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Rapid Growth of Research Output Amidst Political Instability: A Study of Libya's Last 20 Years

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Abstract

Political stability is widely seen as a foundational building block of a national innovation system. For countries like Libya whose last 20 years have included revolution and civil war, this means that low research productivity has been assumed and thus ignored. Seeking to empower the innovation system in Libya, this article examines the current status of Libya's research accomplishments and capabilities through the lens of top-tier scientific research output. Counterintuitively, this retrospective bibliometric study on the Web of Science shows robust research growth in Libya over the last 20 years, even through political turmoil and despite lack of funding. International partnerships are noted as a key correlate of this growth, perhaps supported by capacity building projects and mobility programs. While the overall scientific output from Libya is currently low relative to regional, economic, and developmental comparisons, the growth also suggests the existence of substantial intellectual capital that could sustain expansion in research and innovation.

Introduction

It is widely accepted that key components of national innovation systems (NIS; Lundvall et al., 2002) have difficulty thriving in the midst of political instability (Feng, 1997; Globerman & Shapiro, 2003; Leydesdorff & Meyer, 2006). Libya is widely viewed as such a context, given a societal revolution in 2011 and an unresolved civil war beginning in 2014. Consequently, it has often been left out of studies on scientific productivity, even within its own geographic region (Aggarwal et al., 2020; Ali & Elbadawy, 2021; Landini et al., 2015; Medina, 2015; Radwan, 2018), and also in global indicators such as the World Intellectual Property Organization's Global Innovation Index (GII).

A key part of an NIS is scientific research, where Arab nations face regionally common barriers such as lack of resources, funding, and research infrastructure (Elgamri et al., 2024). These findings were corroborated for the case of Libya in the reports of the recent IBTIKAR project (UNIMED, 2024) – a capacity-building effort, funded by the European Commission under the Erasmus+ program. In surveys, site visits, and training for the 11 participating Libyan universities, Libyan researchers expressed many difficulties in the national and institutional research climate. As part of its efforts to address these issues, the IBTIKAR project provided research

equipment to support and enhance the capabilities of these institutions, aiming to foster a more conducive research climate. The project characterized Libyan research & innovation (R&I) as "embryonic"; they called for (and sought to lead the way to) "a more mature phase" of R&I in Libya. SCIMAGO, based on Scopus-indexed articles, currently ranks Libya as #113 in its Country Rank – second-to-last in the Middle East & North African (MENA) region.

With an overarching goal of empowering the innovation system in Libya, we start by trying to understand the current status of Libya's research accomplishments and capabilities. Our task in this study is to quantify the state of top-tier scientific research output in Libya. In particular, we consider Web of Science (WoS) publications over the last 20 years, and ask:

- RQ1: How does Libya's output in research publications compare with regional and global output?
- RQ2: How has Libya's output in research publications been affected by the sociopolitical environment and events?
- RQ3: How has Libya's output in research publications been affected by (a) funding practices and (b) international partnerships?

With the results of IBTIKAR and anecdotal evidence of the challenges experienced by researchers, we hypothesized that Libyan scientific output would be relatively sparse compared to similar nations, impaired by political instability, poorly funded, and weakly partnered. The results of our study do in fact show that research output is lower than comparison countries along several intuitive axes, and that Libya exhibits low degrees of overall funding for research projects.

However, the major result of this present work is that, counterintuitively, *growth* in top-tier scientific output from Libya in 2004-2024 has far outstripped global comparisons, and has kept pace with North African counterparts. Furthermore, the longstanding political instability and crisis-level national events such as revolution and war have only minor, short-term effects. This growth persists despite few increases in domestic funding, in that most publications do not report any funding sources.

Another result of our study is that partnerships with international entities have been very important for Libyan research. This is especially reflected in the composition of authorial teams, the imperviousness of funded projects to political turmoil, and the decreasing indigeneity of Libyan research. We conjecture about how indirect funding, through capacity-building and mobility programs, may contribute to the creation of an alternative structure within the Libyan NIS.

Finally, we suggest that Libya's research capabilities are strong and severely under-utilized within the existing available NIS. We also suggest some follow up work in Libyan innovation studies.

Data and Methods

We first sought to compare Libyan WoS publications to regional, economic, developmental, and population-size counterparts (RQ1, results in Table 1). Then we considered how Libyan research output has developed over time, compared to aggregated comparison countries (RQ1 & RQ2, results in Figure 1); how domestic

vs. international funding has correlated with WoS output (RQ3, results in Table 2 and Figure 2); and how domestic vs. international teams have correlated with WoS output (RQ3, results in Table 3 and Figure 3).

Inclusion Criteria

To form the body of scientific literature for analysis, we accessed the Web of Science (WoS) on November 14, 2024 and searched for "Address" to include "Libya"; the "Year Published" to range from 2004-2024, and the "Document type" to be articles, proceedings papers, book chapters, or review articles. With this time range, we retrieved a resulting 7,821 WoS-indexed articles.

Aside from Libya, we compared with other countries or groups of countries. In doing so, we followed the same procedure on December 4, 2024 as we did for Libya, except that we listed those comparison countries under "Address" (and in the case of global-scale WoS statistics, we removed the "Address" requirement).

Factors for heuristic comparison

We performed comparisons of Libya with other countries and regions, utilizing heuristic factors (i.e., common-sense labels) that were defined as follows:

- **Regional**. North Africa: Mauritania, Morocco, Algeria, Tunisia, Libya, and Egypt.
- **Economic**. Gross Domestic Product (GDP): From the World Bank 2023.[1]
- **Development**. Human Development Index (HDI): From the United Nations Development Programme (UNDP) 2022.[2]
- **Population**: From the United Nations Department of Economic and Social Affairs (UN DESA) 2023.[3]

For each of the quantitative factors above, we considered the global pool of ranked countries, and chose the two countries that were numerically above Libya and the two countries that were numerically below Libya. For example, the Economic comparison group consisted of 4 countries: 2 with GDP just above Libya (Turkmenistan and Jordan), and 2 with GDP just below Libya (Uganda and Tunisia). In addition to comparing Libya vs. the other countries, this elucidates which factors are salient comparisons for the metric of per capita publication output.

[1] Accessible at https://databank.worldbank.org/

[2] Accessible at https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

[3] Accessible at https://population.un.org/wpp/

Calculated factors

We calculated a per capita publication output, namely, the number of publications divided by the 2023 World Bank estimate of population (reported in units of thousands under the label "WoS per 1000" in Table 1).

The 4 comparison countries for each factor were later considered in aggregate on a longitudinal basis (see Figure 1); e.g., the Economic comparison group combined the raw publication output of the 4 countries, and did not include Libya. This was chosen over finding a most-similar country because this study does not purport to be an in-depth analysis between two countries; nor did we select synthetic controls because we are not quantifying the "expected" research output of Libya to tease out the effect of a specific event; rather, our RQ1 goal seeks to make simple heuristic comparisons.

WoS Variables

For longitudinal data, we used the "Publication Year" publication counts directly from WoS's online interface for each country or group of countries.

For funding sources, we did an initial assessment of WoS's "Funding Agencies" and found it to be incorrect in spot-checked cases. Thus, we instead examined the Acknowledgement sections of all papers and searched for mentions of "funding"/"funded" or "financial support" or a grant/project number of some kind. Those with such mentions were manually checked for correctness, and then considered to constitute funded projects. We manually coded the resulting papers as having funding sources that were international (INTL), domestic (DOM), or both.

For the affiliations of research teams, we parsed the "Address" field. The majority of the WoS records included unambiguous lists of author-affiliation pairings, even when there were multiple affiliations; the affiliations listed in this field included a mention of their respective country. We normalized each individual author as either having international, domestic, or dual (both international and domestic) affiliation, and counted how many authors of each category were authors on the paper.

Results

WoS publication output comparisons

In Table 1, we compare Libya to other countries along a few heuristic axes: Regional, Economic, Development, and Population. We primarily consider how much research is being produced per capita (or more precisely, per 1,000 population, in the "WoS per 1000" metric).

Among countries with similar population, Libya has a respectable 1.07 publications per 1000 capita – if we exclude the outlier of an economically and developmentally advanced Hong Kong. However, when compared with other North African countries, Libya's publications per capita is second lowest in the region, only ahead of the less-populated Mauritania. Libya is also at the lower end of countries that have similar GDP and countries that have similar HDI scores. Though untested, it appears that the factor of population may be more indicative of potential research output than the other factors.

In the process of selecting comparisons, Turkmenistan arose as a country that is similar in terms of economy, development, and population. Libyan researchers are producing more than 20 times as many articles as Turkmen researchers, per capita. Thus, when considering the full intersectional profile of Libya, research output seems apropos to the context. However, when Libya's research output is compared to similar countries according to a single factor, its relative research performance is poor, corroborating our hypothesis for RQ1.

Table 1. Libyan scientific output from 2004-2024, compared to similar countries. Subtables consider the closest countries in Region (North Africa), GDP (Gross Domestic Poduct; World Bank 2023), HDI (Human Development Index; UNDP 2022), and Population (UN DESA 2023). "WoS" is the number of Web of Science articles produced in the time period listing the country in its "Address" field, while "WoS per 1000" is that value divided by the population in thousands. "h-index" (SCIMAGO 2024) approximates research impact.

	Region	GDP	HDI	Population	WoS	WoS per 1000
Regional comparison						
Mauritania	*North Africa*	$ 10,453	0.540	5,022,000	958	0.19
Morocco	*North Africa*	$ 141,109	0.698	37,713,000	88,276	2.34
Algeria	*North Africa*	$ 239,899	0.745	46,164,000	94,292	2.04
Tunisia	*North Africa*	$ 48,530	0.732	12,200,000	108,976	8.93
Libya	***North Africa***	**$ 50,492**	**0.746**	**7,306,000**	**7,821**	**1.07**
Egypt	*North Africa*	$ 395,926	0.728	114,536,000	333,232	2.91
Economic comparison						
Turkmenistan	Central Asia	*$ 59,877*	0.744	7,364,000	373	0.05
Jordan	Middle East	*$ 50,814*	0.736	11,439,000	74,116	6.48
Libya	**North Africa**	***$ 50,492***	**0.746**	**7,306,000**	**7,821**	**1.07**
Uganda	East Africa	*$ 49,273*	0.550	48,657,000	28,005	0.58
Tunisia	North Africa	*$ 48,530*	0.732	12,200,000	108,976	8.93
Development comparison						
Brazil	South	$	*0.760*	211,141,000	1,170,519	5.54
Colombia	South	$ 363,540	*0.758*	52,321,000	162,943	3.11
Libya	**North Africa**	**$ 50,492**	***0.746***	**7,306,000**	**7,821**	**1.07**
Algeria	North Africa	$ 239,899	*0.745*	46,164,000	94,292	2.04
Population comparison						
Hong Kong	East Asia	$ 382,055	0.956	*7,443,000*	400,430	53.80
Turkmenistan	Central Asia	$ 59,877	0.744	*7,364,000*	373	0.05
Libya	**North Africa**	**$ 50,492**	**0.746**	***7,306,000***	**7,821**	**1.07**
Kyrgyzstan	Central Asia	$ 13,988	0.701	*7,074,000*	4,456	0.63
Paraguay	South	$ 42,956	0.731	*6,844,000*	7,019	1.03

Longitudinal growth in WoS publication output

In Figure 1, we plot the percent growth in number of yearly WoS publications since 2004. Whereas the WoS as a whole showed a global trend of increasing research output (153% increase from 2004 to 2023, the last complete year in our study), Libya showed a much more marked increase (817%) during the same period. Libya's overall publication growth far outstrips that of population-matched countries (285%

growth), HDI-matched countries (366% growth), GDP-matched countries (652% growth).

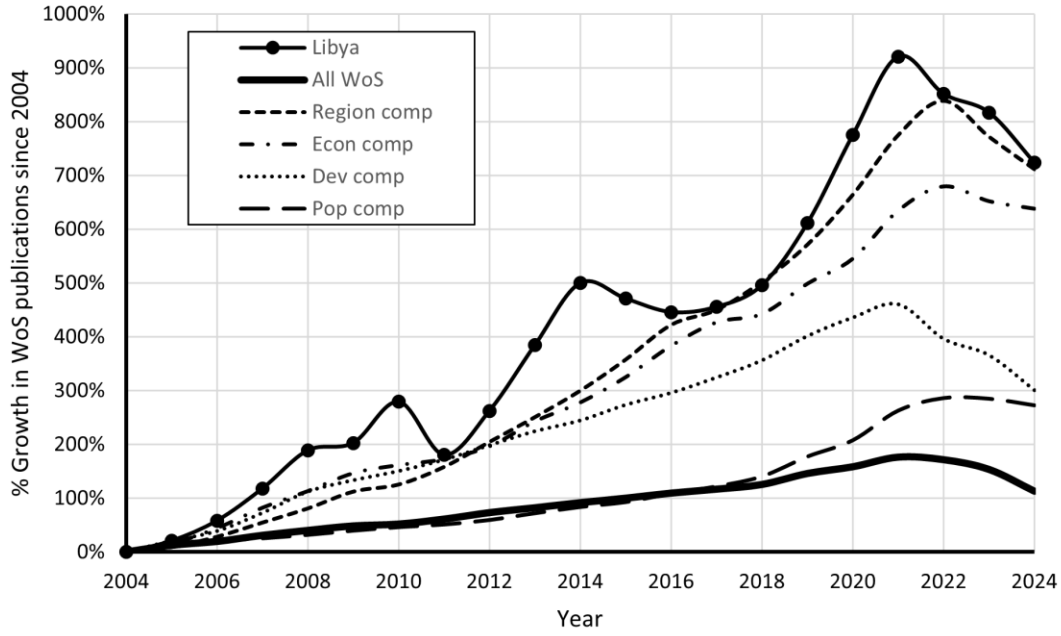

Figure 1. Libya's percent growth in publications over time, compared to regional, economic, development, and population comparison groups. Percentages are calculated relative to research output in 2004. Some salient events over this timeline include a Libyan revolution in 2011, an ongoing civil war since 2014, armed conflict in 2019, and COVID-19 in 2020.

Libya's trend is similar to that of the North African region (772% growth), This growth was achieved despite large dips in the rate of publication growth, concurrent with the February 2011 revolution and the beginning of the 2014-2015 civil war (see these years in Figure 1). Interestingly, the rest of North Africa, which also experienced the Arab Spring in 2011, did not demonstrate as severe a drop in publication growth during that event. Of course, the Libyan civil war is localized to Libya and its lasting effects were not visible elsewhere in the region or the world.

This contradicts our hypothesis for RQ2 that Libyan research is relatively unstable. While a negative effect was visible during periods of national turmoil, the increase of publications has continued at pace with the North Africa region, or better.

Table 2. Funding sources acknowledged in Libyan Web of Science publications from 2004-2024 (WoS Publ).

	WoS Publ	%
Unfunded	5,683	73%
Funded	2,138	27%
International	1,768	23%
Joint	185	2%
Domestic	185	2%
Total (Libya)	7,821	100%

Funding sources for Libyan WoS publications

Focusing on the acknowledged funding sources in the 7,821 Libyan WoS publications, Table 2 shows that 73% of publications were unfunded. Of the publications with funding, 83% received their funding exclusively from outside of Libya. Libyan funding was only acknowledged in 370 publications (4% of the total). Considering funding sources over time, Figure 2 displays the raw count of publications that acknowledge domestic vs. international vs. joint domestic-and-international funding sources. Interestingly, the majority of the growth in WoS publications has occurred in unfunded work. If we considered only unfunded work (white area in Figure 2), there would still be a 546% increase in research output from 2004 to 2023.

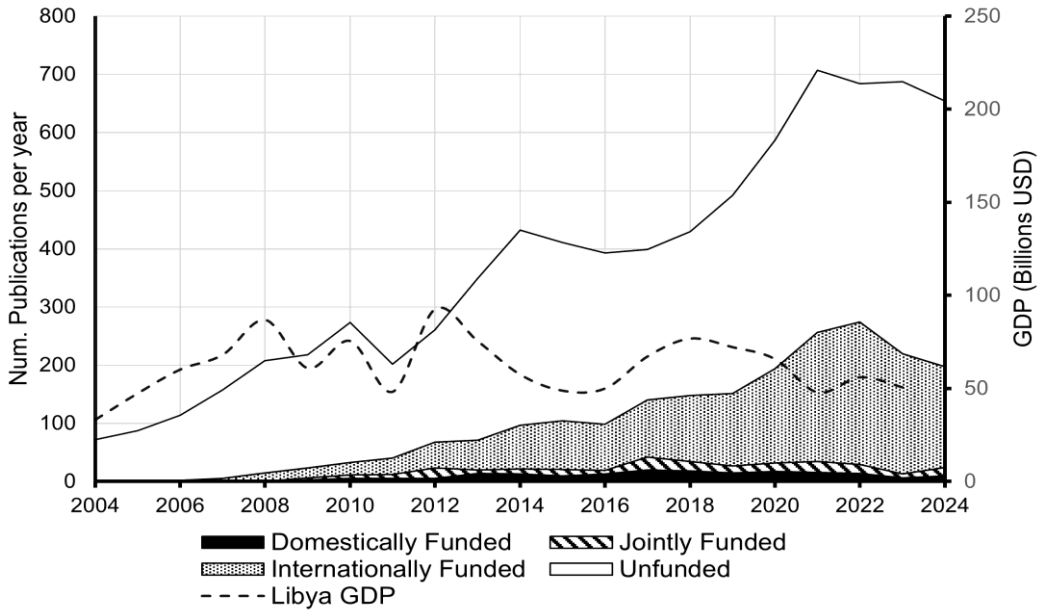

Figure 2. Number of Libyan WoS publications acknowledging domestic vs. international funding sources, yearly, since 2004. Funding sources are stacked (e.g., of 707 publications in 2021, 451 were unfunded, 222 internationally funded, 16 jointly funded, and 18 domestically funded), and the GDP for the same time period is overlaid for comparison.

Over the 20-year period, there is consistent growth in the international funding, with an additional bump in 2021 and 2022, concurrent with global trends of COVID-19 funding. However, there was little growth in the domestic funding, and even in joint funding between international and domestic sources.

It is also evident that unfunded publications bear the brunt of the effect of national-scale events such as the 2011 revolution and the 2014-2015 civil war – financially supported articles show little, if any, effect of those tumultuous events. We have overlaid GDP information over the figure, which fluctuated during the study period and during those events. This general economic indicator fluctuates widely and seems to have had no direct impact on the research output of Libya, as it does not

Table 3. Composition of authorship teams in Libyan WoS publications from 2004-2024 (WoS Publ). "Libyan – with Diaspora" indicates the presence of an author with a dual affiliation, one domestic and another international.

	WoS Publ	% of Publ
Libyan - Local only	1,304	16.7%
Small team (< 5)	1,112	14.2%
Large team (≥ 5)	192	2.5%
Libyan - with Diaspora	75	1.0%
Small team (< 5)	65	0.8%
Large team (≥ 5)	10	0.1%
International - Libyan Majority	762	9.7%
Small team (< 5)	403	5.2%
Large team (≥ 5)	359	4.6%
International - Foreign Majority	5,190	66.4%
Small team (< 5)	1,880	24.0%
Large team (≥ 5)	3,310	42.3%
Missing data	490	6.3%
Total (Libya)	7,821	100.0%

display a similar trend of growth (unfunded and internationally funded work) or stability (domestically funded or jointly funded work).

While this data does show that Libya's research sector is under-funded (RQ3a), it also shows that research in Libya continues to grow despite the under-funding.

WoS publication co-authorship team composition

Recognizing that there is international involvement in the Libyan research sector, Table 3 and Figure 3 consider the composition of co-authorship teams for Libyan WoS publications.

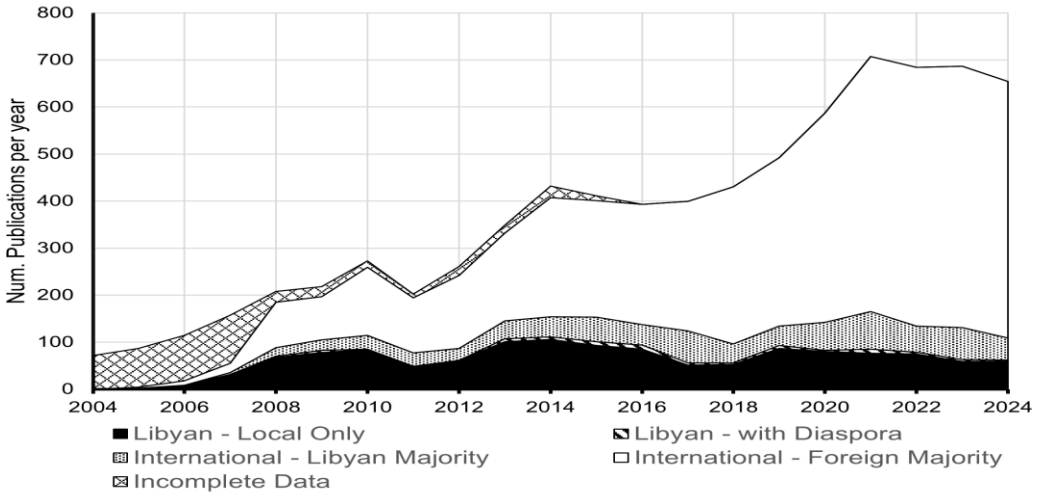

Figure 3. Number of Libyan WoS publications with teams of domestic Libyan authors vs. international authors, yearly, since 2004. Each paper includes at least one Libyan author. "Libyan – with Diaspora" includes Libyans who have a dual affiliation between a Libyan institution and a foreign institution. A division between 50% of the team being Libyan "International – Libyan Majority" or "International – Foreign Majority" indicates that over 50% of the team was either Libyan or non-Libyan. "Incomplete Data" is comprised of 490 studies whose "Address" fields could not be uniquely disambiguated within WoS.

In particular, we classified each author as one who listed a Libyan affiliation (assumed to be Libyans), an international affiliation (assumed to be foreigners), or both (assumed to be Libyan diaspora, namely, those who are working or studying abroad). If a team of co-authors included foreign authors and was more than 50% foreign, we considered the team an "Foreign Majority" team; if fewer than 50% were foreign, we considered it an "Libyan Majority" team. Note that the WoS did not track unambiguous information for this analysis in some of its older articles (6.3%) and these articles were excluded from the classification in this section.

In Table 3 we see that the majority of research from Libya was done in collaboration with foreign-majority authorial teams (66.4%), and oftentimes on large collaborations with over 5 authors (42.3%). However, publications with only Libyan authors in Libya also made contributions (16.7%), but in contrast to the foreign-majority teams, these seemed to focus on smaller teams of fewer than 5 authors (14.2%).

In Figure 3, we can see that publications from Libyan-only teams increased until about 2010 but has not grown much since then. Instead, it was predominantly international partnerships – whether Libyan Majority or Foreign Majority – that accounted for the large rise in publications over the last 20 years. This means that other factors were less explanatory for growth, for example, a 2012 initiative by Libyan authorities to require that scholarship recipients in mobility programs should list a dual Libyan affiliation alongside their foreign affiliation. The corresponding "Libyan – with Diaspora" is poorly represented and it is hard to see a large increase in WoS publication output.

The effect of political turmoil in the 2011 revolution and 2014-2015 civil war was more pronounced for Local-only Libyan teams, though it is also present for other types of teams.

Discussion

Rapid growth in Libyan research productivity, amidst political and societal disruption

The main result of this study is that there was rapid growth in Libyan scientific productivity over the last 20 years, a trajectory which has been heretofore undocumented. The strong growth rate in the North Africa region as a whole was previously only documented for the early part of our study period with publication records up until 2012 or 2013 (Landini et al., 2015; Medina, 2015), and a 7-fold increase in the wider region of the African continent was reported between 2004 and 2019 (Ali & Elbadawy, 2021).

Unfortunately, many studies on bibliometric trends in the region often excluded Libya from analyses due to its low research output (Aggarwal et al., 2020; Ali & Elbadawy, 2021) or failed to select it even among the set of North African countries (Landini et al., 2015; Medina, 2015; Radwan, 2018), or focused on a particular field of study rather than on the productivity of individual countries (Chaabna et al., 2021). However, Siddiqi et al. give a highly relevant and thorough treatment of the Middle East-North Africa (MENA) region according to productivity, indigeneity, and

specialty of the countries' scientific output. Libya and many other MENA countries were shown to increase in global share of publications over the time period of their study; however, its analysis is on older WoS data from 1981-2013 (Siddiqi et al., 2016), which excludes some events of crucial interest for our RQ2, and the issues of RQ3 are also unaddressed for Libya.

The robust growth in research publications in the midst of political turmoil in Libya contradicts our RQ2 hypothesis that Libya's long periods of political instability would correspond with impairment of scientific productivity. While the growth rate decreased slightly during and shortly after events such as the 2011 revolution, the long-term trajectory of growth continued; scientific growth was altogether unaffected by armed East vs. West conflict in 2019. (Note, however, that a global post-COVID decline in 2022-2023 was indeed reflected in the number of Libyan research publications.) This is all the more noteworthy given the expectation that political stability is a precondition for vibrant NISs (Allard et al., 2012; Feng, 1997; Siddiqi et al., 2016), that war and conflict were the greatest challenge facing Libyan universities (UNIGOV, 2016), and the anecdotal evidence from surveys and site visits in the IBTIKAR project considered the instability a barrier (UNIMED, 2024). Relative to unfunded publications, funded publications were less negatively impacted by the political turmoil. Something similar can be said about international-majority teams. We postulate that unfunded, domestic research work depended on societal structures that were affected by armed conflict, whereas funded projects and internationally collaborative research work had a level of invested infrastructure that was less quickly destroyed, and hence less volatile in turmoil.

Libya's trend of productivity growth was observed amidst a fluctuating economy and low reported levels of funding. Though oil and gas output from Libya was unstable through our study period, and the GDP correspondingly, this appears to have no effect on research output. Though UNESCO's Institute for Statistics does not have statistics on Research & Development expenditures for Libya, we surmise that scientific productivity is uncorrelated with GDP because little of the GDP is allocated for research activities.

While there was growth in scientific productivity, the volume of publications from Libya remains on the lower end of regional, economic, and human development comparisons, validating our hypothesis for RQ1. It is most similar in research productivity to countries of similar population (Table 1) and even compares favorably with most of them. Our heuristic selection of factors, and the publication patterns within them, suggest that a low population size may limit the research capabilities of Low-to-Middle Income Countries.

International partnerships and capacity-building funding

One clear result of our work is that most of the growth in Libyan research has involved international-majority authorship teams, a partial answer to RQ3. This effect was previously reported a decade ago as a decrease in "indigeneity" (Landini et al., 2015) of research in Libya and many other parts of the MENA region. Despite some difference in definitions (they only mentioned the address of the contact author, instead of the percent composition of author affiliations), we assert that, indigeneity

continues to decrease in Libya as the overall productivity increases, following the trend observed by Landini et al.

Note however, that this does not necessarily mean that international funding is directly responsible for research work in Libya, since "unfunded" publications showed great increases alongside "internationally funded" publications during the time period of our study. We suggest that the role of international funding to date has not been direct research support that would have been named in WoS papers' Acknowledgments sections, but rather an indirect capacity-building investment in Libya-International research collaborations, and the structures that allow them to occur. Foreign funding of this kind has primarily originated from Europe, including mobility programs, UNIGOV, Libya Restart, and IBTIKAR. International funding has thus made cooperation between Libya and international entities more possible.

International partnerships are also likely to arise out of mobility programs from Libya, as Libyan graduates maintain relationships with the institutions at which they studied. We suspect many not-precise-enough statements mentioned in Acknowledgments sections (e.g., "Embassy of Libya in Malaysia" for "supporting this research") actually had financial support provided by Libyan government-sponsored higher education mobility programs. Although research is part of postgraduate studies for mobility, the achievement in mobility programs tends to be a diploma rather than the research that it took to get that degree. This mindset potentially explains why mobility programs were rarely mentioned in Acknowledgments.

Limitations

Research written in Arabic, particularly in the humanities, often goes unrecognized by global platforms like the WoS due to language barriers, limited access to international publishing, and insufficient institutional support for translation and dissemination. Despite its rich intellectual contributions in fields like literature, history, and philosophy, Arabic research remains underrepresented globally. Bridging this gap requires initiatives such as promoting translations, fostering international collaborations, and creating platforms to highlight Arabic scholarship, ensuring these valuable works gain the recognition they deserve.

Practically speaking, picking periods to calculate percent growth of WoS publications is inherently noisy. Thus, comparisons of percent growth are approximate. The North African region, for example, exhibits a similar growth trend to Libya, and the start and endpoint of the percent growth comparison will dictate whether the country or region exhibits larger growth.

Also, it was inherently difficult to determine the funding status and the funding sources of papers by their Acknowledgments section alone. Noting that the calculated WoS fields were not fully accurate, we attempted our own computationally assisted manual review. However, we still speculate that the actual funding rate is higher and that some systematic biases have prevented more attribution of funding. In particular, funding from the Libyan government through mobility programs was likely underrepresented, given that the Libyan government-

sponsored higher education mobility programs did not obligate the grantees to acknowledge their financial support in Acknowledgments sections.

The Libyan innovation system and Future work

The potential of Libyan innovation is far greater than the current domestic NIS is able to support. The rapid growth in number of publications with international teams demonstrates this potential – it would not be possible if Libyan researchers were entirely lacking the intellectual capital necessary to carry out top-tier research. Thus, in the presence of international team and funding structures, Libyan researchers have been able to sustain rapid growth.

Rather than looking exclusively to the international collaborations and investments that led to the current growth, we may also ask what other types of domestic policies, programs, or other actions can take advantage of the under-utilized research sector in Libya. These initiatives can be informed by further work in innovation studies in Libya. For example, Libya Restart and IBTIKAR projects (UNIMED, 2020, 2024) noted that there are internal struggles with a lack of research administration and funding or projects. Namely, in Libya's NIS, there is no reliable structure for funded research projects. International partnerships provide this type of administrative structure, and it would be instructive to consider what other types of administrative structures would be able to tap into the same research capabilities that the international collaborations are currently tapping into.

Continuing our work here, future studies will need to establish the link between scientific productivity and international capacity building actions. This will enable foreign funders to determine their return on investment, and will also provide a guide for any potential domestic investment in research by the Libyan government. Similarly, Libyan-sponsored mobility programs should be further analyzed to establish how they have impacted scientific productivity. This will enable Libyans to evaluate the benefits of popular programs and compare it with potential domestic investments.

More substantially, although literature on NISs in the region often leaves out Libya (Djeflat, 2004), our results demonstrate that international influence is a key component of the current NIS in Libya. Future work can more precisely identify the players in the trans-national aspects of Libya's innovation system in order to develop policies for encouraging R&I. As new domestic policy actions are taken towards innovation, further studies will need to address underlying internal barriers to having an effective NIS, such as weak interactions between actors (Hamidi & Benabdeljalil, 2013).

Conclusion

A retrospective bibliometric study of Libya's Web of Science publication productivity has shown robust growth over the last 20 years, even through political turmoil and despite lack of funding. International partnerships are noted as a key correlate of this growth, perhaps supported by capacity building projects and mobility programs. While the overall scientific output from Libya is currently low relative to regional, economic, and developmental comparisons, the growth also

suggests existence of substantial intellectual capital that could sustain expansion in research and innovation.

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