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Ecological Modernization Theory (EMT): Antecedents and Successors

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Abstract: This study consolidates the state of academic research on the Ecological Modernization Theory (EMT). The EMT starts from a sociological perspective and enters into a series of political and economic factors that are considered crucial under the aegis of processes and practices. EM predicts that under political, economic, and technological conditions, competition among capitalists can be redirected to achieve eco-efficiency of pollution prevention. Based on a literature review from across 26 years, the study presents an overview of the evolution of the theme, background, and future perspectives. Using the databases Scopus, Web of Science, and Science Direct, a sample of 291 studies was mapped, which were read in full. Content analysis was conducted to abstract the current panorama of the theory of ecological modernization and to infer trends of the progress of the subject. The originality/value of this study is that we integrate diverse research perspectives into a comprehensive multidimensional structure of EM, with the purpose of analyzing the antecedents, artifacts associated with theory, method, types of studies developed, constructs explored together with the theory of EM and subcategories context, relevant stakeholders, technological innovations, and public policies. As future perspectives for studies, we suggest aligning EMT with circular economy, industry 4.0, and management information systems based on big data.

Keywords: ecological modernization theory, historical flow, sustainable practices.

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INTRODUCTION

The Ecological Modernization Theory (EMT) provides a useful theoretical framework for the organization of some of the most contemporary theoretical debates in the environmental social sciences, in a manner similar to neo-Marxist environmental sociology did in the 1970s and 1980s (Mol & Spaargaren, 2000). The EMT is a valuable starting point for the analysis of the contemporary scenario, reorganization, and transformation of production according to ecological criteria (Mol, 1996). It consists of an attempt to combine environmental and social sustainability, respecting the imperatives of profitability of a capitalist economy (Hudson, 2001).

The theory of modernization has generated questions and criticisms among supporters and spectators, having been understood as a technician, business as usual theory and focused on technological aspects. It was questioned the usefulness of its arguments to the organizations acting in the contemporary context (Zhu et al., 2012). The literature review of the last 26 years showed that the mapping described in this study showed that in January 2019 there were already 5 articles published on the subject, which portrays a scenario of academic interest in this theoretical perspective. In addition, in recent years, special editions have been held on the theme, such as the Special Issue organized by the Journal of Environmental Policy & Planning (Massa & Andersen, 2000); in the Journal Geoforum a Special Issue organized by Murphy (2000); Special Issue "Sustainability through the Lens of Environmental Sociology" organized by journal Sustainability in the year 2016; the Thematic Section Modernization Theory framework organized by the 6th International Euroma Sustainability Operations and Supply Chain Forum in the year 2019.

Above all, the EMT theme is also relevant to the journal Organization & Environment, which has constantly published articles that have an interface with the subject, such as the study by York & Rosa (2003), Buttel (2003), Gould et al. (2004), Davidson & Fricker (2004), Mol & Spaargaren (2005), Pulver (2007), Shwom (2009), McLaughlin (2012), Foster (2012), Niazi (2018), Tounés et al. (2019) and others. It is noteworthy that among the established authors of the subject, there have already been publications published in the Journal Organization & Environment.

The Theory Ecological Modernization (EMT) began its debates more strongly in the 1980s under the aegis of environmental sociology (Mol & Spaargaren, 2000). The critique of the Theory of Ecological Modernization focused on the specific contents and outline of the first phase of the Ecological Plan of Modernization Theory (Mol & Sonnenfeld, 2000). In a way, it was a directed reaction to the dominant schools of thought in environmental sociology in the late 1970s and early 1980s (Mol & Spaargaren, 2000). At the time there were two dominant schools - counter productivity or deindustrialization theorists and neo-Marxists (Mol & Spaargaren, 2000). EMT is thus a distinct counterpoint to the theories of political economy addressed by O'Connor (1994) and Schnaiberg (1980) and the perspective of demodernization described by Sessions & Devall (1985).

This clash has made EMT supporters recognize the need for some fundamental transformations within the modernization project to restore some of the structural design flaws that have caused serious environmental destruction. Other debates on technology have been related to controversies between demodernization perspectives and EMT (Mol & Spaargaren, 2000). Redclift (2000), in turn, contrasts this thinking by affirming that ecological modernization is a management strategy, with a deeper culture, fundamental and generating profound transformations (Huber, 1991; Lawhon & Murphy, 2012).

At EMT level, emerging concepts that try to give this social ecological rationality, economic and political impact: environmental accounting and accounting, annual environmental reports, green PNB, environmental efficiency, environmental productivity, environmental audit, etc. It is these types of concepts that link ecological modernization as a theory of social change on the one hand and ecological modernization as a political program or political discourse on the other. (Mol & Spaargaren, 2000).

York & Rosa (2003) emphasize that social modernization is necessary for the promotion of ecological sustainability. However, the EMT is not restricted to analyzing how contemporary industrialized industries and societies deal with environmental crises (Mol & Sonnenfeld, 2000). Industrial ecology such as the elimination of mercury and lead in products goes beyond mere efficiency improvements. However, the key to the development of the ecology industry is the dematerialization of production (Huber, 2000; Revell, 2007). Table 1 presents the historical evolution of the EMT debate.

Table 1 Evolution of the EMT Debate

Author (Year)	Contributions to the debate
Schnaiberg (1980)	Refutes the possibility of a capitalism of ecological connotation.
Huber (1985)	They present a technocratic path and a sociocratic path of development.
Beck (1986)	Associated EMT with the idea of reflective modernization.
Sarkar (1990)	It analyzes environmental reforms mainly via Schumpeterian evolutionary models.
Mol et al. (1991)	Led debates on demodernization, deindustrialization or counter-productivity.
Tellegen (1991)	Critique of technological optimism and supposed technocratic character.
Wehling (1992)	He interpreted EMT as a contradiction to Reflective Modernization.
Huber (1991); Jänicke et al. (1992)	In the 1980s the debates focused on the themes of ecological modernization and demodernization.
Mol & Spaargaren (1993)	Idea of reflexive modernization, especially in the confrontation with the Theory of the Society of Risk.
Spaargaren & Mol (1992); Mol (1995)	Ecological modernization challenged central ideas from the perspective of demodernization.
Hannigan (1995)	Reiterates that EMT is hampered by an imperceptible technological optimism.
Hager (1995)	Incorporated the debate on technocracy within the project of ecological modernization.
Christoff (1996)	It identified weak (economic-technological) and strong (democratic institutional) ecological modernization.
Mol (1996)	Reflexive modernization as umbrella theory for ecological modernization.
Leroy (1996)	Conflicting models of social change are used to emphasize that EMT is theoretically subordinated to power.
Mol (1995) Spaargaren (1997)	Contributions to create the sub-disciplines environmental sociology and environmental social sciences.
Bunker (1996)	We must go beyond the social, taking into account the naturalness and flows.
O'Connor (1994)	Contradiction of capitalism is used to point out the role that capitalism plays in environmental deterioration.
Neale (1997); Jokinen & Koskinen (1998)	The conceptualization of technology and technological changes.
Blowers (1997)	From this, the EMT's lack of attention to social contexts and ethical issues.
Mol et al. (1998)	Market instruments versus command and control strategies, the increasing role of non-state actors in environmental policy, and the new governance styles.
Mol & Spaargaren (2000)	Structuring the historical perspective that gave rise to EMT. Recognizes that there has been a transformation of the old political institutions of the national state into environmental reforms.
Mol & Sonnenfeld (2000)	Criticism on the Theory of Ecological Modernization of the first phase Plan of Modernization Theory.
Redclift (2000)	It defends EMT as a management strategy, a deeper, fundamental and transformative culture.

EMT develops and progressively legitimizes itself by developing a theoretical framework with a descriptive and explanatory dimension (Mol et al., 1991) allowing it to be evaluated in terms of its suitability to interpret and predict the processes of institutional change induced in societies at the time. over the decades (Mol & Spaargaren, 2000).

EMT underlines the growing importance of economic and market dynamics in ecological reform (Mol & Sonnenfeld, 2000) and the role of economic agents as social agents that catalyze ecological restructuring itself. These actors play a relevant role in the processes of ecological restructuring for the construction of creating favorable conditions to facilitate the processes (Redclift, 2000).

Thus, our objective in this study is to analyze the evolution of the theme, background and future perspectives. A systematic literature review was carried out to map scientific studies that mention EMT and which have been published over the last 26 years. From a meticulous analysis of the content of these studies, this study shows the evolution of EMT in the last 5 decades. Based on the description of this evolution, prospects for content expansion are presented over the coming decades.

METHODS

Based on a systematic review of the literature published in the last 26 years, the study presents an overview of the evolution of the theme, background and future perspectives. We searched the Scopus, Web of Science and Science Direct databases. The search strings were 'EM' and 'EMT'. Figure 1 shows the flow traveled to map the analyzed studies.

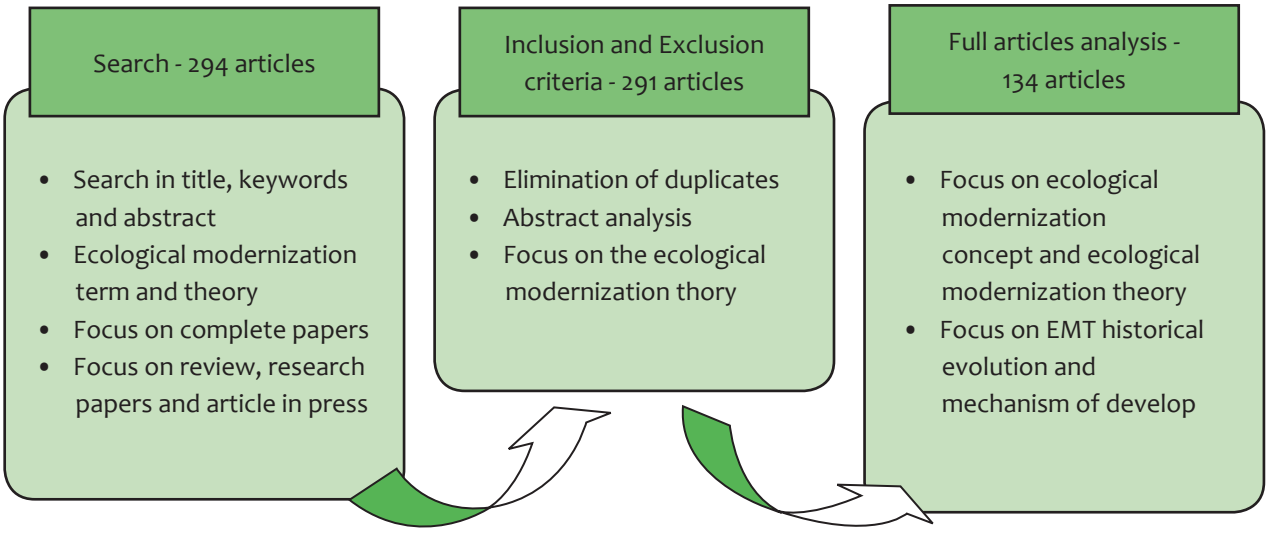

Figure 1 Review steps

Inclusion criteria included the document type and study language. They allowed the mapping of a sample of 291 studies, read in full. From these, it was possible to perceive that 134 had alignment with the pre-established premises to conduct this research. Content analysis was undertaken to abstract the current picture of the theory of ecological modernization and to infer trends in the progress of the subject. The originality/value of this article is that we synthesized several research perspectives in a comprehensive multidimensional structure of MS, with the objective of analyzing the antecedents, artifacts associated to theory, method, types of studies developed, constructs explored together with the theory of MS and sub-categories, relevant actors, technological innovations and public policies.

We also suggest determinants of MS and future perspectives, especially focused on research and management practices. Preliminary evidence from the systematic analysis of the research indicates that the management area gradually appropriated the theory of MS to promote industrial advancement (Huang & Li, 2018). Although economies are generating breakthroughs in resource economics (York & Rosa, 2003), the scale of global output has grown dramatically. And the EMT seeks to promote the achievement of sustainability from the internal premises adopted by the company through the greening of business (York & Rosa, 2003; Pataki, 2005).

RESULTS AND DISCUSSION

Presentation and analysis of data - Profile of articles reviewed

Table 2 Presents the Journals that most Published in the Analyzed Subject

No.	Journal	Total	Impact Factor
1	Environmental Politics	14	2.695
2	Journal of Cleaner Production	8	5.651
3	Organization & Environment	7	5.049
4	Society & Natural Resources	7	1.823
5	Geoforum	4	2.566
6	International Journal of Environment and Sustainable Development	4	-----
7	Development and Change	3	1.526
8	Human Ecology Review	3	-----
9	Sustainable Cities and Society	3	3.073
10	International Journal of Production Research	2	2.623
11	Journal of Business & Industrial Marketing	2	1.833
12	Journal of Environmental Policy and Planning	2	2.739
13	Journal of Facilities Management	2	-----
14	Journal of the Operational Research Society	2	1.396
15	Land Use Policy	2	3.194
16	Landscape Research	2	1.198
17	Local Environment	2	1.928
18	Social Forces	2	2.156
19	Sustainability (Switzerland)	2	2.075
20	Global Environmental Change	2	6.371
21	International Journal of Construction Management	2	-----
22	American Journal of Sociology	1	3.764
23	Antipode	1	3.108
24	Asian Social Science	1	-----
25	British Journal of Management	1	3.059
26	Business Strategy and the Environment	1	5.355
27	China Quarterly	1	2.276
28	Cities	1	2.704
29	Critical Sociology	1	1.295
30	Current Sociology	1	1.241
31	Economic Geography	1	6.438
32	Ekonomski Vjesnik	1	-----

33	Environment And Planning C-Government And Policy	1	1.864
34	Environment and Urbanization	1	-----
35	Environment Systems and Decisions	1	-----
36	Environmental Hazards	1	1.220
37	Espacios	1	-----
38	European Journal of Operational Research	1	3.428
39	Forest Policy and Economics	1	2.496
40	Fresenius Environmental Bulletin	1	-----
41	Futures	1	2.556
42	German Politics and Society	1	-----
43	Global Environmental Politics	1	3.237
44	Greener Management International	1	-----
45	Human Ecology	1	1.642
46	International Journal of Energy Economics and Policy	1	-----
47	International Journal of Hydrogen Energy	1	4.229
48	International Journal of Innovation and Sustainable Development	1	-----
49	International Journal of Production Economics	1	4.407
50	International Journal of Sustainability in Higher Education	1	1.876
51	International Journal of Systems Science: Operations &	1	-----
52	Logistics	1	-----
53	International Sociology	1	1.033
54	Journal of Comparative Asian Development	1	-----
55	Journal of Engineering and Technology Management - JET-M	1	2.686
56	Journal of Environment and Development	1	2.313
57	Journal of Environmental Education	1	2.472
58	Journal of Industrial Ecology	1	4.356
59	Journal of Integrative Environmental Sciences	1	1.216
60	Journal of Sustainability Science and Management	1	-----
61	Journal of World-Systems Research	1	-----
62	Journal on Chain and Network Science	1	-----
63	Maritime Policy and Management	1	-----
64	Nature + Culture	1	-----
65	Political Geography	1	3.495
66	Progress in Industrial Ecology	1	-----
67	Public Understanding of Science	1	2.452
68	Regional Studies	1	3.147
69	Remote Sensing of Environment	1	6.457
70	Renewable Agriculture And Food Systems	1	-----
71	Resources	1	-----
72	Resources, Conservation and Recycling	1	5.120
73	Revista Pos Ciencias Sociais	1	-----
74	Social Justice Research	1	0.826
75	Social Problems	1	2.071
76	Social Science Quarterly	1	0.874
77	Sociological Forum	1	1.602
78	Sustainable Development	1	2.75
	Total	134	

It is noted in Table 2 that the EMT theme is eclectic and has been addressed in different journals. The leading journals were Environmental Politics, Journal of Cleaner Production, Organization & Environment, and Society & Natural Resources. Thematic areas that have engaged in EMT publications are Business, Management and Accounting, Environmental Science, Engineering, Energy, Decision Science and Social Science. In the scope of management, the Business, Management and Accounting area was very expressive in the number of publications made. Soon after, Figure 2 presents the historical timeline of annual evolution of the writings on EMT.

The data show that the highlights were 2018, 2012, 2013, 2011 and year 2000. Historical events alluding to the sustainability trajectory may have corroborated the formation of peaks of EMT publications. The global scenario, regulatory guidelines, international treaties with co-participation of emerging and developed countries, the constant announcement by the international media of the environmental and social aspects and impacts of society are elements that instigate the academic environment to look at different cases, regional contexts, organizational environments, and systemic structures to find plausible insights for social, environmental, and economic advancement.

However, although this view certainly has a high potential for recognizing limits, it is important to analyze and evaluate all points in different aspects so that knowledge of organizational environments can be taken into account. Groups from different segments can induce sectoral interests so that policies are established so that actors can find plausible insights for new steps with EMT.

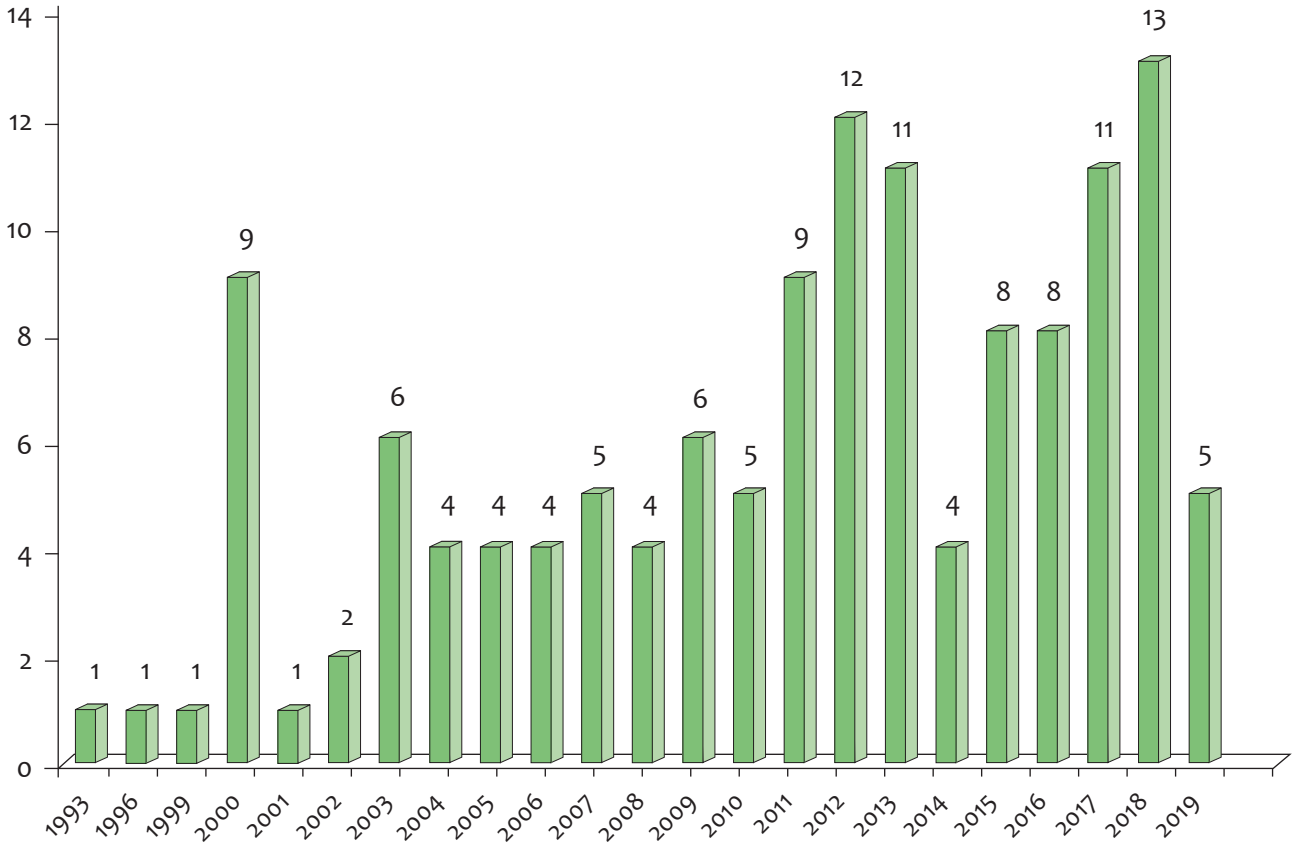

Figure 2 Year of Publication of Articles Analyses

Table 3 Top Articles Most Cited

No.	Authors	Year	Journals	Total Citations
1	Sarkis, J., Zhu, Q., & Lai, K.	2011	International Journal Of Production Economics	1191
2	Mol, A. P. J. & Spaargaren, G.	2000	Environmental Politics	1008
3	Buttel, F. H.	2000	Geoforum	627
4	York, R. & Rosa, E. A.	2003	Organization and Environment	452
5	Spaargaren, G. & Van Vliet, B.	2000	Environmental Politics	428
6	Truffer, B. & Coenen, L.	2012	Regional Studies	365
7	Ehrhardt-Martinez, K., Crenshaw, E. M., & Jenkins, J. C.	2002	Social Science Quarterly	343
8	Mol, A. P. J.	1996	Environmental Politics	323
9	Murphy, J. & Gouldson, A.	2000	Geoforum	317
10	Mol, A. P. J.	2000	Geoforum	309
11	Mol, A. P. J. & Spaargaren, G.	1993	International Sociology	304
12	Zhu, Q., Sarkis, J., & Lai, K.	2012	Journal of Engineering and Technology Management - JET-M	235
13	Tilley, F. & Young, W.	2006	Greener Management International	206
14	Jorgenson, A. K. & Clark, B.	2012	American Journal of Sociology	189
15	Huber, J.	2008	Global Environmental Change	166
16	Jorgenson, A. K. & Clark, B.	2009	Social Problems	157
17	Sonnenfeld, D. A.	2000	Environmental Politics	151
18	Bailey, I., Gouldson, A., & Newell, P.	2011	Antipode	145
19	York, R. & Rosa, E. A. & Dietz, T.	2004	Journal of Industrial Ecology	139
20	Gibbs, D.	2006	Economic Geography	132
21	Spaargaren, G.	2000	Journal of Environmental Policy and Planning	132
22	Sonnenfeld, D. A.	2002	Development and Change	112
23	Lankao, P. R.	2007	Environment and Urbanization	101
24	Carolan, M. S.	2004	Society & Natural Resources	101
25	Mol, A. P. J. & Spaargaren, G.	2005	Organization & Environment	98

It is noteworthy that in the 25 articles featured theoretical, reviews predominate, highlighting the researchers who are considered the classic, prolific and most notorious EMT in the international academy (Table 3).

EMT Evidence Over the Decades

Decade of 1970: gave rise to EMT, in the field of sociology, sub-field environmental sociology. EMT emerged as a pro-capitalist theory. It adopts as a guideline the long-term transformation of society. At the time, the theoretical framework of technology from the sociological perspective lacked a systemic approach. The debate unfolded on the perspective that, in order to reestablish the balance between nature and modern society, a kind of repositioning must take place, said theorists of ecological modernization at the time. There was also a

focus on the process of emancipation of the ecological sphere, as distinct from the ideological sphere and the political and cultural sphere. Something also suggested by Waeraas & Nielsen (2016) how core concept.

Decade of 1980: EMT continued to receive academic criticism from a variety of perspectives. However, there was also a spread of the perception that efficiency. Discussions have intensified on factors driving environmental degradation or those contributing to sustainability. The EMT focused primarily on institutional analysis. This led to new rules of the game for social organization of production and consumption.

Decade of 1990: EMT theorizes that continuous industrial development, instead of continuing to degrade the environment, offers the best option to escape the global ecological challenge. The modernization process is understood as a possible solution to the ecological crisis. Emerging view that the era of late modernity offers the promise that industrialization, technological development, economic growth and capitalism not only potentially compatible with ecological sustainability, but also can be the key drivers of environmental reform. Due to profit, producers have an incentive to continually expand production. Modernization contributes to the development of environmental sustainability.

Decade of 2000: EMT suggests the need to internalize impacts to ensure future production inputs - which have the potential to lead to ecological sustainability. Need to demonstrate the effectiveness of institutions of late modernity, not just their reorientation. The debate about state environmentalism emerges, that is, government supporting environmental protection leads to a decisive shift towards sustainability. Emphasis of the discussions on the relationship between state environmentalism and environmental degradation.

Decade of 2010: MS theorists emphasize the dynamism of modernity institutions (capitalism) and therefore are not necessarily arguing that in all earlier times these institutions were compatible with sustainability. The modernization process not only expanded the scale of human influence on the environment, but also led to qualitative changes in how societies affect the biosphere. It recognizes that human impacts on the environment can not be measured only as a one-dimensional indicator. One of the challenges of environmental quality assessment (and sustainability in general) is to recognize the types of impacts.

In this context, Ahmed & Cokinos (2017) emphasize that growth economics can contribute to technological efficiency. This, in turn, can influence how we solve various environmental problems with regard to climate-related risks. This brief account of the evolution of EMT history allows us to construct the following historical flow.

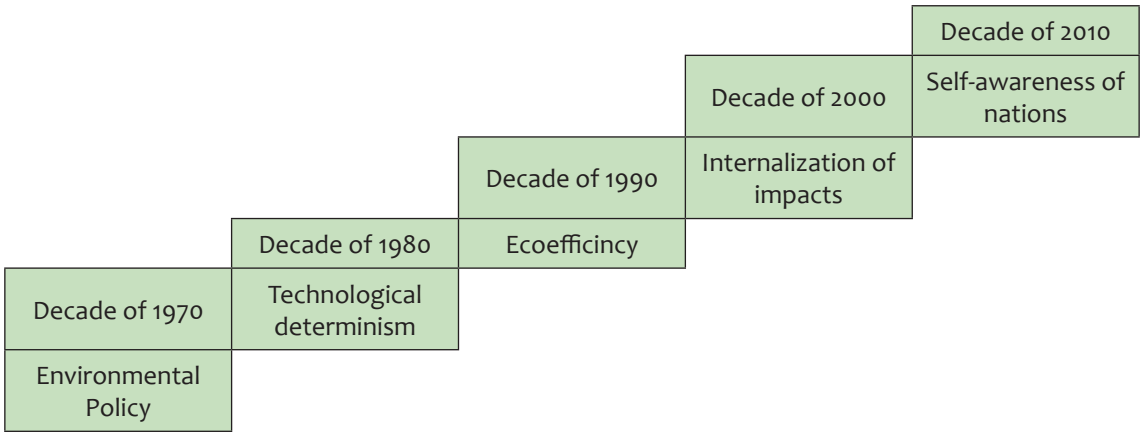

Figure 3 Historical Flow

Figure 3 shows the gradual evolution and key elements of each of the decades of EMT history. From a totalitarian perspective of the organization, there was an emphasis every decade on internal continuous improvement aspects, especially in the 1980s and 1990s. According to Hope & Muhlmann (2001) from the 2000s onwards, the supply chain perspective becomes effective, bringing to the discussion the assumptions of the systemic effects of a production system and the best practices. Focus on practices, tools and methods to promote ecological modernization with empowerment of people (Lincoln et al., 2002), valuation of natural resources (Jamali & Karam, 2016) and democratization of access to clean technologies, information to manage environmental liabilities, reintroducing waste into production chains adopting the premises of circular economy, use of big dates to manage environmental and social data for a society that develops economically and finally, investments in strong sustainability and performance measurement (Okwir et al., 2018).

Yusoff et al. (2018) point out that regulatory initiatives and perspectives to promote the connectivity of actors must be intensified between companies and this generates engagement and learning capabilities. Companies can strengthen engagement and expand best practices globally (Nurim & Asmara, 2019). These debates bring elements that strengthen the expansion of good practices, and evidence that corporate systems can improve information and capabilities for continuous improvement (Usman, 2020). Thus, adopting industry 4.0 concepts can strengthen the expansion of good practices, improve the capacity for ecological modernization and make a difference to reduce the environmental footprint.

CONCLUSION

EMT has a long and diversified historical evolution described in the management literature. Although there are references to EMT in the 1970s, it was in the 1980s that its rise, effective dissemination, and broad membership of different global researchers occurred. The writings of Schnaiberg (1980), Huber (1982, 1985), Beck (1986) and Jänicke (1985, 1986, 1988, 1989) are the main highlights of the decade. It was proposed at the time that Huber be considered the father of EMT. In the 1990s, EMT developed considerably. The academic literature grew substantially in the period and the prominent names were Huber (1991, 1992), Beck (1992), Spaargaren & Mol (1992), Jänicke et al. (1992, 1993), Mol (1995, 1996), Spaargaren (1997), Sonnenfeld (1998), among others. A perspective based on technological tools that contribute to the generation of ecoefficiency, continuous improvements and modernizing technological innovations came into being. The social gaze began to strengthen without losing sight of the ecological perspective (Mol & Spaargaren, 2000; Murphy, 2000; Murphy & Gouldson, 2000; Buttel, 2000; Rosa & York, 2002, 2003; Bergendahl et al., 2018). Finally, in the decade of 2010 the concept began to be explored in the academic literature with an approach to alternative themes, such as environmental and social compensation, business ethics, corporate citizenship and sustainable supply chains. As a future perspective, we can see an approximation of the EMT with the circular economy, industry 4.0, big data-based management information systems, people's health and well-doing as timely elements to be explored throughout the next decade. For the consolidation of these studies, the empirical research is adequate and should be conducted in organizational contexts of developed and emerging countries. Comparative studies, portraying the distinct evolutionary stages experienced by different nations are relevant, especially to highlight practices, tools, governance structures and actors engaged in promoting continuous improvement for sustainability. Thinking about the ecological modernization of companies and public institutions in a constantly dematerializing commercial scenario can become the key to the progress of EMT. Particularly with mechanisms, instruments and policies at the global level, as the EMT essentially addresses and captures important public concerns about

companies, institutions and nations and the mechanisms used to solve the environmental liabilities generated by the different production systems industries. A zeal for health, zeal for natural resources, so that they provide quality of life, with drinking water available to all people, unpolluted air, uncontaminated soil, nutritious foods and low food toxicity. In this new scenario, market dynamics and economic agents must use a new way of acting, new molds for the governance structure to conduct their business and generate economic results.

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