

ANÁLISE BIBLIOMÉTRICA DA LOGÍSTICA REVERSA

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RESUMO

Este artigo tem como intuito investigar o desenvolvimento atual em pesquisas na área de Logística Reversa (LR), por meio da análise de conteúdo das publicações relacionadas ao tema. Buscou-se classificar estas pesquisas, identificar os periódicos que publicam nesta área, assim como quais são os atores e opções de recuperação envolvidas, o país de realização da pesquisa, o ano da publicação e seu impacto, tendo por base uma análise bibliométrica. O estudo mostrou que existe uma evolução das pesquisas em Logística Reversa nos últimos 10 anos e que a atuação dos fabricantes como atores e da remanufatura como opção de recuperação têm sido as mais abordadas nas pesquisas. Além disso, apontou o Brasil como um país de destaque, com mais pesquisas sendo desenvolvidas utilizando nossa realidade como cenário de análise. Acredita-se que esta revisão ajudará pesquisadores a avançar em suas pesquisas futuras, preenchendo assim as lacunas ainda existentes nesta área de estudo.

Palavras-chave: Logística Reversa; bibliometria; *software Publish or Perish*.

BIBLIOMETRIC ANALYSIS OF REVERSE LOGISTICS

ABSTRACT

This article has the intention to investigate the current development in research in the field of Reverse Logistics (LR) through the analysis of published literature. In this way, we aimed to classify those researches, identify the periodicals that publish in this area, as well as which actors and recovery options are involved, the country, the year, and the impact of the publications, using a bibliometric analysis. The study showed that there is an evolution of research on Reverse Logistics in the last 10 years, and that performance of manufacturers as actors, so as remanufacturing as a recovery option, has been most discussed in those researches. Besides, it pointed to Brazil as a leading country, with more research being developed using our reality as scenario of analysis. We believe that this review will help researchers to advance their future research, thus filling the gaps in this area of study.

Keywords: *Reverse Logistics; bibliometrics; Software Publish or Perish.*

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1. INTRODUÇÃO

A logística reversa é um conceito relativamente novo na área de logística e gestão da cadeia de suprimentos, no entanto, ela está recebendo uma atenção crescente das indústrias e pesquisadores e tem se tornado cada vez mais importante como uma estratégia de negócio rentável e sustentável (DU; EVANS, 2008). Segundo Leite (2003), a logística reversa se refere às etapas, às formas e aos meios como parte dos produtos que foram parcial ou totalmente utilizados, retorna ao ciclo de produção, com um novo valor devido à sua reutilização ou à reciclagem dos materiais neles contidos.

De forma geral, três aspectos podem ser mencionados para justificar as atividades da logística reversa: aspectos econômicos, diretivas do governo e pressão dos consumidores (MELO; NICKEL; SALDANHA-DA-GAMA, 2009).

Outros aspectos importantes para a Logística Reversa e que serão parâmetros de análise neste artigo são os atores e as opções de recuperação. Os atores na Logística reversa são os agentes que desempenham papéis no sistema e, segundo De Brito (2004), podem ser classificados em Atores da Cadeia de Suprimentos Direta – aqueles especializados no gerenciamento do fluxo reverso – Instituições Governamentais e Atores Oportunistas. Já as opções de recuperação lidam com a forma como a logística reversa funciona na prática, ou seja, como o valor é recuperado. De Brito (2004) classifica a recuperação direta em Reuso, Revenda e Redistribuição e os processos de recuperação em Reparo, Remodelagem, Remanufatura, Recuperação, Reciclagem e Incineração. Se nenhum desses processos de recuperação ocorrer, os produtos estão dispostos a ir para um aterro.

Dessa forma, com base em fatores ambientais, legais, sociais e econômicos, a logística reversa, também entendida como cadeia de suprimentos de ciclo fechado (*closed-loop supply chain*), têm atraído a atenção do meio acadêmico e de profissionais da área. Essa atenção é evidente pelo grande número de publicações em revistas científicas nos últimos anos. Assim, uma ampla revisão da literatura de trabalhos

recentes e estado da arte é vital para desenhar um quadro do passado e lançar luz sobre direções futuras (GOVINDAN; SOLEIMANI; KANNAN, 2015).

No entanto, os esforços para sintetizar a pesquisa em uma forma integrada de conhecimento têm sido limitados, (POKHAREL; MUTHA, 2009), não havendo uma abrangência. Nesse sentido, apresentar a evolução e a importância das pesquisas em logística reversa ao longo dos anos, identificar lacunas ainda existentes, apontar o que precisa ser aprofundado e, conseqüentemente, gerar um conhecimento estruturado sobre o assunto é extremamente importante, justificando assim a realização deste trabalho.

O objetivo deste artigo é realizar um levantamento bibliográfico, do período de 2004 a 2015⁴, e discutir a abrangência da logística reversa em termos de atores, opções de recuperação, escala de tempo e países pesquisados. Para isso, este artigo está estruturado em 4 seções, que, além desta Introdução, configuram-se em Metodologia, Apresentação dos Dados Obtidos e Considerações Finais.

2. METODOLOGIA

Este trabalho teve como natureza uma pesquisa bibliográfica sobre Logística Reversa, visando expandir conhecimentos úteis envolvendo verdades e interesses universais. Do ponto de vista da forma de abordagem, foi uma pesquisa qualitativa e, no aspecto de seus objetivos, consistiu em uma pesquisa exploratória, envolvendo um minucioso levantamento bibliográfico assumindo a forma de uma revisão bibliográfica estruturada.

Já com relação aos procedimentos técnicos, teve em sua constituição uma pesquisa bibliográfica elaborada a partir de material já publicado, constituído unicamente de artigos de periódicos consultados na base de dados da *ScienceDirect* e publicados de 2004 a 2015. Para a análise Bibliométrica, foi utilizado o Software

⁴ Para a realização deste trabalho foi considerado que um horizonte de tempo de 10 anos seria satisfatório para caracterizar o cenário das pesquisas em logística reversa e sua evolução.

*Publish or Perish*⁵ (HARZING, 2007) desenvolvido pela Prof.^a Anne-Wil⁶ da Universidade de Melbourne (Canadá), que tem como função buscar e analisar citações acadêmicas.

Para a aquisição dos artigos empregados neste trabalho, utilizou-se como filtro no domínio da *ScienceDirect* que o termo “Reverse Logistics” estivesse presente no título, no resumo ou nas palavras-chave do artigo em um horizonte de tempo de 10 (dez) anos, compreendendo de 2004 a 2015, sendo então listados 304 (trezentos e quatro) artigos que atenderam aos pré-requisitos (*Search results: 304 results found for TITLE – ABSTR - KEY (“reverse logistics”) AND LIMIT – TO (yearnav, “2015, 2014, 2013, 2012, 2011, 2010, 2009, 2008, 2007, 2006, 2005, 2004”)*). Após a exclusão de artigos incompletos ou listados incorretamente, foram selecionados 289 (duzentos e oitenta e nove) artigos (ANEXO).

Assim para a análise, foram selecionados 289 artigos publicados nos últimos 10 anos relacionados ao tema logística reversa, e analisados os seguintes aspectos: os autores; o periódico em que o artigo foi publicado; o tema pesquisado; os atores e opções de recuperação envolvidos na pesquisa (artigo); o ano em que foi feita a publicação; o país em que a pesquisa foi realizada; o número de citações que o artigo recebeu; e o tipo de acesso (livre ou não) do público. A partir dos dados coletados, foi então realizada a estruturação das informações requeridas.

3. APRESENTAÇÃO DOS DADOS OBTIDOS

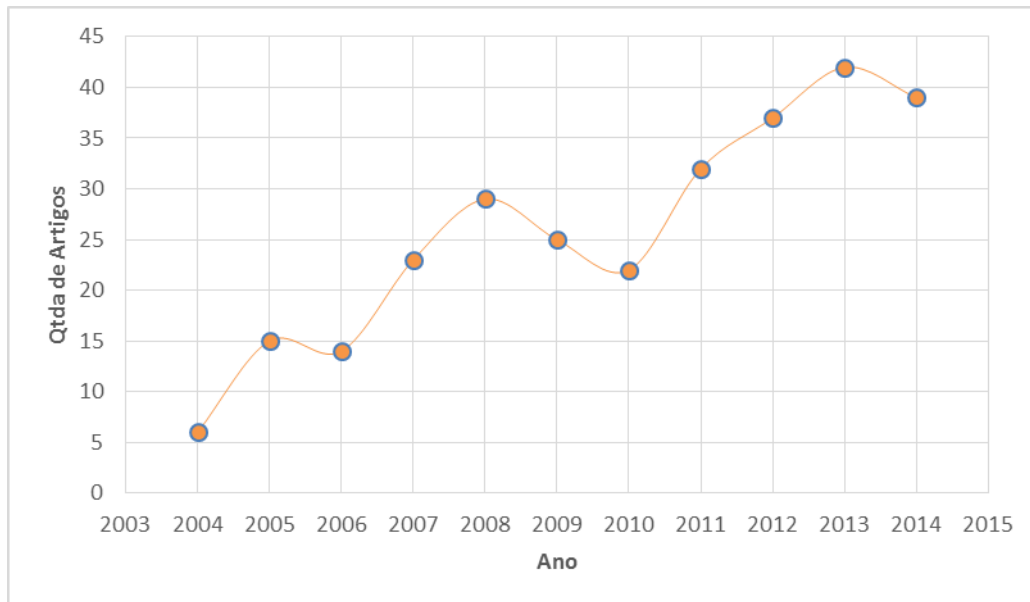
O Gráfico 1 apresenta a evolução em quantidade das pesquisas em Logística Reversa de 2004 a 2014⁷.

⁵ <http://www.harzing.com/resources.htm>

⁶ <http://www.harzing.com/index.htm>

⁷ Foi desconsiderado o ano de 2015 para a construção deste gráfico, pois o mesmo encontrava-se em andamento na data da coleta de dados.

Gráfico 1 – Evolução do número de publicações por ano



Fonte: elaboração própria

Como pode ser observado, apesar de existirem algumas oscilações, há uma evolução na quantidade de artigos publicados por ano na área de logística reversa, fato já previsto por muitos autores, como Prahinski e Kocabasoglu (2006), Du e Evans (2008), Melo, Nickel e Saldanha-da-Gama (2009), Govindan, Soleimani e Kannan (2015). Dessa forma, o Gráfico 1 reafirma a constatação de ascendência na quantidade de publicações na área.

Segundo Prahinski e Kocabasoglu (2006), a importância do estudo da Logística Reversa tem crescido nos últimos anos devido a algumas razões: a quantidade de produtos retornados tem sido muito alta, com algumas indústrias experimentando retornos acima de 50% das vendas; as oportunidades de vendas em mercados globais e secundários aumentaram a previsão de receitas de produtos anteriormente descartados; as leis de retornos de fim de vida têm se intensificado nas últimas décadas, tanto na União Europeia quanto nos Estados Unidos, requerendo um gerenciamento eficiente de toda a vida do produto; os consumidores têm pressionado com sucesso as empresas a ter responsabilidade pela disposição de seus produtos que contenham resíduos perigosos; a

capacidade dos aterros tornou-se limitada e cara e alternativas como reembalagem, remanufatura e reciclagem tornaram-se mais prevalentes e viáveis.

O Quadro 1 apresenta o volume de publicações sobre o tema por periódico, evidenciando aqueles que mais publicam este assunto. A revista *International Journal of Production Economics* foi a que publicou a maior quantidade dos artigos base desta pesquisa. É importante salientar que os 289 artigos analisados se distribuem em 55 periódicos, dos quais os 5 (cinco) primeiros do *ranking* com maior número de publicações concentram mais de 50% dos artigos analisados. Foram suprimidos do gráfico os periódicos que tinham somente um artigo publicado com base nos filtros utilizados nesta pesquisa para uma melhor visualização.

Quadro 1 – Quantidade de Artigos por Periódico.

| PERIÓDICO | Nº ARTIGOS |
|---|------------|
| International Journal of Production Economics | 57 |
| Journal of Cleaner Production | 27 |
| European Journal of Operational Research | 26 |
| Computers & Industrial Engineering | 23 |
| Computers & Operations Research | 21 |
| Resources, Conservation and Recycling | 19 |
| Omega | 13 |
| Transportation Research Part E: Logistics and Transportation Review | 13 |
| Expert Systems with Applications | 11 |
| Applied Mathematical Modelling | 7 |
| Procedia-Social and Behavioral Sciences | 6 |
| Industrial Marketing Management | 5 |

| | |
|---|---|
| Waste Management | 5 |
| Journal of Manufacturing Systems | 4 |
| Computers in Industry | 3 |
| Journal of Environmental Management | 3 |
| Journal of Operations Management | 3 |
| Applied Soft Computing | 2 |
| Engineering Applications of Artificial Intelligence | 2 |
| Procedia Engineering | 2 |
| Robotics and Computer-Integrated Manufacturing | 2 |
| Transportation Research Part C: Emerging Technologies | 2 |
| Procedia | 2 |

Fonte: elaboração própria

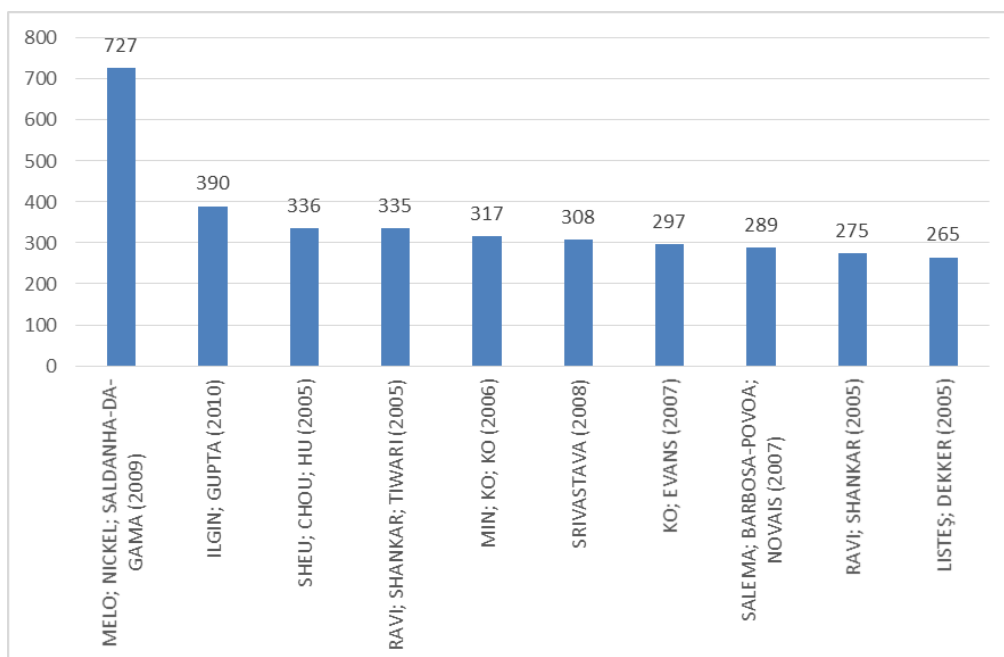
O número de citações dos 10 artigos mais citados encontra-se exposto no Gráfico 2. Além desta medida, o número médio de citações por ano que cada artigo recebeu também foi obtido e consta no Gráfico 3. Tendo em vista que essas variáveis são dinâmicas, os valores expostos no gráfico se referem aos valores coletados entre os dias 18-21 de Fevereiro de 2015. Esta análise bibliométrica básica foi realizada utilizando o Software Livre *Publish or Perish* (HARZING, 2007).

Essas informações possibilitam a análise do impacto da pesquisa publicada e, seguindo essa métrica, quanto mais citações um artigo recebe, mais impacto a pesquisa nele contida causou nas novas pesquisas desenvolvidas; entretanto, é necessário analisar uma série de fatores que podem influenciar o impacto da pesquisa. A quantidade de citações é uma métrica de impacto da pesquisa que deve estar atrelada ao número de citações por ano, pois considera o período decorrido da publicação da pesquisa, ou seja, um artigo mais recente pode obter um menor número de citações do que um artigo publicado há mais tempo, e neste caso, o gráfico de número de citações por ano poderia

fornecer um cenário mais realista (Gráfico 3). Outro aspecto importante é que o número de citações também pode estar condicionado ao nível de abrangência da pesquisa, ou seja, artigos que tratem de temas mais generalizados, por uma questão de abrangência, podem ser mais citados do que os que tratem de temas mais específicos.

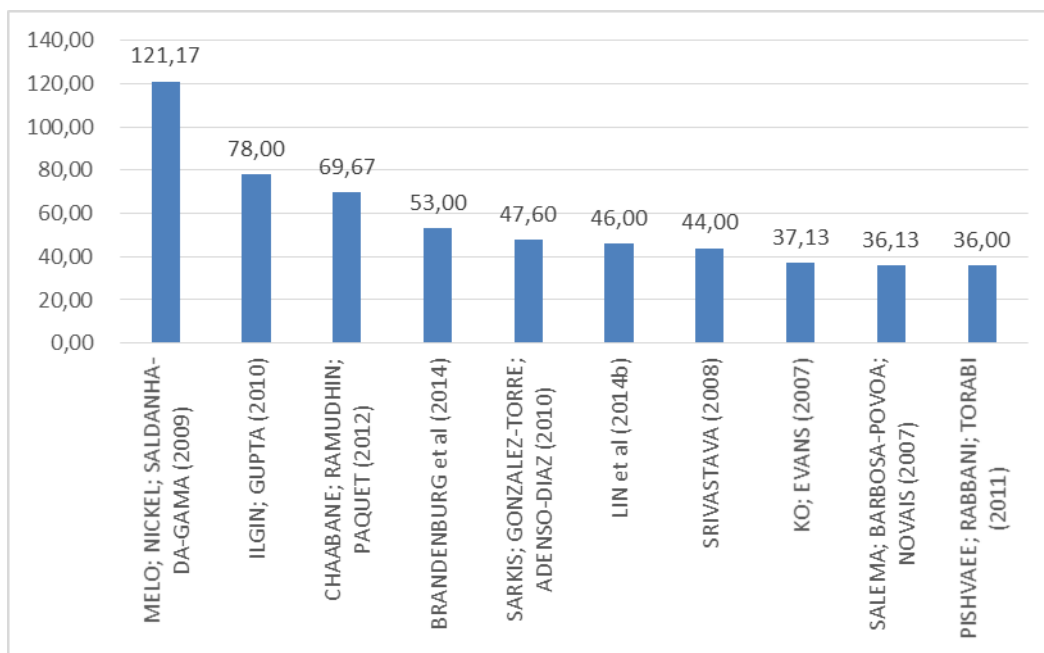
Os Gráficos 2 e 3 mostram que os dois artigos com mais citações ao longo dos últimos 10 anos também são aqueles com a melhor média de citações. Esses artigos são Melo, Nickel e Saldanha-da-Gama (2009), com 121,17 citações/ano, e Ilgin e Gupta (2010), com 78 citações/ano. O primeiro trata da localização de facilidades e gestão da cadeia de suprimentos, com ênfase na logística reversa, na forma de revisão bibliográfica, e o segundo apresenta o estado da arte das pesquisas em fabricação ambientalmente consciente e em recuperação de produtos. Vale destacar que estes dois artigos possuem a metodologia de revisão bibliográfica, e suas altas taxas de citações podem ter ocorrido pela sua utilização como base teórica para outros artigos, tendo em vista a abrangência dos temas.

Gráfico 2 – Número de Citações dos 10 artigos mais citados



Fonte: elaboração própria

Gráfico 3 – Os 10 artigos com maior média de citações por ano



Fonte: elaboração própria

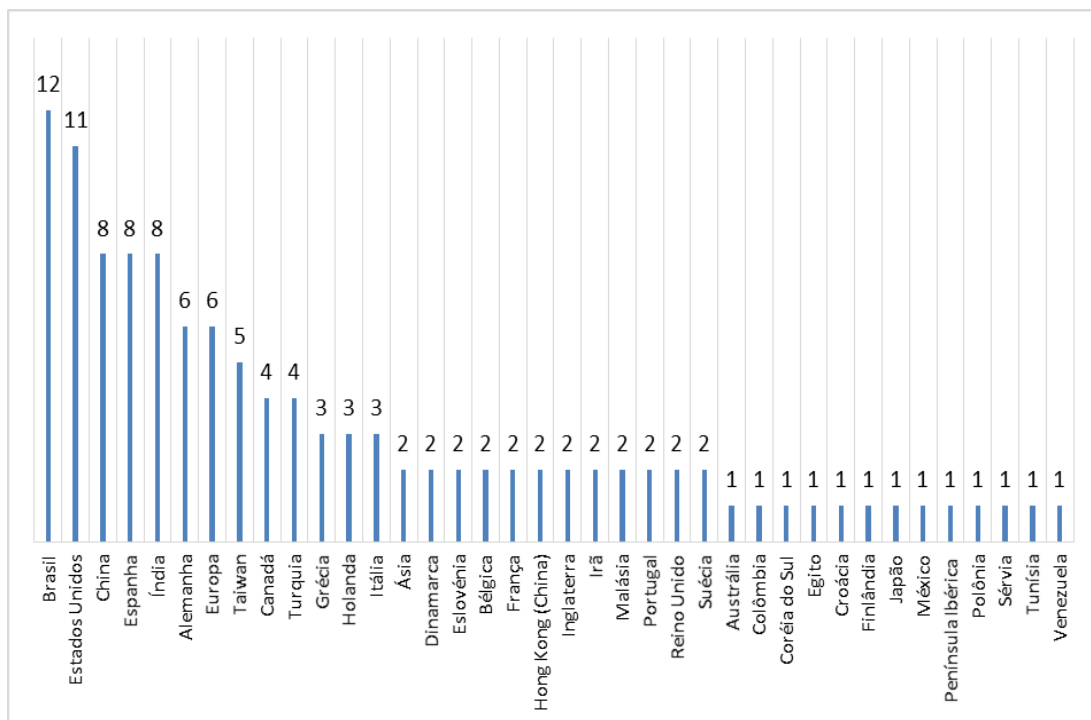
Dos 289 artigos analisados, 28 eram de acesso livre e 261 não eram, ou seja, aproximadamente 90% não eram de acesso livre. Para esta análise, foi considerado que os artigos de Acesso “Não Livre” eram aqueles que, ao serem acessados fora de um ambiente com licença específica para realização de *downloads* dos artigos no domínio da *ScienceDirect*, necessitavam que o usuário pagasse para ter acesso ao artigo completo. Nesse sentido, foram considerados artigos de “Acesso Livre”, aqueles que, ao serem acessados em qualquer rede ou domínio de *internet*, eram disponibilizados para *download* completo sem qualquer custo no site da *ScienceDirect*.

Desta forma, pudemos observar que um usuário comum que não esteja envolvido em um ambiente com licença para acesso a esta plataforma, não conseguiria ter acesso livre a aproximadamente 90% das pesquisas publicadas sobre logística reversa no site da *ScienceDirect*.

É importante salientar também que não foi encontrada nenhuma relação entre o número de citações que um artigo recebeu e o fato de o mesmo ser de acesso livre ou não. Dos 10 artigos mais citados analisados nesta pesquisa, nenhum deles era de acesso livre.

Com relação à classificação dos artigos, verificaram-se aqueles que abordavam uma aplicação da logística reversa em um dado país. Conforme o Gráfico 4, observa-se que os cinco países que foram cenário da maior quantidade de pesquisas foram: Brasil, Estados Unidos, China, Espanha e Índia, sendo que o Brasil está em primeiro lugar, com 12 pesquisas. O Gráfico 4 não se refere à quantidade de pesquisas publicadas sobre logística reversa em cada país, mas sim o país que serviu como cenário para a pesquisa, ou seja, o país pesquisado. É importante pontuar que dos 289 artigos, 176 não utilizaram nenhum país específico como cenário da pesquisa, ou seja, são estudos aplicáveis a qualquer realidade.

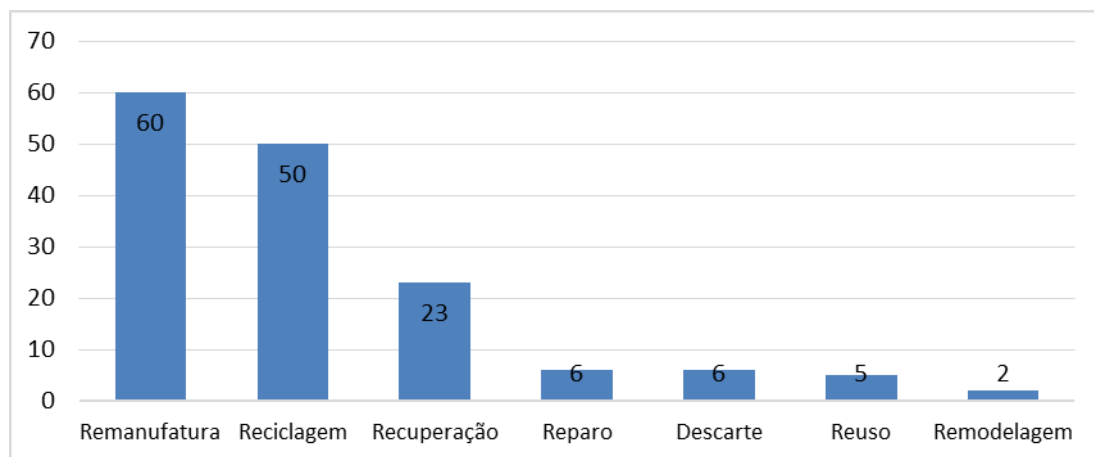
Gráfico 4 – Quantidade de Artigos por país de realização da pesquisa



Fonte: elaboração própria

Com relação às opções de recuperação, De Brito (2004) classifica em Reuso, Revenda, Redistribuição, Reparo, Remodelagem, Remanufatura, Recuperação, Reciclagem, Incineração e, caso nenhum destes seja aplicado, tem-se o descarte em aterro. Essa classificação foi utilizada como base para a categorização dos artigos neste trabalho, conforme o Gráfico 5. Com relação às opções de recuperação identificadas, a remanufatura foi a mais abordada entre os artigos, sendo que 60 dos 289 artigos tratavam da remanufatura como processo de recuperação, seguida pela reciclagem, que foi abordada em 50 artigos. No entanto, em 157 dos 289 artigos, não foi identificada a predominância de uma opção de recuperação específica. Cabe destacar a pequena quantidade de estudos que abordaram o reparo, o reuso e a remodelagem como opções de recuperação (menos de 5% dos artigos analisados), apontando para a necessidade de intensificar estudos que abordem e impulsionem estas opções tão relevantes.

Gráfico 5 – Quantidade de artigos que abordavam as opções de recuperação



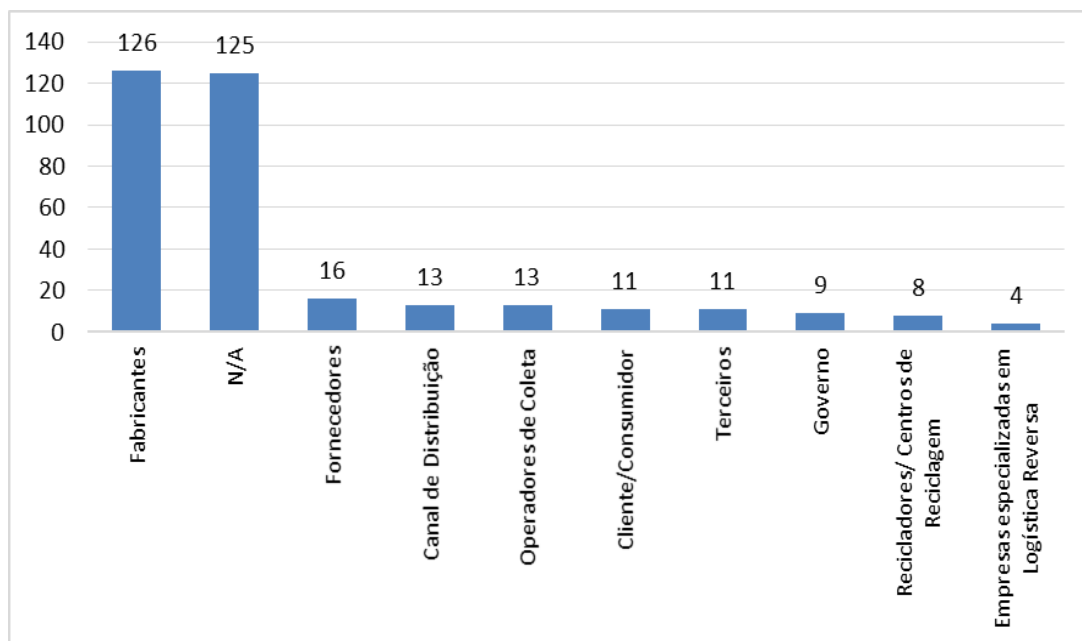
Fonte: elaboração própria

No que diz respeito aos atores envolvidos com a logística reversa, o Gráfico 6 mostra que 126 artigos tiveram os fabricantes como atores principais, seguido dos fornecedores, abordados em 16 artigos. Isso mostra que a grande maioria dos artigos tem analisado a atuação dos Fabricantes como atores na logística reversa, o que pode indicar que os Fabricantes têm sido vistos pelos pesquisadores e profissionais da área

como atores em potencial, impulsionadores e elementos chave para o sucesso da logística reversa.

Em contrapartida, analisando o Gráfico 6, percebe-se que poucas pesquisas têm abordado a atuação como atores das Empresas Especializadas em Logística Reversa, dos Recicladores e do Governo, evidenciando a necessidade de intensificar o estudo direcionado a esses atores, que também têm sua relevância no processo logístico reverso. Dos 289 artigos analisados, em 125 não foi encontrada a predominância de um ator.

Gráfico 6 – Quantidade de artigos por atores envolvido



Fonte: elaboração própria

4. CONSIDERAÇÕES FINAIS

O resultado deste trabalho disponibiliza ao leitor o cenário atual das pesquisas na área de Logística Reversa, com o intuito de revelar o que tem sido pesquisado nos últimos 10 anos. Nesse sentido, o objetivo geral foi atingido, e sua contribuição reside

na compilação, análise e apresentação de informações que, reunidas, expõem o cenário atual das pesquisas em logística reversa e sua evolução nos últimos anos.

A análise dos artigos evidencia que alguns poucos periódicos concentram a maioria dos artigos na área de Logística Reversa (considerando a metodologia empregada), entre os quais destacam-se o *International Journal of Production Economics*; *Journal of Cleaner Production*; *European Journal of Operational Research*; *Computers & Industrial Engineering*; *Computers & Operations Research e Resources*, *Conservation and Recycling*.

As pesquisas em logística reversa têm se intensificado ao longo dos anos, apresentando uma tendência ascendente na quantidade dos artigos publicados. A pesquisa mostrou o Brasil como um país de destaque, com mais pesquisas sendo desenvolvidas utilizando nossa realidade como cenário de análise. Com relação às opções de recuperação, a Remanufatura e a Reciclagem se mostraram como as opções mais abordadas nos artigos. De acordo com a priorização entre as atividades envolvidas com a logística reversa, o reuso, que envolve uma reutilização direta (sem necessidade de processos), deve ser priorizado, mas foi pouco estudado dentro do escopo desta pesquisa, apontando orientação para estudos futuros.

Por fim é importante destacar que a contribuição deste artigo vem no sentido de fornecer uma sucinta caracterização do cenário das pesquisas em logística reversa e assim impulsionar novas pesquisas nesta área de estudo, inclusive por meio de pesquisas bibliométricas mais aprofundadas. Mais do que isso, porém, pesquisas devem ser realizadas para suprir algumas lacunas. Por exemplo, poucas pesquisas envolvem o papel do governo, um importante ator envolvido ou propulsor da logística reversa. No entanto, o fator legal é um dos principais motivadores da implantação desta atividade. Logo, recomendam-se pesquisas que envolvam o papel do governo na estruturação da logística reversa.

Da mesma forma, o elo consumidor também precisa de mais pesquisas em nível internacional. Este elo é apontado pela literatura como aquele que inicia a logística reversa pós-consumo, e sua efetiva participação pode definir o sucesso desta atividade. No entanto, a grande maioria das pesquisas enfatiza o elo fabricante em detrimento de outros atores.

Como sugestão de pesquisas futuras, podem ser avaliadas outras variáveis que caracterizem os artigos, além das que foram analisadas neste artigo. Sugere-se a utilização de outros filtros, horizonte de tempo e base de dados para uma caracterização ainda mais abrangente, além de outras possibilidades que possam enriquecer a caracterização das pesquisas na área de logística reversa.

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ANEXO – ACERVO BIBLIOGRÁFICO UTILIZADO NA ANÁLISE BIBLIOMÉTRICA

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