

RESEARCH ARTICLE

Media narratives on (Ecological) sustainability: A topic modeling analysis of entrepreneurship news in the MENA region

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Abstract

Amidst the increasing ecological pressures arising from industrial activity and consumerism, with particularly tangible impacts outside of the global north, the private sector is being held accountable to reduce its environmental footprint and transition to sustainable business models and processes. Nevertheless, perceptions of sustainability and its dimensions largely vary between cultures and contexts, while local media discourses both shape and reflect those concepts and narratives. This in turn shapes sustainability practices and the nature and impacts of emerging entrepreneurial business activity. Given the dearth of sustainability research in the Middle East & North Africa (MENA) and the region's extreme vulnerability to climate change, pollution, draughts combined with political instability and institutional fragility, this paper provides an in-depth analysis of media narratives at the intersection of sustainability and entrepreneurship in the region. This was done by means of the machine learning method of topic modelling on two datasets of 486 and 217 news media articles extracted from a major regional English-language news outlet, followed by a manual content analysis of the extracted topics and articles. We find that the term sustainability is highly associated with economic prosperity and that ecology-related themes are often formulated in terms of financial gain, for instance transitioning out of oil & gas dependence. We find a surprising lack of focus on water scarcity and biodiversity, coupled with a welcomed focus on the energy transition, recycling, urban mobility, as well as social networking and minority integration. Our findings hence provide a nuanced contextual understanding of sustainability, which may support businesses and decision-makers alike in (re)defining priorities and reflecting upon the status quo and necessary next steps in the transition to more sustainable societies.

Author summary

Ecological pressures keep increasing: Arising from industrial activity and consumerism, they have severe impact especially outside of the global north, such as the Middle East & North Africa (MENA) region. To mitigate risks and impacts, the private sector is being

held particularly accountable to shift to more sustainable business models and processes. However, perceptions of sustainability largely vary between cultures and contexts. Local media discourses both shape and reflect those narratives. This paper provides an analysis of media narratives at the intersection of sustainability and entrepreneurship in the region. We applied the machine learning method of topic modelling to regional English-language entrepreneurship news media articles. This was followed by a manual content analysis that revealed e.g. that the term “sustainability” is highly associated with economic prosperity, even in domains usually associated with ecological themes. We find a surprising lack of focus on water scarcity and biodiversity, and a welcomed focus on the energy transition, recycling, urban mobility, as well as social networking and minority integration. Our findings may support businesses and decision-makers alike in (re)defining priorities and necessary next steps in the transition to more sustainable societies.

1. Introduction

The term *sustainability* as referring to social and environmental concerns has emerged in the 1980s and became a common buzzword in the global north by 2010 [1]. The most universally used definition of sustainability is that of societal “development, that meets the needs of the present without compromising the ability of future generations to meet their own needs”, coined by the World Commission on Environment and Development in the 1980s [2]. To advance its understanding and solutions, the topic of sustainability has emerged as its own research stream in many social science and management domains including innovation and entrepreneurship literatures, as such business activity by its nature seeks and instigates radical change, and is therefore suited as means to find solutions to developmental challenges [3,4]. Nevertheless, ambiguity in the understanding of what *sustainable entrepreneurship* entails may hamper its ability to achieve desired outcomes. Indeed, the term *sustainable* has been criticized as being vague and interpreted differently in different parts of the world [1,5,6]. This has downstream impacts on social norms, such as the understanding and acceptance of sustainable entrepreneurship as a practice, as well as cross-cultural collaborative action to address global social and ecological crises. This is particularly relevant in sensitive contexts where historical power imbalances and colonial relationships come into play, for instance in the case of global north-originating development aid that focuses on establishing global south-based sustainable entrepreneurship programs. Accordingly, this research seeks to contribute to a deeper understanding of sustainability as a concept as prevalent in public narratives in an understudied global south context, namely the Middle East & North Africa (MENA), with focus on entrepreneurship and technological innovation media articles in a renowned news outlet, providing a unique contribution to the sustainable entrepreneurship as well as international development, media and communication literature streams.

1.1. Sustainable entrepreneurship & the triple bottom line

Especially over the past 25 years the topic of sustainability within entrepreneurship and innovation studies has gained substantial traction [3,7] due to entrepreneurship’s potential to address market failures such as environmental and social disruptions and correct negative externalities like environmental and social costs typically not accounted for in traditional cost structures [8]. Major current research streams within entrepreneurship studies are green entrepreneurship & ecopreneurship [9], sustainable entrepreneurship [3,10] and social entrepreneurship [11,12]. Each of these streams addresses a different set of domains captured by the

UN's definition of sustainable development and the SDGs [13]. This broad coverage of aspects of sustainability is reflected in the common definition of sustainable entrepreneurship as that which focuses “on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society” [10].

A common umbrella framing of sustainability—also within entrepreneurship studies—is the concept of the *Triple Bottom Line* (TBL) of economic, environmental and social sustainability [14]. Introduced by John Elkington and starting as an accounting concept in the 1990s, the TBL gained traction quickly throughout economic & business research [15–20] and practice [21]. A compelling feature of the TBL is that it frames the three concepts on par. The first one, namely the economic dimension, had always been at the center of any business and economic concerns, both in business practice and economic policy. This dimension concerns firm's economic sustainability in terms of e.g. its funding, profitability, liquidity and survival. The TBL adds to this the dimensions of social and ecological sustainability and conceptualizes them as equally important pillars, implying that all three dimensions need to be considered for the entire endeavor—be it a business or an entire economy—to be sustainable in the original and broad sense.

1.2. Sustainable entrepreneurship & the MENA Region

The MENA region [22,23] is one of the globally most vulnerable regions to environmental crises [24,25] and faces challenges on all three pillars of the Triple Bottom Line of sustainability. The MENA region is considered the “most water-stressed region on earth” [26] and is also threatened by climate change (e.g. rising sea levels & droughts), energy shortage, and water and sewage pollution [27]. This is exacerbated by poor governance, institutional fragility, and a history of conflict and inequality, leading to dwindling environmental ethics and ecological sustainability prioritization by the business sector [28]. However, while business activity and technological innovation contribute their share to environmental damage [15], they hold tremendous potential to contribute to environmental restoration and ecological sustainability [3,29,30].

While governments and large organizations are often slow and inefficient in their response to sustainability challenges, bottom-up development through entrepreneurship is a powerful vehicle to drive sustainability transitions [31–34]. With focus on ecological issues often being deprioritized in settings where humans lack the psychological safety and the resources to fulfill their more basic needs [35–37], entrepreneurship provides needed products and services as well as employment opportunities, besides fulfilling roles typically fulfilled by governments [34,38,39]. This would support individuals in challenged environments in satisfying basic personal and communal needs, enhancing their capacity to develop empathy and understanding for the needs of the whole. Also, entrepreneurs typically creatively channel and (re)allocate existing meagre resources to new purposes to solve problems through bricolage processes [40,41], enhancing circular economy practices (e.g. upcycling or reusing materials, reducing new inputs and maximizing the value per resource). They are also able to identify and seize opportunities amidst uncertainty and information scarcity [42,43]. Entrepreneurship may also facilitate collaboration between conflicting groups and promote social integration [32]. Those changes at the grassroots level may trickle up the system and facilitate cultural, political, and regulatory transformations [32,44].

This has motivated large international development organizations, as well as local governments, to focus on sustainable entrepreneurship ecosystem building in global south countries with examples from Tunisia [38], Lebanon [45], and Iraq [46]. However, academic research on

sustainable entrepreneurship is scarce outside of the global north and highly industrialized economies. For example literature reviews on the circular economy found not a single study either generated in the MENA region [47] nor addressing the region [48]. Motivations, processes, and impacts of entrepreneurship are largely shaped by the local context and they in turn shape their context [49–51]. Hence, situational and contextual analyses of MENA entrepreneurship is essential to understanding its impacts on sustainability and the ecological environment in the region.

1.3. The role of narratives

Perceptions and understandings of sustainability and its dimensions and definitions are largely impacted by local culture, history, needs, and values [1], which in turn shape the nature of emerging entrepreneurial solutions and innovation activities. Additionally, the rapid spread and far-reaching potential of today's entrepreneurial innovations and associated global north-originating narratives necessitates an understanding of their impacts on various contexts [6]. This is particularly important in lower resource, vulnerable (post-colonial) contexts which have thus far lacked sufficient research and policy attention and where innovations for ecological sustainability are urgently needed [52]. Therefore, to understand the intersections between entrepreneurship and ecological sustainability in the region, a contextualized, localized understanding of common narratives and mainstream opinions is necessary.

Media narratives reflect local culture, political systems, and mindsets which need to be taken into consideration when designing eco-oriented business & tech innovations and promoting a transition to a greener local economy [53,54]. In turn, media narratives also shape culture, mindsets, and behaviors [55–57] which may ultimately lead to change in public policy [58]. According to Markard et al. [59], “Whether a technology thrives and flourishes depends, among others, on how well it is aligned with the norms, values, and beliefs in its wider context. A technology that is well understood, compatible with established practices, socially accepted, and perhaps even endorsed by regulation, possesses a high degree of legitimacy, which is essential for resource mobilization and successful development”. Furthermore, information portrayed by news media may interact with social and culture processes in ways that alter risk perceptions of sustainability issues and strengthen existing biases, and establishing new social norms, as seen from research on narratives pertaining to climate change, plastic pollution, and sustainability as a general term [60–62]. The news media also plays a vital role in (de)legitimizing innovations in the society, as seen in an example on electric vehicles [63].

Therefore, identifying the framing of *sustainability* in predominant MENA business and technology media reporting is important to understand how emerging entrepreneurial solutions for environmental crises are perceived, understood, and used in this regional context [1,64]. Understanding media narratives surrounding sustainability in the technological innovation context indicates the legitimacy of those approaches in the MENA region and their appropriateness & impacts with respect to resolving regional eco-crises [59,65]. Additionally, such an understanding may also shed light on the relationship between the regional investment landscape and sustainability, respective support needs, mindsets, value systems, and societal trends. To our knowledge, analyses of media narratives on sustainability in MENA are virtually non-existent—with the exception of Almaghlout in 2022 [1], though research on sustainability narratives in general does exist, for instance regarding storytelling in company sustainability reporting [66] or fictional sustainability narratives in books [67].

Accordingly, this research aims to investigate the following question:

RQ1 What **narratives of sustainability in general** are addressed and discussed in relation to entrepreneurship in the MENA region?

And given the specific importance of the environmental dimension in the (ecologically) vulnerable MENA region, we also ask a second question:

RQ2 What **domains of ecological sustainability specifically** are present and dominant in the discourse on entrepreneurship within the MENA region?

To shed light on these questions, a case study was conducted based on English-language entrepreneurship news articles in the MENA region. The news articles were analyzed by means of the machine learning method of *topic modelling*—a text mining and clustering technique based on semantic word correlations (see section 2.2)—in combination with a qualitative analysis of the resulting material.

2. Methodology

To understand the narratives surrounding “sustainability” in general and ecological sustainability specifically in the MENA region, we analyze media content from articles from the largest entrepreneurship news outlet in the MENA region, www.wamda.com. The platform features all articles in both Arabic and English languages, and the English language content was chosen for analysis. Wamda was founded in 2010 [68] and has the self-stated mission to “accelerate entrepreneurship ecosystems across the Middle East and North Africa region” [69]. The platform comprises its own venture capital fund, fellowship programs, startup events and a publishing section called “Thought Leadership” that features opinion pieces and research articles by Wamda authors as well as industry experts. The sum of articles under “Thought Leadership” is the foundation of the analysis in this research. These articles cover the timespan from March 2013 –the first published article–to December 2021 –the last article included in this analysis. The articles were extracted via web scraping and analyzed by means of topic modelling.

2.1. Data collection & preparation

The news articles were web-scraped by means of an automation coded in Python and accessing the website via the Python library Selenium. In a first run, titles, authors, author-generated tags, region tags and publishing date were scraped from the 278 pages within “Thought Leadership”, each of which containing 16 articles, i.e. 4448 articles in total. In a second run, the full texts of all articles were scraped, matched, and merged with the dataset. In the process, 206 full texts (4,6%) could not be retrieved; their full texts were hence omitted in the subsequent analysis, resulting in a final dataset of 4242 full-text articles.

Subsequently, for each of the two research questions, the articles were filtered differently: For research question 1) on the general narratives of *sustainability* in general, all full texts were searched for the occurrence of “sustainab*” as to include variations of the term. All 486 out of 4242 articles (11,5%) that included the search term at least once, were considered in the subsequent analysis (Fig 1).

For research question 2) on *eco-sustainability* specifically, the process involved a more rigorous screening with the aim of capturing as many articles as possible that address ecological sustainability: A first screening step involved article tags: Most articles contain up to 3 author-generated tags. All articles contained in total 3933 unique tags, all of which were manually screened for any potential relation to ecological sustainability. 63 such tags were identified and included, for example “ecosystem”, “cleantech”, “green” and “solar”. All articles matching any of the 63 tags *and* all articles containing the term “sustainab*” in their full text were considered for further manual screening.

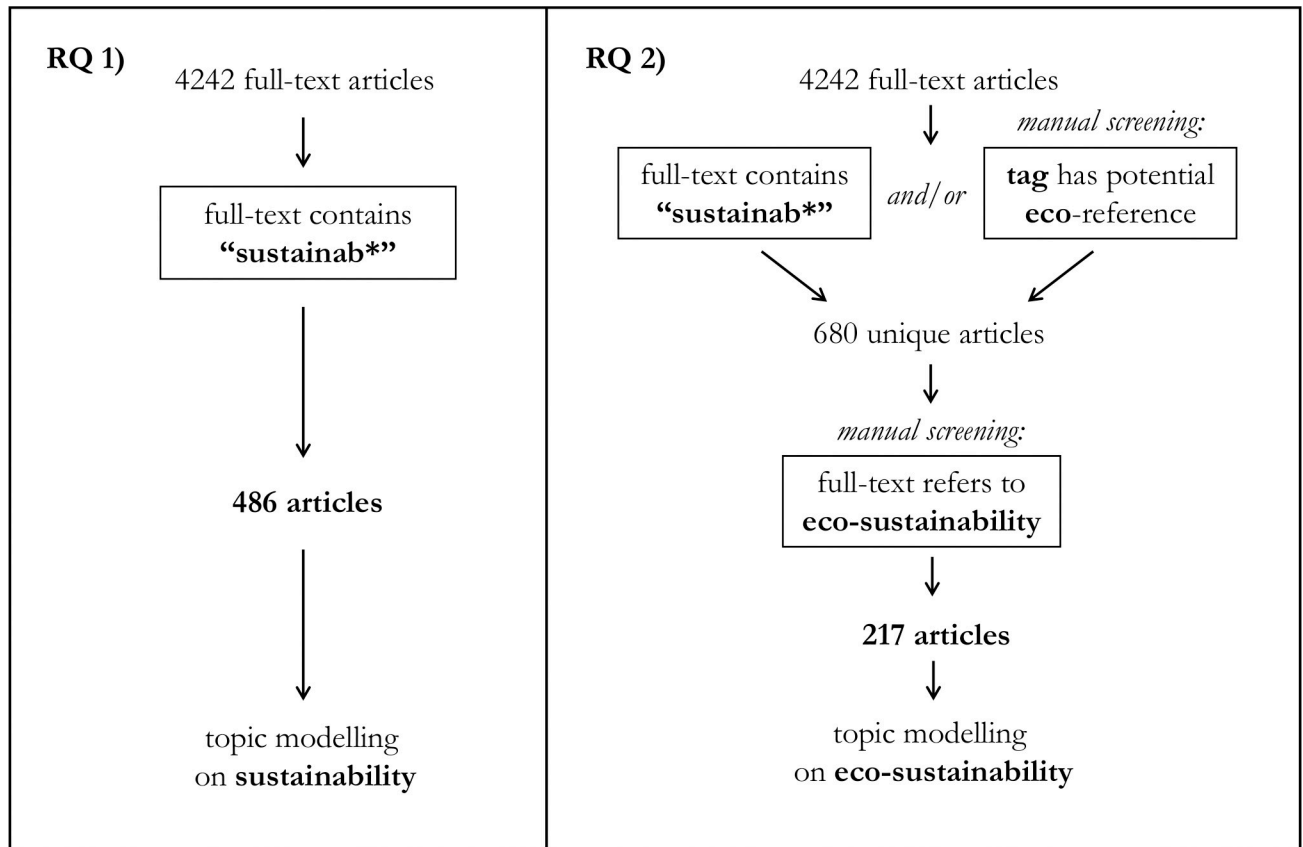


Fig 1. Filtering process for "sustainability" (RQ1) and eco-sustainability (RQ2) articles respectively.

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These two filters resulted in 680 unique articles (i.e.: duplicates omitted). In a second step these articles were manually screened for whether they actually addressed a matter of ecological sustainability at any point within the text. This was deemed the case when an article not only mentioned an innovation or initiative contributing to ecological sustainability, but when that innovation or initiative was explicitly framed in terms of its ecological impact as opposed to merely an economic or business opportunity. 217 articles (out of 4242, i.e. 5.1%) were identified and thus used for the subsequent investigation of research question 2 (Fig 1).

2.2. Topic modelling

The resulting datasets of 486 and 217 full-text articles for *sustainability* and *eco-sustainability* respectively were the basis for a separate Latent Dirichlet Allocation (LDA) topic modelling process. Probabilistic topic modelling algorithms like LDA are statistical tools to compare the vocabulary of texts and to uncover patterns of co-occurrences of words [70,71]. Topic modelling is an unsupervised machine learning technique, which means there are no pre-determined topics or categories; instead, they only emerge from the statistically identified co-occurrences of words. These clusters of co-occurring words define topics to which each word contributes with a certain weight. In turn, each document (i.e.: article) analyzed can comprise of various topics with a certain weight, so that each topic is represented in a number of most relevant documents. It is a relatively new approach in business research [72,73] though it is more established in the life sciences when handling massive data quantities[74,75], but has been proven a

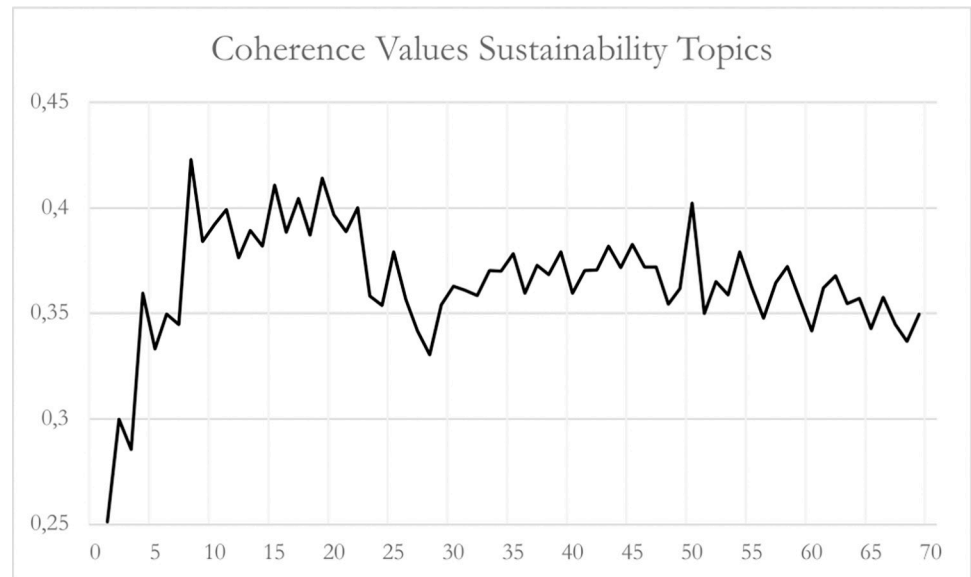


Fig 2. Coherence values across Topic Models by number of topics for “sustainab*” articles. 50 topics yielded the most meaningful outcome.

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useful approach for the categorization and mass analysis of media articles [55,57], also in the context of sustainability narratives [63,76–79].

Although several topic modeling approaches exist, such as Latent Semantic Analysis (LSA), Top2Vec, and BERTopic, we chose LDA for several reasons. Firstly, it was experimentally shown to have better performance in comparison with LSA in terms of topic coherence measurement [80]. Additionally, the Top2Vec and BERTopic methods were generally shown to produce a large number of topics and are therefore more suitable for larger dataset [81]. In preparation of the topic modelling, the full-texts went through several steps of pre-processing to prepare them for the subsequent LDA application: making all words lower-case, removing digits, formatting and punctuation, removing standard stopwords using the NLTK library (“Natural Language Toolkit” to be found [here](#)), creating bi- and tri-grams, removing all words that are not nouns or adjectives and subsequently lemmatizing words, i.e. reducing them to their stem or basic form as to make equal all grammatical variations of a word (e.g. turn “entrepreneurship”, “entrepreneurial” and “entrepreneur” all into “entrepreneur”) [82]. LDA topic models were generated using the Gensim library for Python.

The most important determinant of a topic model is the number of topics to be generated. To establish the best number of topics, for both data-sets models with 1 to 70 topics were generated. For each model the value of topic coherence was established [83,84] and graphed across the number of topics (see Figs 2 and 3). The Alpha & Beta parameters were left at their standard settings of $1/\text{#topics}$ and 0.1 respectively [63,85]. A comparison of the coherence measure across a wide range of Alpha & Beta values confirmed these to yield the best results while there was also no visible difference when inspecting the topics and keywords. For the topic modelling of “sustainab*” articles (RQ1), high coherence was found between 7 and 23 topics, and another peak at 50 topics. A manual qualitative inspection of these highest-ranking models and their respective keyword clusters was conducted to find the model leading to the most promising semantic resolution and most clearly defined topics. A model with 50 topics lead to keyword-clusters that revealed the best definition among the most represented topics and was therefore picked to best represent the data body’s topical landscape. For the modelling of “eco-

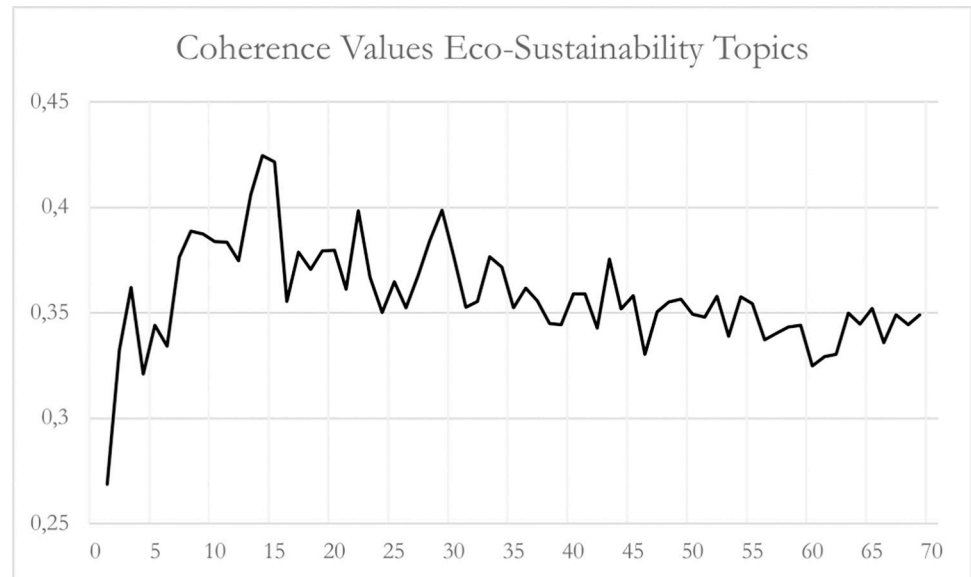


Fig 3. Coherence values across Topic Models by number of topics for eco-sustainability articles. 29 Topics yielded the most meaningful outcome.

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sustainability” articles, models with 14, 22 and 29 topics respectively yielded the highest coherence value. Also here, the highest number of topics among these three options yielded the best semantic resolution as it presented more clearly distinct keyword clusters around the overarching topic of ecological sustainability: The model with 29 topics was chosen for further analysis.

For both topic models the top 10 keywords contributing to each topic were identified, as well as the top 10 documents most represented by that topic. That way, at a later stage each topic could be interpreted both based on their most co-occurring keywords and the context of the articles containing the topic and its keywords.

Subsequently, topics represented by less than 3 documents (i.e. news articles) were entirely dropped, as well as topics whose keyword clusters qualitatively did not point in any coherent direction. Those undefined topics were found mostly among those that consisted of only very few documents and had keywords with relatively low representation in the data body. The evaluation of topic meaningfulness was facilitated by topic model visualizations using the PyViz package (to be found [here](#)) that revealed both the closeness to other topics, and allowed a deeper dive into all keywords of a cluster. The elimination process resulted in 31 meaningful topics left for “sustainab*” articles (RQ1) and 13 remaining topics for eco-sustainability articles (RQ2).

2.3. Coding of documents & topics

For all topics identified by the two topic models, the respective keywords were screened to identify a meaningful title for the topic and omit those keywords that do not bear value for its interpretation. The coding for both datasets was conducted differently: For the “sustainab*” dataset (RQ1), each of the top 10 documents was coded according to which of the three triple bottom line dimensions—economic (“Econ”), green (“Gre”) or social (“Soc”)—it addresses. The ecological component was labeled “green” to distinguish it orthographically more clearly from “economic”. Documents could also address more than one dimension, i.e. receive more than

one label. When there was no clear reference to either dimension—e.g. because the term “sustainability” was used too vaguely or in a context other than the TBL dimensions—it was given the label “undefined” (“Und”). The labeling was based on both the specific use of the word “sustainab*” in the document, as well as other references to sustainability in terms of the TBL. To minimize a bias in the interpretation of the respective context, the coding was conducted by two researchers individually and successfully checked for inter-coder reliability.

For the interpretation of the “eco-sustainability” dataset (RQ2), an inductive coding approach was employed. Already in the preceding article selection, it was made sure that all articles concern the domain of *ecological* sustainability. What further possible categorizations would emerge from the data was to be explored by both inspecting each topic’s keywords as well as the associated documents.

3. Results

The unfiltered dataset of 4242 news articles—i.e. not yet filtered for sustainability or eco-sustainability—spans the almost 10 years from the 19th of March 2013 until the 25th of February 2022. Many articles contained a “country” tag indicating the country or region on which it reports (see Fig 4). 31,1% of articles did not contain a geographical tag. Among those articles with a geographical tag, 45,4% refer to not just one specific country, but address matters on a country-spanning level, i.e. either “Global”, “Regional” or more specifically “Maghreb”. Beyond that, the most represented countries are the United Arab Emirate (U.A.E.) (14,3%), Egypt (9,8%), Lebanon (8,0%) and Saudia Arabia (6,3%).

3.1. Sustainability: Topic model & coding

The topic model for all news articles including the term “sustainab*” yielded 31 meaningful topics. In total the topics had 266 document references (up to 10 documents per topic) of which some documents may have been associated with multiple topics. In 22 of those 266 (8,2%) cases, the sustainability reference in the associated document was coded as “undefined” (“Und”) as the term “sustainab*” was not used in the sense of any of the three Triple Bottom Line (TBL) categories. In 48 cases (26,3%), a document received labels for two out of the three TBL categories. The dimension labels for economic, ecological, and social sustainability were applied to documents 178 (66,9%), 70 (26,3%) and 47 (17,6%) times respectively. Based on the ratio of the three dimensions occurrence in each topics’ (up to) top 10 documents in combination with the associated documents’ topic, a “Triple Bottom Line focus” label was given to state which dimensions were dominant. The results of this coding process across topics are listed in Fig 5 (a visualization can be found in S1 Appendix).

The topics identified in the articles cover a wide range of domains. Firstly, several topics represent a rather general discourse of sustainability on a rather macro scale. E.g. topics relate to the broader economy with differing angles such as general trends (T3), examples of entrepreneurship put into a broader context (T1), the societal role of social entrepreneurship initiatives (T2), a macro-economic view (T4), a perspective on the (impact) investment scene (T8) or international affairs & foreign investment (T13). Other topics spell out specific industries, markets, innovations or societal domains addressed by the entrepreneurial activity, such as smart-cities/living (T5), e-commerce (T6, T12), renewable energy (T11), education (T14, T17), automobile & car sharing (T23), health-tech (T16) and more. In some instances, one domain is reflected with a different focus: E.g. “education” is addressed alongside gamification and modern media (T14) and with a focus on refugee education (T17) (similarly e-commerce: T6 & T12).

Country tag	% of articles	% of tagged articles
no tag	31,1%	
"Regional"	19,6%	28,5%
U.A.E.	9,9%	14,3%
"Global"	8,0%	11,6%
Egypt	6,8%	9,8%
Lebanon	5,5%	8,0%
Saudi Arabia	4,4%	6,3%
Jordan	3,8%	5,5%
"Maghreb"	3,7%	5,3%
Palestine	1,5%	2,2%
Kuwait	1,5%	2,1%
Others (<1%)	4,4%	6,4%

Fig 4. Table: Percentage of news articles by country tag.

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3.1.1. The dominance of economic sustainability

Looking at the coding results, interesting patterns emerge. A first and major observation is that the economic dimension of the triple bottom line (TBL) dominates the discourse. Almost every topic has a very strong economic component indicating that most of the time and across most topics, sustainability is at least partly and often dominantly framed in terms of economic prosperity or survival of businesses or the economy. This is in line with the above-quoted 67% of TBL-labels being “Econ”. Among the top-10 topics, in 6 cases of “sustainability” articles, the economic dimension is clearly the most represented. This holds for the macro-topics T1, T3, T4 as well as for e-commerce (T6), fashion (T9) and impact investment (T8). Overall in 25 out of the 31 topics, the economic component is dominant or strongly represented alongside the two other dimensions. Typical uses of “sustainability” in economic terms are for example in the broad topic 1 “*Despite their [delivery services] growth, the model has been called out for being unsustainable, especially since many charge little or sometimes nothing for delivery, the costliest part of the chain.*” (T1) or “*. . .we realized we need money to advertise. but paid ads are not sustainable. many startups get money from investors to spend on google ads.*” (T1).

Some topics cover domains that are usually intuitively associated with the non-economic dimensions of social or ecological (“green”) entrepreneurship and sustainability. Also in many

Topic #	Representative keywords	Topic title	Triple Bottom Line				TBL focus
			Econ	Ecol	Soc	Und	
T1	company startup business market people year investment	General: Entrepreneurs & specific initiatives	10	1	0	0	economic
T2	entrepreneur social project program event idea woman community	Social entrepreneurship: macro views & examples	5	0	7	0	social (economic)
T3	business innovation market company technology growth global economic	Broader economy, entrepreneurship focus	9	0	0	1	economic
T4	government startup country sector ecosystem economy fund bank sme	Economy news, national focus	8	0	1	2	economic
T5	city project people space lab smart building	Smart cities & living, urban development	1	2	3	4	undefined
T6	user medium platform content online video digital app website	Social media & e-commerce	9	0	1	0	economic
T7	product system waste material use recycling	Circular economy/principles, material use, waste utilization	5	8	1	0	green (economic)
T8	investment impact region fund social entrepreneur	Impact/ethical investment, social entrepreneurship	9	0	6	1	economic (social)
T9	team fashion brand designer business competition feedback	fashion industry (weak definition)	6	2	1	2	economic
T10	technology innovation food restaurant government	food industry (weak definition)	4	2	4	1	mixed
T11	energy solar water electricity power environmental plant	renewable/clean energy, esp. solar	6	8	0	0	economic (green)
T12	customer product online ecommerce service brand payment sale store	e-commerce	8	0	0	2	economic
T13	percent cost company business uac fee	foreign investment, international affairs	7	3	0	1	economic (green)
T14	student teacher education school university online course class	ed-tech, digital/online education, gaming	6	0	3	3	economic (social)
T15	game developer volunteer gaming agile lean software	gaming, entertainment, music & arts	7	2	0	1	economic
T16	health healthcare doctor medical patient disease digital hospital	healthcare, health-tech	7	0	4	0	economic (social)
T17	refugee assistance emergency userbase language respondent	education & ed. for refugees	8	1	6	0	economic (social)
T18	space tech freelancer blog political talented vibrant	aerospace technology, co-working (weak definition; "space")	3	7	0	1	green (economic)
T19	machine scientific hardware engineering manufacturing printing	tech & hardware, advanced manufacturing & engineering	5	5	0	1	green & economic
T20	pakistan venture beach fruit capital agriculture truck	Pakistani economy (weak definition)	7	4	1	1	economic (green)
T21	music apple producer scene riyadh independentrock	music industry & music streaming	7	3	0	0	economic (green)
T22	podcast fellowship literacy audiobook genderequality reading	podcasts, audiobooks & ed tech	7	2	3	1	economic (social)
T23	car rental sharing station road taxis	automobile industry, car sharing	7	7	0	0	green & economic
T24	bitcoin blockchain election certification verification currency digitisation	bitcoin & blockchain (weak definition)	5	1	1	0	economic
T25	green cell residential advocate climatechange	ecological sustainability projects	3	10	0	0	green
T26	girl booth fitness cosmetic birth body beauty makeup skincare	female-associated topics/products/innovations	5	1	1	0	economic
T27	influencer creator content youtube tiktok subscriber placement	social media & influencer	3	0	0	0	economic
T28	silver mobilephone ewaste electronic recycler aluminium contaminate copper	materials in electronics	1	2	1	0	green
T29	micromobility escooter cycling adoption	micromobility	2	1	1	0	economic
T30	merchant spend catalogue instalment paypal creditcard	commerce	5	1	1	0	economic
T31	publisher journalist reader podcast wanda content language	journalism	3	0	0	0	economic

Fig 5. Table: Topic Model result & coding of “sustainab*” articles. Triple bottom line: number among top 10 documents that addresses Economic (Econ), Green (Gre), Social (Soc) sustainability or remains undefined (Und).

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of those cases the economic dimension is strongly represented. For example, the topics of circular economy (T7) and renewable energies (T11) contain a strong economic component among their top-10 articles (5 and 6 labels vs. 8 for “green”). Instances of this economic view within those topics are e.g. “*innovation champions are harnessing the potential of abundant data to fuel a revolving cycle of sustainable growth*” (T7) and “*Ensuring a high level of quality projects is critical for industry sustainability.*” (T11). An example within the topic of social entrepreneurship is (T2) is “. . .stakeholders also agreed that Tunisia should learn to be self-sustainable rather than rely on foreign aid”.

Similarly, the results show that topics that are commonly *not* inherently associated with either social or ecological sustainability—while being subject to severe social and ecological challenges—are also among those Wamda articles indeed discussed rather with economic sustainability in mind as opposed to framing them in social or ecological terms. For example the term “sustainability” is used in relation with the fashion industry (T9), social media and e-commerce (T6 & T12), the music industry (T21) and blockchain technology (T24) and predominantly refers to the economic sustainability of the associated entrepreneurial activity. For example in the fashion domain(T9): *“to achieve sustainable profitability, a small startup brand needs to have the right people wearing them”* or regarding the music industry (T21) *“investors will need to [...] add value [...] by helping these startups to build robust organisations that are sustainable and able to generate returns to shareholders and everyone involved, including the employees and founders.”*

3.1.2. Ecological & social focus

Among several topics either the social or ecological dimension strongly define the discourse: The second-biggest topic, social entrepreneurship (T2), is indeed strongly framed in terms of social sustainability (labeled 7x social and 5x economic). Often the interpretation of the term depends on the general direction of the paragraph surrounding it. For example in some cases the term is used in combination with the concept of “sustainable development” without mentioning e.g. a specific SDG, but the context implies that “sustainability” refers to social prosperity (in T2, social entrepreneurship). For example *“Enactus [...] works to support youth entrepreneurship and sustainable development.”* goes on addressing a startup competition that focusses on solutions to social and societal issues. A similarly context-dependent case for social sustainability can be found for example in topic 17 on education for refugees: *“The one-on-one conversations allow for more awareness on refugee conditions and helps individuals understand how to better welcome refugees in their respective countries through sustainable solutions”*.

Two other topics that contain a comparatively strong social component are health-tech (T17) and ethical/impact investing (T8). A common theme in health-care (T17) related articles is the improvement of quality of life as reflected for example in the statement *“healthcare is likely to revolve around sustaining wellbeing rather than reacting to illness.”*, although in some cases the reference is less explicit: for example the statement *“There must be affordable health-care and there must be jobs in order to sustain the growth of the population.”* is embedded in a broader context of quality of life in the face of growing populations and demand. Interesting is the case of impact investing (T8): while “impact” could commonly be understood as either social or ecological, articles in this domain do not refer to ecological solutions at all, but rather address entrepreneurial activity that aims for the improvement of life to certain groups or whole societies. In some cases the focus on social sustainability in impact investment (T8) is very explicit: *“these startups must be ethical, have a social impact and operate within the united nations sustainable development goals”*. In other cases the social reference is more implicit as articles refer to “ethical investing” without further elaboration but alongside with topics and solutions addressing e.g. diversity and equality and quality of life. All articles in the impact investment cluster (T8) however refer to economic sustainability that clearly dominates the framing.

There is a similar contextual dependance regarding the ecological framing of sustainability. For example in topic 11 on solar & renewable energies, the context around the term “sustainable energy” often associates it *not* with economic survival but rather the use of natural and renewable resources—a likely implication being that they allow for an energy consumption that can be sustained also for future generations and with a low environmental footprint. For

example an article states “Ahmad Gaber, [. . .] a longtime expert in sustainability, said biomass was one area yet to be explored in Egypt.” which succeeds a list of renewable energy measures that explicitly emphasizes their environmental benefits. More explicitly, an article about a solar startup states that “they then applied to Ford’s conservation & environmental sustainability grants” which clearly frames the startup initiative in the context of ecological solutions. In two topics, the economic and green dimensions were on par: hardware & advanced manufacturing (T19) and the automotive industry & car sharing (T23). The latter being discussed both in terms of the sustainability of e.g. modern car sharing business models as well as the potential benefits they have for the environment in terms of an overall reduced CO2 emission as well as the health in cities.

The discussion of the former—hardware & advanced manufacturing (T19)—is well represented in this statement: “. . .it is not just efficiency that might propel the industry’s growth. Prior to the pandemic, the biggest issue that affected the world was climate change and sustainability. Much of the world’s governments had committed to reducing their carbon emissions while startup and investor focus had shifted to sustainable and impactful innovation.” Here both the economic and the ecological dimension of sustainability are addressed: Efficiency gains through innovative technology is seen as contributing both to economic growth of an industry and being in line with environmental goals as set both by political and private actors. Interestingly, the statement differentiates between a pre- and post-Covid19 pandemic situation.

One topic identified concerns very explicitly ecological sustainability projects (T25) with several articles listing green-tech startups and initiatives like for example local solar power generators or water level sensors for flood-plagued regions. Not surprisingly all top10-articles associated with this topic address the ecological dimension of sustainability while some also include the economic framing.

3.1.3. Unspecific TBL focus

Two topics stand out with a particular absence of focus in terms of TBL dimensions, in very different ways: food-industry (T10) and smart cities & living (T5). On the one hand the topic on the food-industry (T10) lacks this focus by addressing all three dimensions to a similar extent. Here, the ecological dimension is addressed mostly in terms of the inefficiency of food-waste implicitly along with the needless consumption of resources & emissions. The social dimension of food is addressed for example in relation with humanitarian aid to hunger-ridden people and regions. In contrast, topic 5 on smart cities & living is very well defined as most of its top10 articles very explicitly address that one domain. The topic’s TBL focus is rather weak, too, but in a different way: the term sustainability in relation with cities is often used very vaguely. Its context often describes how cities become smarter, more modern and connected, but the sustainability implications remain unspecific. This is exemplified by statements like “. . .organizing and regulating urban initiatives to ensure sustainability is crucial for a positive change.” or the slightly more suggestive statement “a smart city is one that relies on telecommunications to provide its services and infrastructure, with the aim of improving economic growth, sustainability and a better quality of life.” Overall, in the smart-cities topic, many progressive concepts are presented but not framed in terms of their specific sustainability purpose.

3.2. A Zoom-in on ecological Narratives: Topic model & coding

The topic model for all Wamda news articles that referred particularly to ecological sustainability yielded 12 meaningful topics with each having at least 3 associated documents (i.e. news articles) as listed in Fig 6. All 12 topics contained 10 top10 articles, except for urban mobility

Topic#	Representative keywords	Topic title	Conceptual level
T1	entrepreneur business startup company project social development	summaries, trends & role of eco-sust.	macro-view
T2	energy solar power electricity water technology	renewable & decentralized energy	innovations/products
T3	program community social lab workshop impact csr game	societal & entrepr. education	facilitation
T4	waste recycling oil machine material truck	waste treatment, circular principles	innovations/products
T5	event idea local attendee people	incubation, acceleration, networking, inspiration	facilitation
T6	space event entrepreneur startup office work room hub workshop lab	co-working, incubators	facilitation
T7	gas oil requirement firm technology	eco-entr. trends & innovations	macro-view
T8	fashion designer fund online brand	sust. fashion, lifestyle	innovations/products
T9	food raw local fruit smallscale conscious water	food production, consumption & waste	innovations/products
T10	woman palestinian refugee volunteer handmade cosmetic product	female & refugee entrepr., female-associated products	innovations/products
T11	transport bike cycling carpooling micromobility scooter city road	urban mobility	innovations/products
T12	circulareconomy emotional desolator recycle circular premium	Circular economy/principles, macro-view & examples	innovations/products

Fig 6. Table: Topic Model result & coding of eco-sustainability articles. 3 conceptual levels.

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(T11) with just 9 associated articles. The topic keywords alone already suggested mostly very clear-cut semantic domains that could be confirmed by reviewing their associated articles. Upon closer inspection, the LDA-generated topics revealed a pattern of addressing ecological sustainability and entrepreneurship on different levels: On the one hand, 7 topics explicitly address particular domains of ecological sustainability or innovations, namely: renewable energies (T2), waste management (T4), fashion & lifestyle (T8), food industry (T9), female & refugee entrepreneurship (10), urban mobility (T11), circular economy (T12).

Next to those 7 topics, 5 topics did not contain a reference to any dominant domain, but represent broader perspectives: Topics 1 & 7 contain articles that look at ecological economy and entrepreneurship through a macro-lense by describing general eco-trends and the role of ecological sustainability in entrepreneurship and the MENA economy as a whole. Often, they list a few startups or initiatives—similar to the 7 above-mentioned topics—but frame them in the larger context of economic developments. Furthermore, topics 3, 5 & 6 are tied to neither specific ecological domains nor address the macro-perspective, but instead describe important facilitating functions within entrepreneurial eco-systems, like entrepreneurship-education, incubation, acceleration and networking. Consequently, by induction, we identified three

different conceptual levels that we frame within the dichotomy of a macro-, meso- and micro-level:

- **1) macro-level:** ecological trends in entrepreneurship and the economy (T1 & T7)
- **2) meso-level:** the role of the entrepreneurship eco-system for ecological activity & innovation (T3, T5 & T6)
- **3) micro-level:** specific entrepreneurial initiatives within confined ecological domains. (T2, T4 & T8-T12)

3.2.1. Macro-level: trends & summaries

The nature of the two macro-topics is well represented already within the titles of their associated articles. For example within topic 1: *“MENA social enterprises grow in spite of deep-rooted challenges and little support”*. The article refers to “social” not within the triple bottom line dichotomy but uses it more broadly, addressing matters of *“education, health care and the environment”* and describes some findings of an international MENA report. Similarly, the article titled *“Changing MENA with the ‘sharing economy’”* addresses the broad trend of the sharing economy, touching upon various domains such as shared mobility and shared spaces as well as addressing MENA’s stage of the sharing economy in comparison to Europe. In contrast to topic 1, the second macro-topic (T7) devotes some articles to specific startups or industries, but always frames them in a wider context. For example, several specific startups are mentioned in the article titled *“Middle Eastern environmental startups get on the right side of the green line”* but contextualized within a general trend towards more ecological entrepreneurship as already clarified with its opening line: *“In recent years, the tech sector around the world has come to recognize the importance, the urgent necessity even, of going green.”* And going on about such trends in the MENA region. Another headline exemplifying this contextualized look at specific start-ups in topic 7 is: *“Startup watch: How to save your job from a robot, bringing back the cubicle, and meatless shawarma”*—an article addressing broader trends with specific examples.

3.2.2. Meso-level: entrepreneurship eco-system

The meso-level is represented in 3 topics: societal & entrepreneurial education (T3) and two very closely related topics addressing acceleration, incubation, coworking and networking (T5 & T6). Topic 3 on societal & entrepreneurial education covers both education programs for kids and students as well as for entrepreneurs. The article titled *“Intel’s Inara initiative to engage Egyptian youth”* describes an educational initiative to students that has broad goals like generally improving skills and preparing young students for a successful career, but also frames this in terms of raising a generation that is ready to tackle current and future environmental challenges, hence *facilitating* ecological transformation. Similarly, the article titled *“Morocco’s Eiréné4Impact in the push for social entrepreneurs”* describes an initiative that aims to educate entrepreneurs to incorporate the social and environmental dimension of sustainability into their activities. As in the case of the above-mentioned macro-view article, the term “social” in this article refers to the environmental dimension, too.

Topics 5 and 6 are very similar, addressing acceleration, incubation, co- and networking, with topic 5 including a focus on entrepreneurship events and topic 6 more dominantly addressing the topic of co-working spaces. Where events and co-working are addressed, there is a strong focus on the element of exchange, networking, and mutual inspiration among

entrepreneurs. This is exemplified by statements like “*In order to build a community that could foster creativity and innovation, Biaz launched the space to offer three elements: the co-working space itself, an event series, and labs.*” or the quote of the founder of a co-working space that is explicitly dedicated to social and ecological innovations: “*We view Cogite as a home for impact-driven individuals and organizations in Tunisia. It is a community in the truest sense, where exciting social innovation projects are co-created for high impact.*”. Overall, articles of the topics 3, 5 & 6 mention very specific examples and even lists of co-working spaces and specific educational initiatives, i.e. initiatives that foster learning and exchange. Most of them either explicitly or more implicitly frame these initiatives as factors that facilitate or accelerate a transformation towards more sustainable and ecological entrepreneurship and ultimately economy & society. In that sense these topics address elements that *moderate* sustainable transformation.

3.2.3. Micro-level: ecological domains & entrepreneurial initiatives

Subject of this moderation by education and exchange are individual entrepreneurs and startups that address specific domains of ecological challenges and innovations. Those domains are addressed within the seven topics 2, 4 and 8 through 12. The two biggest topics (i.e.: most represented in the corpus and ranked highest in the list) are renewable energy (T2) and waste treatment & circular principles (T4). Interestingly, these two were also the two highest ranked “ecological” labeled topics within the topic model on general “sustainability”. Among the top10 articles in the renewable energy topic (T2), 4 articles address solar energy, 2 address wind energy, 3 address general developments in renewable energy. One article addresses hydro-energy, however in European startups (UK, France, Austria). Within the topic of waste management (T4), 5 articles address general problems and innovative solutions to household and other waste, 2 address specifically e-waste recycling solutions, and 3 articles address bio-fuels or fuels generated from waste. All 10 articles acknowledge severe problems with waste management in the MENA regions and some include comparisons with other regions like Europe (e.g. waste per capita). Topics 8 through 12 address further markets and domains with ecological innovations and solutions. Articles in the fashion topic (T8) address ecological challenges of the industry like textile waste, chemical pollution and energy consumption.

Some address more general trends in the industry, while others portray specific startups; for example a data-startup that allows supply chain monitoring and certification by sustainability standards, or a startup producing garment from bamboo as a renewable and biodegradable resource. While topic 9 on the food industry lacks some definition, it does address multiple stages of the supply- and consumption-chain, namely both food production-like smart and resource efficient farming-food consumption of more plant-based alternatives to meat and the mitigation of food waste. Articles within topic 10 on female & refugee entrepreneurship are somewhat eclectic, but fall into the categories of typically female-associated products like cosmetics and fashion items and their female founders, initiatives aimed at equality and female inclusion in entrepreneurship, and entrepreneurship by and for refugees. These articles likely fall into one LDA-identified topic because several of them address within the same article different social and ecological startups, including either female or refugee focused ones. The articles under the topic of urban mobility (T11) revolve around micro-mobility like (e-)bikes and scooters (3 articles), car- & ridesharing (3 articles), greener shipping (2 articles). The final topic labeled circular economy & principles (T12) is somewhat eclectic. It subsumes several topics commonly associated with ecological progress, most of which can be framed within the concept of the circular economy like: the circular economy as such, use of renewable resource like solar energy for desalination of water or rooftop-farming, more ecological use of cars, and waste management.

4. Discussion

Our first research question (RQ1) asked what *narratives of sustainability in general* are being addressed in relation to entrepreneurship in the MENA region. The topic modelling and the inspection of articles within our case study makes several suggestions: Most strikingly, almost all generated topics were framed either dominantly or at least strongly in terms of economic value of enterprises or economies, funding or sustained firm-survival. This holds for topics with a macro-perspective, but also entrepreneurial domains and innovations that are often associated with either social or ecological impact—like renewable energy, impact investing, education, and circular economy. At the same time, several industries that are known to induce tremendous challenges to social and ecological sustainability, too, are represented with a dominant economic focus—such as the fashion industry, e-commerce, social media and blockchain technology. Those domains sparsely contain references to the social or ecological dimension, suggesting that MENA’s social or ecological initiatives in these domains are in practice either rare or overlooked in the media discourse.

On the one hand, this strong presence of the economic dimension in “sustainability” seems surprising given the dimensions of economic, ecological and social sustainability in the framework of the triple bottom line (TBL) are considered equally important. On the other hand, the economic component has always been the entrepreneurial doctrine and *raison-d’être* for entrepreneurial initiatives, while the other two dimensions only seeped into the economic discourse throughout the 20th century, e.g. in the 1970s (Club of Rome, “The Limits to Growth”) the 1980s [2], 1990s [14], culminating in the more recent research streams on sustainable entrepreneurship and the popularization of the topic in practice and public discourse. Therefore, the media framing of sustainability in terms of financial growth may align with traditional narratives on the primary role of business as an agent for financial growth, using the term sustainability to indicate business longevity and persistence rather than the TBL. This may also align with the traditional view of socially oriented entrepreneurship as being embedded in a non-profit perception [86]. Nevertheless, this strong focus on economic sustainability in media narratives may perpetuate social norms and perceptions of entrepreneurship and innovation as being primarily drivers for financial rather than socioecological prosperity, potentially hindering the implementation of inclusively sustainable entrepreneurship initiatives in the region.

There may be several MENA-specific explanations for the dominance of the economic dimension: Firstly, many Arab and North African countries are either active or recovering conflict areas with fragile institutions, high levels of poverty, inequality, and uncertainty. This may promote disengagement from environmental values among entrepreneurs [87,88]: Since environmental sustainability may be perceived as resource-consuming, entrepreneurs in an environment of scarcity and uncertainty may focus on generating those economic resources in the first place, deprioritizing environmental or social issues in the process [36]. Additionally, many MENA countries face systematic challenges related to recovery from conflict or political uprisings (e.g. Egypt, Tunisia, and Palestine), refugee influxes (e.g. Lebanon and Jordan), and economic crises whose complex roots go in part back to colonial influences [89]. Hence, national security and economic revival are likely to take priority over environmental concerns [90,91], while externalizing the responsibility of mitigating environmental damage to more stable economies in the global north. Nevertheless, our data shows that MENA countries with more stable and rich fossil fuel-based economies (e.g. Saudi Arabia and the UAE) seem to have recognized the economic unsustainability of their prosperity and are beginning to re-orient their economies to new sources of revenue in the shape of gigantic innovation and

development projects and a refocus on their renewable energy resources—however primarily under the pretense of economic survival [92–94].

Thirdly, an optimistic interpretation of the strong presence of the economic dimension in MENA’s sustainable entrepreneurship discourse is that even domains typically associated with ecological and social sustainability (e.g. renewable energy, circular economy, refugee entrepreneurship etc.) are not framed merely by philanthropic motivation. Instead, they may be seen as not only reconcilable with economic survival, but as a manifestation of financial opportunities to entrepreneurs [95]. This may signal a “doing well by doing good” approach. Finally, it may be that socially and ecologically inclined entrepreneurs in the MENA region may primarily adopt sustainability practices while doing business as usual rather than develop business models that directly address sustainability issues, which further explains the economic focus. However, empirical research through questionnaires and in-depth interviews is needed to explain the predominance of the economic dimension in the MENA context beyond our theoretical speculations.

In many cases the term “sustainability” is used quite vaguely, which is in line with its reputation as a business buzzword [1]. This is most obvious in the domain of smart cities and urban development—a domain that both spans a vast range of topics, disciplines and challenges and is very close to the day-to-day reality of the urban population. The articles associated with the topic address many technologies and innovations that are meant to transform cities but often lack specificity regarding the sustainability contribution they make, be it economic, ecological or social, almost as if progress bore value in itself without further explanation.

When looking at *narratives of ecological sustainability specifically (RQ2)*, the two most present topics—renewable energy & waste management—stand representative for the region, and also represent two different takes on sustainability. On the one hand as an *opportunity*, namely renewable energies—especially solar and wind of which the MENA region is very rich and that promise to supersede the fading status quo of fossil resources that brought tremendous wealth to the region [92–94]. The other of the two—waste management—addresses a specific sustainability *challenge* dominating the region: waste treatment. The associated articles portrait many startups and initiatives tackling this problem, in many cases combined with the opportunity for value generation through recycling or fuel from waste. This can be seen as an example for the private sector providing bottom-up ecological and social innovation and filling institutional voids where governments fail to provide solutions [34]. Surprisingly, MENA’s other urgent environmental challenge finds hardly any representation in a specific topic: water scarcity and droughts [96]. This may be due to the large geographic scale of the problem that makes it less suitable for individual entrepreneurial solutions, except for desalination innovations that find the occasional mention, especially under the circular economy umbrella.

The meso-level perspective on ecological entrepreneurship addresses the facilitating features of the regional entrepreneurship eco-system: articles specifically address co-working spaces and incubators as hubs for functional exchange and mutual inspiration and other synergies between individual entrepreneurs and startups. On the other hand, the discourse addresses educational initiatives with the aim of fostering ecological innovation and future-proofing a young generation of both students and entrepreneurs, and thereby society. This meso-level can be seen as moderating individual entrepreneurial initiatives—the micro scale—on their way and contribution to a green transformation that ultimately results in what is addressed by articles on the third conceptual level: the macro-scale. Here, Wamda’s authors present views on general trends within MENA’s entrepreneurial scene as a whole, the economy or even society. The analysis of the corpus shows that the narrative of ecological sustainability in the MENA region goes beyond individual measures, spanning a wide conceptual range that

indicates a strong transformational momentum not only within individual entrepreneurs, but the structure of their eco-system as a whole.

5. Limitations

Given the exploratory nature and the scope of the present study, more research to contextualize sustainability narratives in the cultural and economic frame of the MENA region will be valuable to identify further trends and potentials. Especially focused interviews with MENA startup founders and decision makers would allow a sharpening of their specific understanding and definitions of sustainability, their social and ecological priorities, and in how far and what way they aim to consolidate them with economic thriving. Furthermore, a higher geographic resolution of narratives would be useful to reflect the vast economic and cultural differences between MENA countries. Similarly, comparing MENA with other countries would allow more conclusions about what trends and narratives are really MENA specific.

The study also has several methodological limitations: firstly, it refers to only one dataset based on 10 years of news-articles, the majority of which are more than five years old. Furthermore, we investigated English-language articles, which means that any information provided in Arabic in other outlets is not considered; potentially the focus in English differs from the Arabic focus as it may address a different, more international audience. Similarly, since we did not analyze material from outside the MENA region (e.g. EU), this study lacks a benchmark to compare findings. Nevertheless, since the sustainability concept and sustainable entrepreneurship as a discipline emerged from European and North American literature and narratives to primarily point out to the TBL, as explained in our introduction (section 1.2), we conceptually position our findings in this understanding of sustainability. Future empirical research could focus on a comparative analysis of those contextual differences.

Thirdly, many of the articles—especially those referring to general or national trends (macro-level)—captured multiple topics, e.g. by listing and describing many startups that are vaguely related, and often touched topics only briefly. Therefore, some keyword co-occurrences may not always represent a close common topic-relatedness. Despite thorough text-preprocessing, in some cases ambiguity of keywords remained, like “space” referring to aerospace technology as well as coworking-spaces and therefore associating two otherwise unrelated topics. Similarly, articles addressing the food industry were not strongly focused on that one domain, leading to a rather fuzzy topic definition.

6. Conclusion and future research

The present study analyzed the corpus of entrepreneurship news articles in English from the Middle East and Northern Africa region. The analysis referred to both the use of and narratives surrounding the term “sustainability” in general, and the concept of ecological sustainability specifically. The economic component of sustainability within the Triple Bottom Line clearly dominates the discourse: Even topics that may be expected to have a strong environmental or social component (e.g. renewable energies) are largely framed in economic terms next to the social and ecological component. In turn, some initiatives and industries that have been proved to associate with high environmental impact (e.g. fashion industry) are hardly framed in terms of ecological sustainability, but also dominantly in economic terms.

The investigation of specifically ecological sustainability topics reveals a broad conceptual spectrum of initiatives to be covered in the discourse, namely: individual initiatives and business ideas (micro level), facilitating support and entrepreneurial eco-systems (meso level) and general trends and initiatives on domestic and region-wide level (macro level).

Our findings provide a nuanced contextual understanding of sustainability narratives, which may support businesses and decision-makers in (re)defining priorities and reflecting upon the status quo and necessary next steps in the transition to more sustainable societies. This results in several implications for practice. Firstly, we recommend fostering an inclusive sustainability and TBL mindset among MENA private sector actors and aspiring entrepreneurs through targeted and specialized educational efforts and incentives, given that different aspects of sustainability can be fostered through different support service offerings [97]. Additionally, given that all countries in the study are of Muslim-majority and that traditional religious teachings emphasize altruism and environmental protection, behavioral change and educational campaigns drawing on Islamic spirituality and principles, for instance framing the natural environment as sacred, might prove effective [98,99]. Moreover, we recommend that aspiring ecologically minded entrepreneurs and decision-makers in support of sustainable entrepreneurship pay high attention to promoting business activity in fields that truly serve the region, for instance water scarcity. Finally, psychological health support and well-being empowering practices can reinforce the feeling of “I already have enough” and reduce the feelings of anxiety and fear resulting from perceiving the absence of enough resources, thus promoting a shift to more holistically sustainable mindsets and behaviors in more resource-rich contexts and demographic groups (e.g. the gulf countries).

Our work also paves the way for future research in several ways. Especially focused interviews with MENA startup founders and decision makers would allow delineating their specific understanding and definitions of sustainability, what their social and ecological priorities are, and in how far and what way they aim to consolidate them with economic thriving and survival of their businesses. Structured interviews with experts on the topic and region could help validate the findings. Research could focus on assessing the quantity, quality, framing, and regional differences in sustainable entrepreneurship discourses. A higher geographic resolution of narratives would be useful to reflect the vast economic and cultural differences between MENA countries. Similarly, comparing MENA with other countries would allow more conclusions about what trends and narratives are really MENA specific. Lastly, comparing media coverage to research on ecological sustainability in entrepreneurship can reveal differences and gaps between the two. Research studies offer in-depth analysis, objectivity, and expertise, but may lack timeliness. Media coverage provides broader coverage but may lack scientific rigor and may be more biased due to commercial interests. By comparing media and research, we can gain a comprehensive view of the topic and bridge gaps in knowledge.

Supporting information

S1 Appendix. Sankey Diagram of distribution of the three TBL dimensions across topics in all media articles addressing “sustainab*”.

(TIFF)

S1 Data. Dataset of all scraped articles from [Wamda.com](https://www.wamda.com).

(CSV)

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