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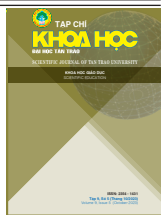

SCOPUS-INDEXED SCIENTIFIC PUBLICATIONS OF LAO PDR FROM 1996-2020

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Abstract

Using the Scopus database, this paper investigates the productivity of scientific articles from 1996 - 2020 to reveal the status of research development in Lao PDR through the lens of bibliometrics review. The finding indicated that publications in Lao PDR have increased considerably since 2010. However, the total number of publications (2,666) in the 1996-2020 period is much lower compared to other countries in the region. Also, it is over-reliant on international collaboration as more than 96% were the international co-authorship and the medical and agricultural research was the most studied. The priority in the research field of the Lao PDR appears unbalanced because some subject areas were overlooked while others were neglected. The scientific community in the Lao PDR is embodied in the health sector as scientific articles are published by health-related institutes and authors. Indeed, the scientific publication production of the Lao PDR is obstructed by several limitations, including the socio-economic such as research funding, human resources, and foreign languages. Moreover, the government's priority on education, incentive policy, and cultural context puts even more pressure on its research development. Therefore, this now necessitates improving the human resources and building the research capacity in Lao PDR. This call is especially addressed to the policymakers to develop the mechanism for scientific publications' advancement in Lao PDR.

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XU HƯỚNG CÔNG BỐ KHOA HỌC CỦA CHDCND LÀO TỪ 1996-2020 QUA DỮ LIỆU SCOPUS

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Tóm tắt

Bài viết điều tra năng suất công bố khoa học từ năm 1996 - 2020 sử dụng cơ sở dữ liệu Scopus để đánh giá tình trạng phát triển nghiên cứu ở CHDCND Lào thông qua phương pháp đánh giá trắc lượng thư mục và dữ liệu. Kết quả chỉ ra rằng số lượng công bố khoa học ở CHDCND Lào tăng đáng kể từ năm 2010. Tổng số công khọc từ năm 1996-2020 là 2,666 bài, thấp hơn rất nhiều so với các quốc gia trong khu vực. Các công trình đăng tải trên tạp chí quốc tế của CHDCND Lào phụ thuộc quá nhiều vào hợp tác quốc tế với hơn 96% là đồng tác giả quốc tế. Ưu tiên trong lĩnh vực nghiên cứu của CHDCND Lào không đồng đều. Hầu hết các nghiên cứu hiện nay tập trung trong lĩnh lực nông nghiệp và y tế. Trong khi đó, rất ít các nghiên cứu trong lĩnh lực thú y và kinh tế. Việc sản xuất ấn phẩm khoa học của CHDCND Lào bị cản trở bởi một số hạn chế, bao gồm kinh phí nghiên cứu, nguồn nhân lực và hàng rào ngôn ngữ. Hơn nữa, ưu tiên của chính phủ về giáo dục, chính sách khuyến khích và bối cảnh văn hóa thậm chí còn gây thêm áp lực cho sự phát triển nghiên cứu. Do đó, điều này đòi hỏi phải cải thiện nguồn nhân lực và xây dựng năng lực nghiên cứu ở CHDCND Lào. Nghiên cứu này sẽ giúp nhà hoạch định chính sách nhìn nhận lại thực trạng nghiên cứu khoa học hiện nay ở Lào để xây dựng cơ chế thúc đẩy công bố khoa học ở CHDCND Lào.

INTRODUCTION

The increase in research productivity indicates the development of economic growth [1]. Research productivity refers to the principal efficiency indicator of any production unit, including individual, research group, department, institution, field, and country, and it is mostly measured by the number of books, book chapters, journal articles, papers in conferences, research grants, and patents [2-3]. Evaluating research productivity permits the identification of research collaboration, researchers' reputation, co-authorship, researchers' role, and research management [4 - 6]. Also, it intensifies the emphasis on research development in the specific field, the strengths, and weaknesses of

research management, and strategizes the effective research development policies [7], [2]. Therefore, many quantitative studies to measure the scientific literature have been conducted all over the world, especially in the Association of Southeast Asian Nations (ASEAN) where many countries reported their status of scientific publications e.g., Thailand, see [8]; Vietnam, see [9]; Malaysia, see [10]; Indonesia, see [11], except for Lao PDR. For that reason, this now necessitates creating detailed information regarding the status of its scientific publications.

As a group of still-developing countries, ASEAN employs the investigation of scientific literature to evaluate their research prosperities and to follow up on their strategic plans and budget allocation for research development. Svasti and Asavisanu [8] revealed the significant growth in the scientific publication output of Thailand with the development of many research disciplines e.g., health technology, see [12]; and translation study, see [13]). Ho [14] and Nguyen et al. [9] also revealed the successful advancement of scientific research in Vietnam in terms of research outputs, while Vuong et al. [15] argued that the scientific publications in Vietnam were still under-developed since the research priority was unbalanced; some topics were overlooked while others were neglected. Bakri et al. [10] also indicated the ongoing process of scientific publication in Malaysia with the increasing trend of many disciplines e.g., clinical medicine, see [16]; engineering, see [17], along with Indonesia, whose progress in development is indicated by the increase of research outputs of different disciplines e.g., dengue, see [18]; mathematics and statistics, see [19]. On the other hand, apart from the increase in the total scientific output, Filipino scholars suggested putting more effort into some specific disciplines e.g., psychology, see [20]; development communication, see [21] and nuclear science and technology, see [22] because of the scarcity of literature. Additionally, Arunachalam and Garg [23] suggested medical research was the most productive field in Singapore and the research publications were rarely cited, even those that were published in high-impact journals. Furthermore, Ho et al. [24] reported the gradual development of scientific publications in Brunei, of which the most productive subject areas were ecology, geoscience, and multidisciplinary. In Lao PDR, the report from UNESCO [25] exhibited the largest type of document was the articles, followed by the meeting abstract, review, and book chapter. The study further reported the gradual increase in the scientific research output as it was driven by international aid and national projects. Moreover, the priority of scientific research in Laos was found to be lower. Most of the scientific publications in Laos appeared only as a part of international projects in which domestic scholars participated as the corresponding authors [26 - 27]. This is due to the limitations in human resources, scientific infrastructure, and domestic research institutes [28]. Although the anecdotal information from scientific papers in Laos has been uncovered, a comprehensive study, especially indexing the Scopus database, is still absent up to this date. Therefore, this study employs Scopus to investigate the scientific productivity of Lao PDR during the last 25 years (1996-2020).

METHOD

Five stages of the general bibliometrics analysis workflow from Börner et al. [29] and Zupic and Čater [30] were used in this study, including:

(1) Study designs: the purpose of this quantitative analysis is to investigate the publication outputs of Lao PDR as seen in the Scopus database from 1996 to 2020 to uncover the status of scientific publications and understand the evolution of science and technology development through the lens of the bibliometrics review.

(2) Data collection: by adopting the study of Ho [14], the data collection process included:

(a) ***Data collection*:** Scopus (http://www.scopus.com) has been chosen as it is the largest single abstract and indexing database [31]. Besides, Scopus was launched in 2004, yet it does not include references before 1996 [14], [32]. Therefore, this study comprehends the total journal article outputs of Lao PDR from 1996 to 2020. The affiliation country is defined as Laos, with the document type of articles from journals written in English. The query strings are as follows: (AFFILCOUNTRY (Laos) AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR,

2019) ... > LIMIT-TO (PUBYEAR, 1997) OR LIMIT-TO (PUBYEAR, 1996) AND (LIMIT-TO (DOCTYPE, "ar") AND (LIMIT-TO (LANGUAGE, "English") AND (LIMIT-TO (SRCTYPE, "j")). A total of 2666 documents were exported from Scopus on February 19, 2021.

(b) ***Data filtering:*** the data was filtered by the tool provided in Scopus to retrieve the input data (authors, titles, journals, etc). Besides, to assess solely the domestic articles, only "Laos" was included in affiliation countries. On the other hand, to assess the total publications, "Laos" and those 96 countries were included. Later, the documents of the domestic were removed from the total publications to evaluate the collaboration articles. The information was exported in CSV format to perform further analysis.

(c) ***Data cleaning:*** Several errors that appeared in the extracted file were corrected for example the duplicated affiliations such as the "University of Health Science", "Mahosot Hospital", "Ministry of Health", etc. were corrected in this part.

(3) Data analysis The various analytical techniques were applied for the analysis. Firstly, the general statistics were employed to calculate the quantitative information of this study. The information regarding the 2020 metrics indicator of journals and authors (h-index, SNIP, and SJR (Quartile)) were retrieved from the (http://www.scopus.com) and (http://www.scimagojr.com) on August 1, 2020.

(4) Data visualization The data was displayed by using the Rstudio [33]. The "ggplot2" function in R was used to visualize the line graph and pie chart. Moreover, the function so-called "tm" was used to perform the text mining for analyzing the frequency of words that appeared in the title.

(5) Data interpretation the findings will be described and interpreted in the next section.

RESULT AND DISCUSSION

The scientific publications of Lao PDR gradually increasing, yet it is considered too slow.

Despite the small rate of annual growth, the number of scientific papers in Laos gradually increased (Fig. 1)**.** However, with a total of 2,666 articles published over 25 years, Laos' research development lags far behind that of the rest of the world. In comparison with the fellow countries in the region, several studies suggested that the number of scientific publications was relatively too small in comparison with other ASEAN countries [34]. Adams et al [35] exhibited the number of total scientific publications of SEA nations from 2014 - 2018, Laos ranked below with the output of only 179 papers, smaller than the Philippines eightfold, Indonesia thirteenfold, Thailand forty-sixfold, and Singapore Seventy-sevenfold. Moreover, Thomson Reuters [36] classified "Lao PDR" as a follower group with the least productivity of scientific publications. Moreover, compared to the countries in ASEAN such as Vietnam, the authors also found that the number of scientific articles in Lao PDR is too small, as during almost the same period, Vietnamese scholars published more than 14,738 articles [14], while the Lao PDR only had 2,666 articles.

The scientific publications in Lao PDR are driven strongly by the international cooperative

The majority of publications were international co-authorships, while only a small number of papers were published solely by domestic authors (Table 1). This wide gap sufficiently provides evidence that the scientific publications of Lao PDR were driven strongly by international collaborations. Besides, unlike international co-authorship, the number of domestic articles remained limited throughout the 25 years (Fig. 2). This indicates the minor contribution of Laotian researchers to the nation's scientific publication hub. Generally, a large proportion of scientific publications in ASEAN countries are derived from international collaborations since international authorships helped to strengthen the research outputs for both general and specific disciplines [37]. The small research output countries (Laos, Vietnam, Cambodia, and Indonesia) tended to have a higher share of international collaboration [38]. The study of Ho [14] and Nguyen et al. [9] proved a point of this statement by investigating Vietnam's collaboration publications. The result showed that the collaboration publications hold the greatest

proportion of publications output, which occupied around 77% of total publications ever recorded. In parallel with the increase of international collaboration in terms of scientific research of ASEAN nations, Kumar et al. [39] and Payumo & Sutton [40] suggested the lack of regional collaboration, which was one of the reasons for the slow development of scientific research in the country. Similar to such fellow countries, Laos still requires enormous support from international fellows in terms of investment, infrastructure, and human resources [41], [38]. Therefore, international collaboration is a prioritized strategy that has always been advocated by the Government of Laos for the country's development [42].

Table 1. The total output of scientific articles in Laos

Year	Domestic	%	Collaboration	%	Total
2020	3	1.09	272	98.91	275
2019	5	1.85	266	98.15	271
2018	13	5.35	230	94.65	243
2017	7	3.45	196	96.55	203
2016	6	2.53	231	97.47	237
2015	6	2.91	200	97.09	206
2014	2	1.23	161	98.77	163
2013	11	6.18	167	93.82	178
2012	4	2.29	171	97.71	175
2011	3	2.36	124	97.64	127
2010	5	5.05	94	94.95	99
2009	7	9.09	70	90.91	77
2008	2	2.44	80	97.56	82
2007	0	0.00	66	100	66
2006	10	14.29	60	85.71	70
2005	3	6.38	44	93.62	47
2004	3	8.82	31	91.18	34
2003	2	7.14	26	92.86	28
2002	2	11.11	16	88.89	18
2001	0	0.00	13	100	13
2000	1	5.88	16	94.12	17
1999	0	0.00	6	100	6
1998	2	18.18	9	81.82	11
1997	0	0.00	11	100	11
1996	0	0.00	9	100	9
Sum	97	3.64	2569	96.36	2666

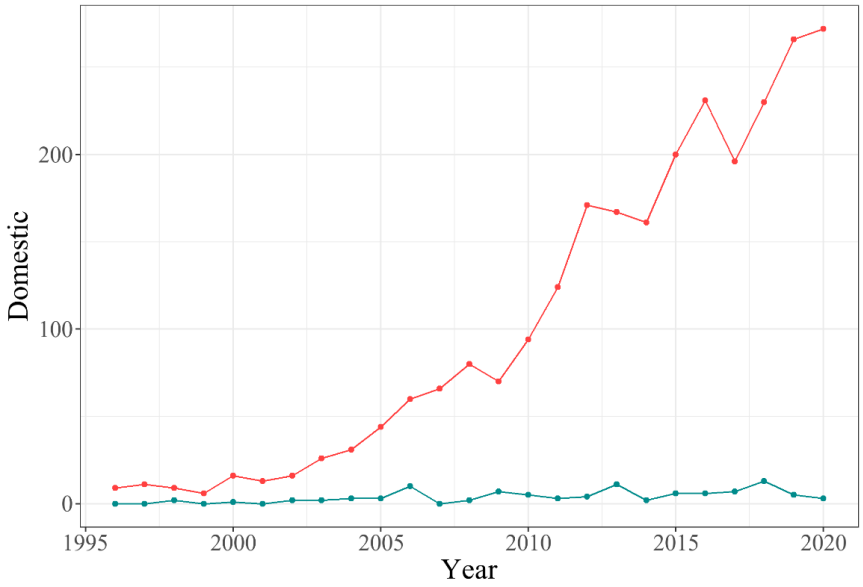

Fig. 2. The growth trend of domestic and collaboration publications of Lao PDR.

The most collaborative partner is Thailand, followed by the United States, the United Kingdom, Australia, and France (fig. 3). As a neighboring country with the advancement of science and technology in the region, Thailand has tremendously helped boost scientific research productivity for Lao PDR. The education cooperation between Laos and Thailand has been prioritized since 1992 by regularly providing and allocating scholarships (postgraduate and doctoral training) and budgets for Lao students to improve the country's human resources [43]. In terms of the research disciplines, the tropical countries with relatively poor living conditions are the ideal places for studying infected diseases [14], [44]. As a result, Thailand, the United States, and the United Kingdom collaborated on medical research focusing on infectious diseases, particularly malaria (Table 2). This is in line with the studies from other ASEAN countries that medical research was the most dominant subject among others (e.g., Singapore, see [23], Thailand, see [45], Indonesia, see [18]). On the other hand, the Australia-Laos and France-Laos collaborations mostly shed light on life science research. ACIAR, part of Australia's aid program fostering international agricultural research, is one of the driving forces behind the success of the Australia-Laos collaboration. Moreover, the bilateral relations between France and Laos permit the reinforcement of agricultural research in Laos through several donors, such as CIRAD, IRD, and water sanitation projects.

Table 2. The frequency of root words appeared in the titles

Thailand		US		UK		Australia		France	
word	%	word	%	word	%	word	%	word	%
Lao	26.75	Lao	17.14	Lao	25.44	Lao	33.11	Lao	22.12
PDR	18.91	PDR	16.95	PDR	19.22	PDR	26.62	PDR	20.19
Laos	18.77	Laos	10.17	Laos	16.31	Laos	15.66	Laos	16.59
Thailand	11.34	New	8.85	Malaria	11.07	Rice	10.07	Soil	9.62
Malaria	8.12	Malaria	7.34	Study	8.74	Study	9.17	Southeast	8.89
Asia	7.84	Southeast	6.78	Plasmodium	8.54	Health	7.16	Study	8.65
Plasmodium	7.42	Health	6.40	Falciparum	8.35	Production	7.16	Tropical	7.21
Southeast	7.14	Asia	6.03	Asia	7.96	Smallholder	6.94	Asia	7.21
Democratic	6.72	Species	5.84	Democratic	6.80	Asia	6.26	Northern	6.25

Thailand		US		UK		Australia		France	
Republic	6.72	Falciparum	5.46	Republic	6.80	Case	5.82	Virus	6.25
Falciparum	6.72	Plasmodium	5.27	Health	5.83	Northern	5.82	New	5.53
New	6.30	Study	4.71	Resistance	5.63	Democratic	5.59	Malaria	5.05
Species	6.02	Mekong	4.71	Detection	5.44	Republic	5.59	Impact	4.81
Study	6.02	Republic	4.71	Peoples	5.44	Southeast	5.59	Land	4.81
Peoples	5.74	Democratic	4.52	Virus	5.44	Peoples	4.92	Case	4.57

The subject area of Laos' publications is uneven.

Fig. 3 shows that, as an underdeveloped country, studies towards health and poverty reduction are set as a main priority. To strengthen healthcare service and overcome the severe health crisis, medicine was the most dominant field for Laos' publications as medical research development was supported by evidence-informed policymaking in the healthcare sector and medical education development in Laos [46 - 47]. Moreover, life science studies also received relatively high attention to optimize the nation's income as the Lao economy heavily relied on the agricultural sector [48 - 49]. In particular, several donors, such as Sida, and IRRI-SDC, played a vital role in the development of agricultural research in Laos in terms of poverty reduction and rural livelihood [50].

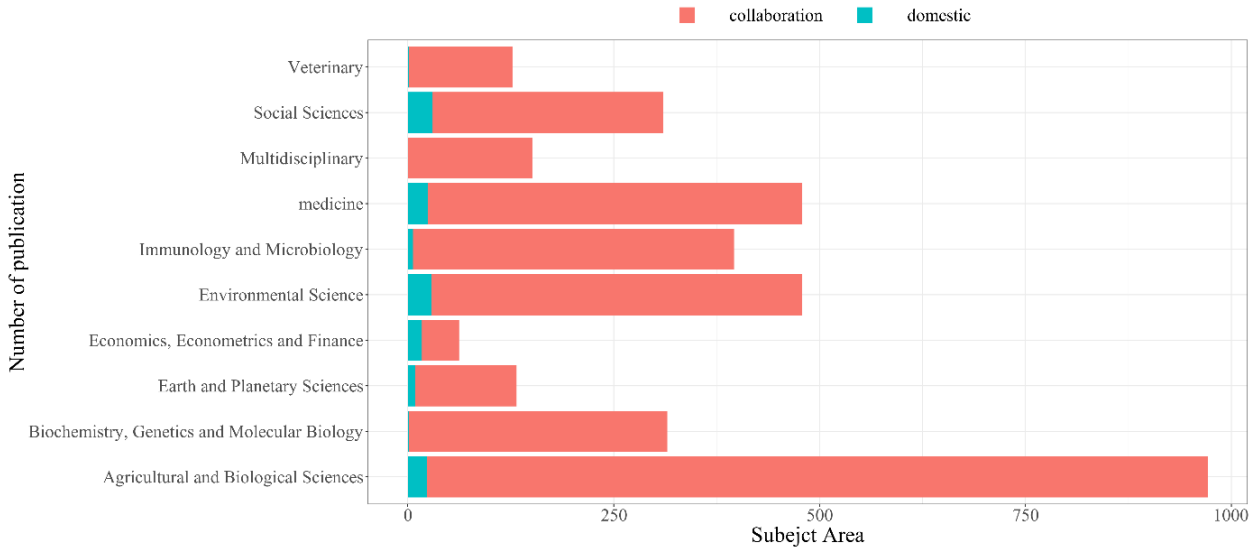

Fig. 3. The articles' output by field.

As the research priority in Laos is embodied mostly in medical and agricultural research, the other fields were given relatively less attention. Only a small number of studies in economics, veterinary medicine, and earth science contributed to the total output. This indicates that such fields receive less priority and support. Consequently, the lack of scientific literature in some underrated fields would be insufficient for effective management strategies such as evidence-based management and adaptive management because the scientific literature plays a key role in such management's implementation. [51 - 54]

The scientific community in Lao PDR is dominated by the health professionals.

Apart from the National University of Laos and the Center of Excellence and Higher Education in Lao PDR [55], most of the research institutes that published Laos' scientific articles were health-related (Table 3). Moreover, medical doctors and health-related professionals published the most in terms of the number of Laos' scientific publications (Table 4). Interestingly, all of the domestic scholars on the list of the most productive authors are working on relevant projects for the medical sector. Furthermore, the support from several donors such as Thailand, the UK, and the US

even intensified the role of medical research. Therefore, the scientific community in Lao PDR is dominated by the health professionals. This is because of the support from internationally funded project to reinforce the livelihood condition of people who are in need such as The Swiss Red Cross, UNICEF, and GIZ, the medical progress have been accelerated and the study of health-related issues have been prioritized [56]

Table 3. The most productive affiliations

Ranking	Affiliation	Country	Number	%
1	National University of Laos	Laos	411	15.42
2	Mahosot Hospital, Lao	Laos	369	13.84
3	University of Oxford	UK	323	12.12
4	Mahidol University	Thailand	322	12.08
5	University of Health Sciences	Laos	282	10.58
6	Ministry of Health	Laos	281	10.54
7	Nuffield Department of Medicine	UK	280	10.50
8	Mahidol Oxford Tropical Medicine Research Unit	Thailand	174	6.53
9	Churchill Hospital	UK	152	5.70
10	CNRS Centre National de la Recherche Scientifique	France	122	4.58

Table 4. The most productive authors

Ranking	Name	**Affiliation**	**No.**	**%**	**h-index**
1	Newton, P.N.	Oxford University, UK	215	8.06	63
2	Mayxay, M.	University of Health Science, Laos	148	5.55	43
3	Preston, T.R.	CIPAV, Colombia	97	3.64	17
4	Phetsouvanh, R.	Mahosot Hospital, Laos	81	3.04	29
5	White, N.J.	Nuffield Department of Medicine, UK	76	2.85	141
6	Sychareun, V.	University of Health Science, Laos	66	2.48	14
7	Blacksell, S.D.	Nuffield Department of Medicine, UK	65	2.44	36
8	Day, N.P.J.	Nuffield Department of Medicine, UK	63	2.36	95
9	Odermatt, P.	Universitat Basel, Switzerland	60	2.25	38
10	Pongvongsa, T.	Savannakhet Provincial Health Department, Laos	60	2.25	19

The scientific research production in Lao PDR is facing limitations.

Due to funding constraints, particularly the payment of article processing fees for most open access journals, many authors, particularly domestic Lao experts, chose to submit their scientific papers on non-open access models (fig. 4). Besides, the lack of high technological skills and research expenditures, extensive human resources, and complicated instrumentation necessitated domestic scholars seeking support from international partners, which led to the medical-related studies towering over the number of Lao's scientific papers. Vice versa, social science was studied the most by domestic authors. Importantly, Siphong [57] and Souriyavongsa et al. [58] suggested that the use of English by Lao students is limited due to a lack of well-trained teachers, insufficient learning periods and curriculum, and an inaccessible learning

environment in some areas of Laos. Therefore, this poses a great barrier to domestic authors' publishing their works in international journals.

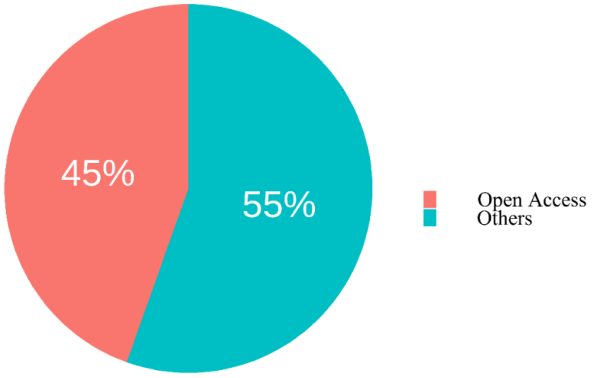

Fig. 4. The model of publishing.

The potential challenges pose a barrier to the scientific publications' development in Lao PDR.

Scientific publications in Laos are gradually growing as a result of enormous support from development partners and the aid community to increase human resource capacity, trading, and skilled labor [59]. Moreover, the New Economic Mechanisms (NEMs) have paved the way for international investment [60]. However, several factors hindering its scientific publication development should not be ignored, especially the socio-economic issue at the heart of the scientific production challenge of Lao PDR. The small population size, a lack of research funding, qualified staff, sophisticated equipment, and domestic research institutions, as well as critical factors such as access, incentive, and adequate foreign language skills, all contributed to the slow progress of research development in Lao PDR [25], [61 - 62]. Moreover, the incentive policies to persuade researchers to conduct scientific research are limited, plus the policies and plans adopted from other countries could not work well in Laos because of the differences in economic, social, geographic, and infrastructure contexts, especially in the cultural context, as there was a significant epistemological gap between the researchers and policy developers. In other words, in situations where the individual researcher's success and ability to produce publications are frequently underappreciated, the authors are unmotivated to conduct quality research [28], [61]. Significantly, the amount of expenditure allocated to education decreased annually and ranked below the global median. It declined considerably from 15.8% to 13.1% from 2015 to 2020 [63]. Moreover, the government's strategies for education development are mostly prioritized minimizing the non-literacy rate, early childhood education, and the quality of teaching rather than conducting research [64]. Therefore, the scientific publication production of Laos appears underrated.

The alarm bell for improving human resources and research capacity is ringing.

The domestic authors tended to submit their works to relatively low-impact journals (Table 5), while the collaboration publications were successfully published in relatively high-impact journals (Table 6). This indicates that domestic scholars should improve the quality of their research to meet the standard of high-ranking journals. This now necessitates improving human resources and research capacity in Lao PDR. To achieve the goals, Chounlamany and Khounphilaphanh [65] recommended that the government of Laos improve the quality of teaching methods, school building, and infrastructure, especially for the teachers who play a major part in the education system by providing them with incentives and motivation. Bounyasone and Keosada [66] further suggested that students should be engaged in all learning processes with the chance to learn new things and express their opinions. The school should be student-centered rather than the old way of teaching, like teacher-centered. Furthermore, while the government of Lao PDR has developed several policies, strategies, and plans to improve human resources, their transparency and predictability need to be improved, especially since corruption is regarded

as a national issue in Lao PDR [67]. On top of that, the capacity for conducting research in Laos needs to be strengthened. To build the capacity of research in underdeveloped countries, Sawyerr [68] suggested that the government should consider two scenarios, including active (skills, abilities, attitudes, and morals of researchers) and the environment (society, institutional, and management). Additionally, Power et al. [69] recommended the government reinforce the graduate study program, strategize effective research management, provide research funding to institutes and academics, and increase access to academic journals. Qualified human resources and strong research capacity contribute significantly to the achievement of the Sustainable Development Goals (SDGs), particularly the quality of education in Lao PDR.

Table 5. The most popular journals published by domestic authors

Source	Nationality	No.	SNIP	h-index	Quartile
Western Pacific Surveillance and Response Journal: WPDR	Philippines	4	N/A	16	Q3
International Journal on Hydropower and Dams	UK	3	N/A	15	Q4
Mountain Research and Development	Switzerland	3	0.687	57	Q2
Asian Journal of Technology Innovation	UK	2	0.549	14	Q3
Journal of Hydrology	Netherlands	2	1.869	226	Q1
Journal of Southeast Asian Economies	Singapore	2	0.532	4	Q3
Livestock Research for Rural Development	Colombia	2	0.578	28	Q3
Malaria Journal	UK	2	1.225	101	Q1
Taiwania	Taiwan	2	0.829	17	Q3
Agris On-Line Papers in Economics and Informatics	Czech Republic	1	0.686	16	Q3

Table 6. The most popular journals published by the international co-authorship

Source	Nationality	No.	SNIP	h-index	Quartile
Livestock Research for Rural Development	Colombia	113	0.578	28	Q3
Plos One	US	108	1.349	332	Q1
Plos Neglected Tropical Diseases	US	68	1.774	135	Q1
American Journal of Tropical Medicine and Hygiene	US	64	1.097	151	Q2
Southeast Asian Journal of Tropical Medicine and Public Health	Thailand	61	0.255	51	Q4
Malaria Journal	UK	48	1.225	101	Q1
Transactions of the Royal Society of Tropical Medicine and Hygiene	UK	29	0.832	105	Q2
Zootaxa	New Zealand	29	1.005	87	Q2
Acta Tropica	Netherlands	25	1.264	101	Q1
Field Crops Research	Netherlands	25	2.354	150	Q1

CONCLUSION

This paper investigates the status of scientific literature in Lao PDR within 25 years (1996-2020) using analyzing the Scopus database and revealing several statuses of Laos' scientific publications through the lens of bibliometrics review**.** This paper proposed several findings, including (1) the scientific publication output of Laos is too small, although it has increased gradually; (2) it is driven strongly by international collaboration; (3) the field research priority is biased and dominated by the health sectors; (4) the scientific publication production is facing several challenges; and (5) the call for improving human resources and building capacity should be addressed to strengthen the scientific publication production in Lao PDR. Therefore, Lao policymakers from both government and non-government sectors should continue addressing and overcoming the challenges regarding scientific publications and disseminating knowledge to the scientific community. This call is especially addressed to many young, talented Lao scholars to publish their works to increase the nation's scientific publication hub.

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Moreover, it is worth acknowledging several limitations of this study. Firstly, the sole use of journal articles from Scopus could not comprehend the total scientific publications of Lao PDR. The use of all publication types and many bibliographic sources will reduce the shortcomings in analysis. Secondly, the subject area identification may appear vague as one paper can comprehend more than one subject area. Thirdly, the quality of the results was dependent on the input data obtained from Scopus, so several errors could appear in the analysis.

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