance</p> <p>All sides are determined to take the lead</p> <p>Commitment is necessary in order to win</p> <p>Certain strategies can enhance the performance or likelihood of winning</p> <p>Different sides draw attention from crowds by being popular</p> <p>The opposite side creates Resistance</p> <p>When one does not reach the desired outcome, one fails</p> <p>The opponent needs to be defeated</p>	<p>“The relationship between the circular economy and sustainability and their influences over the performance of supply chains, business models and innovation systems.”— Geissdoerfer et al. ([19], p. 764)</p> <p>“... that indicated that a few players have taken the lead in the conceptual development of this emerging topic.”— Geissdoerfer et al. ([19], p. 760)</p> <p>This country seems strongly committed and attracted by a CE.”— Ghisellini et al. ([21], p. 12)</p> <p>“Building on the product design and business model strategies to enhance the circular economy...”— Bocken et al. ([5], p. 315)</p> <p>“The circular economy is emerging as a possible strategy that companies of all sizes might adopt to allow them to engage with such challenges.”— Murray et al. ([44], p. 4)</p> <p>“The Ellen MacArthur Foundation has helped popularise the move to a circular economy with business.”— Bocken et al. ([5], p.308)</p> <p>“The circular economy (CE) is trending both among scholars and practitioners.”—Kirchherr et al. ([28], p. 221)</p> <p>“Although there was resistance from some business lobbies, the adoption was carried out.”— Murray et al. ([44], p. 18)</p> <p>“Such a very limited point of view may lead CE to fail...” — Ghisellini et al. ([21], p. 12)</p> <p>“The recognition of the limits to planetary resource and energy use, and the importance of viewing the world as a “system” where pollution and waste are viewed as a defeat, lay at the foundation of circular economy thinking.”— Bocken et al ([5], p. 308)</p>

Table 5 (continued)

Conceptual metaphor	Number of occurrences	Used by	Explains	Insights from the source domain	Example of lexical units
CIRCULAR ECONOMY AS JOURNEY	37	Geissdoerfer et al. [19], Ghisellini et al. [21], Kirchherr et al. [28], Korhonen et al. [30], Bocken et al. [5], Murray et al. [39, 44]	The circular economy is a destination that is reached gradually and step by step	<p>Reaching the destination is the purpose of the journey</p> <p>The accumulation of different steps allows the move to a new destination</p> <p>The participants on the journey want to reach their destination in the safest and quickest way possible</p> <p>There is a path to follow that leads to the destination</p> <p>During a journey, barriers are overcome in order to reach the destination</p> <p>Areas yet to be encountered are unexplored</p> <p>A journey follows directions</p>	<p>Circular economy could help society reach sustainability and wellbeing.”—Ghisellini et al. ([21], p. 12)</p> <p>“[Progress] is perhaps gradually and step-by-step.”—Korhonen et al. ([30], p. 42)</p> <p>Firms may take the path of least resistance to adopt CE if waste hierarchies are not explicated.”—Kirchherr et al. ([28], p. 227)</p> <p>“Authors increasingly see business model innovation as the key pathway to the necessary socio-technical transitions.”—Geissdoerfer et al. ([19], p. 764)</p> <p>“The scientific research content of CE remains largely unexplored.”—Korhonen et al. ([30], p. 37)</p> <p>A circular economy understanding lacking business models is one with no driver at the steering wheel in our point of view.”—Kirchherr et al. ([28], p. 228)</p>

Table 5 (continued)

Conceptual metaphor	Number of occurrences	Used by	Explains	Insights from the source domain	Example of lexical units
CIRCULAR ECONOMY AS GARDEN (including other ecological metaphors)	29	Geissdoerfer et al. [19], Ghisellini et al. [21], Kirchherr et al. [28], Korhonen et al. [30], Murray et al. [44], Su et al. [59]	The circular economy is an idea or concept that is growing and evolving	<p>The ideas underpinning the circular economy are the roots of the idea</p> <p>A circular economy emerges when the right conditions come together</p> <p>A circular economy can be understood by looking at its patterns</p> <p>The goal is to create better ecosystemic outcomes</p> <p>A circular economy can be established through grassroots or bottom-up change</p> <p>Effective circular economy systems contain elements around symbiosis and collaboration</p> <p>Materials flow in a circular economy as they do in nature</p>	<p>"While the roots of the topic are European, much of this recent surge started with Chinese authors."—Geissdoerfer et al. ([19], p. 776)</p> <p>"The CE concept show to be rooted in very diverse theoretical backgrounds."—Ghisellini et al. ([21], p. 24)</p> <p>"In Europe, CE primarily emerged in Germany in the early 1976 [...]—Ghisellini et al. ([21], p. 15)</p> <p>"One interesting difference between circular economy as most of the other schools of sustainable thought is, that it has largely emerged from legislation."—Murray et al. ([44], p. 12)</p> <p>"Circular Economy in China and worldwide seem to follow very different patterns."—Ghisellini et al. ([21], p. 18)</p> <p>"[...] CE aims to increase the efficiency of resource use, with a special focus on urban and industrial waste, to achieve a better balance and harmony between economy, environment and society."—Ghisellini et al. ([21], p. 11)</p> <p>"NGOs, which have easy access to grassroots, possess large, if not current, potential influence on promotion of the CE in society."—Su et al. ([59], p. 218)</p> <p>"[...] from the roots up the world of the future could be transformed towards something similar to the CE vision [...]."—Korhonen et al. ([30], p. 42)</p> <p>The lesson learned from successful experiences is that the transition towards CE comes from the involvement of all actors of society and their capacity to link and create suitable collaboration and exchange patterns—Ghisellini et al. ([21], p. 11)</p> <p>"[...] enterprises could strengthen their mutual understanding and friendship through information exchanges, which will be the solid foundation for further collaboration on promoting the CE."—Su et al. ([59], p. 223)</p> <p>"It is interesting that the CE model too seems to follow that of nature in light of the physical flows of materials and energy."—Korhonen et al. ([30], p. 45)</p>

economy could work and draws lessons from natural systems. The importance of the latter has been emphasised in other literature.

Webster [68] proposes the use of conceptual metaphors from living systems to grasp the nonlinear and complex dimensions in a more appropriate way. Hanauer and Beinhocker [25] suggest that an emerging twenty-first-century view should draw inspiration from natural ecosystems, such as a garden. Mixon [43] suggests that using the garden metaphor instead of the machine metaphor to understand the economy is more neutral, focused on providing the right environment, and provokes humility but not inaction. Hutchins [26] suggests that leadership for such an economy should be inspired by metaphors from natural ecosystems.

Reflections on Mainstream Discourse

Our research shows that current academic discourse makes sense of the circular economy in a mechanistic way, as the sum of resource inputs and outputs (machine metaphor), the relationship between businesses in a circular economy is predominantly competitive (competitive metaphors) and the change towards a circular economy happens step-by-step (journey metaphor). A common thread between these conceptual metaphors is the under-emphasis of complexity and dynamic, nonlinear behaviour using similar conceptual metaphors through which we conceptualise the linear economy. Only a few metaphors have been identified that have nonlinear or ecological components which embrace complex and dynamic features, mostly observed in the work of Ghisellini et al. [21].

This does not mean that the wider research community that engages in circular economy research does not value features such as holistic thinking, collaborative endeavours, or more sudden, radical, and transformative change. It merely demonstrates that the metaphors that are used to make sense of this abstract phenomenon favour and enhance reductionism, competition, and gradual change and allow the user of these metaphors to express these features often in a successful way. Most individuals are unaware of the conceptual metaphors that govern their thinking [32], and therefore, it could be helpful to intentionally engage with new metaphors that enhance certain features that are not enhanced through the mainstream metaphors.

Limitations of This Research

This study has potential limitations. The textual analysis of circular economy papers requires interpretation from the researcher on the conceptual metaphor that is used. In some cases, there are ambiguous boundaries between different conceptual metaphors. To mitigate this, the competitive and ecological metaphors have been analysed as one group and all data has been analysed twice to ensure a correct judgement. In addition, Conceptual Metaphor Theory as a framework and methodology also has limitations. Spoken and written discourse is complex, and this makes separating isolated, single expressions from the systemic nature of conceptual metaphor challenging [22].

Also, the lexical units have been identified and interpreted by the authors only and this has not been independently validated.

Conclusion

Metaphorical thinking is part of how the brain works and makes sense of abstract phenomena. Understanding the extent to which the rhetoric of conventional economics permeates the circular economy discourse is crucial when conceptualising this phenomenon. The conceptual metaphors that are accepted, utilised, and often repeated determine the mainstream conceptualisation of a circular economy and have the potential to leave unnoticed (and potentially problematic) blind spots. This research aimed to understand the extent to which metaphors in conventional economics permeate circular economy discourse.

We found that circular economy discourse is currently most influenced by the machine metaphor, followed by competitive metaphors, the journey metaphor, and to limited extent ecological metaphors. These metaphors are also used for the conceptualisation of the current, linear economy and reinforce the same patterns of thought. The ecological metaphor occurred fewer times but contributes to potentially interesting new lines of enquiry, especially when the circular economy is conceptualised in a natural ecosystemic way, with nonlinear components and complex and dynamic features.

With this study, we contribute to increased recognition of how language and conceptual metaphor in particular inform the conceptualisation of a circular economy. Pluralism in the thinking around a circular economy can help move the conversation away from the dominant CIRCULAR ECONOMY AS MACHINE and break free from old habits of thought. In an educational context, these conceptual metaphors could support educators to allow learners to develop a conceptualisation that is in line with their values and beliefs. By opening the conversation and celebrating the diversity of circular economy conceptualisations, proponents can be empowered to consider different ideas and enhance novel features.

Recommendations for Future Research

Further research is necessary on the nature of circular economy discourse beyond the most-cited papers to identify alternative discourses beyond those presented in this paper. Further research is necessary to explore new conceptual metaphors that could be helpful with the conceptualisation of a circular economy.

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Data Availability All relevant data and material that were used to conduct this research are available upon request.

Declarations

Ethics Approval and Consent to Participate Not applicable.

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