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The Growing Economic Importance of Medicinal Plants and The Need For Developing Countries To Harness From it: A Mini Review

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Abstract: -The need for self-reliance by developing countries in the prevailing global economic recession as it affects research and development, production, procurement, distribution and consumption of pharmaceuticals is reviewed in this paper. These hard economic realities and the widening economic parity between the high and low income countries have made the later solely dependent on the former for almost all of their pharmaceutical needs. As a result, most, if not all of the developing countries import their medicines from their developed counter-parts, mostly at prohibitive prices and in most cases without regard to the endemic disease conditions associated with such developing countries.
Global statistics has revealed the continued growing economic importance of medicinal plants and plant-based pharmaceuticals which developing countries can harness to improve their pharmaceutical supplies that can impact positively on their healthcare delivery system. This is premised on the fact that most of these medicinal plants are abundantly indigenous in these developing countries that export them at very cheap rates to developed countries only to import pharmaceuticals made from them at very exorbitant prices that most often affect their foreign exchange. It is for these reasons and perhaps among others not mentioned, that this review suggests the need to intensify research into ethno-medicine as this can turn to address the current precarious supply and reduce the burden of import of essential medicines by the developing nations.

Keywords: *Medicinal Plants, "Pharmerging", Healthcare, Low-Income, Pharmaceuticals, .*

I. INTRODUCTION

The importance of medicinal plants to the economy of low-income countries remains critical and strategic because medicines are key to maintaining a health population that drives and sustain the economy. For such low-income countries to attain any appreciable level of self-reliance regarding availability of safe and effective pharmaceuticals use for the management of endemic disease conditions, there must be policy directional change from the present. This change must be considered a priority because of the importance of self-reliance in the current and perhaps future economic and political intrigues by developed nations in the areas of pharmaceuticals. For these to be realized, developing countries must first identify their priorities and also realize the economic importance of medicinal plants that abound within their countries. Advocacy and motivation by policy makers should also be an important agenda that will drive and sustain funding of research on medicinal plants. This will at the long run encourage investors in the area of production of pharmaceuticals to invest their resources. While this will boost the economic status of such low-income countries, it will also improve the healthcare delivery system by making available essential pharmaceuticals at affordable prices to the majority of the population.

The place of plant-based pharmaceuticals in global economy and also as component of healthcare delivery system is critical and this makes research on medicinal plants crucial [1]. However, as Lambo [2] once posited, "the continued existence of fragile and irrelevant socio-political infrastructure is a common feature of many developing countries which has made it difficult for a truly national ideology to take place". Indeed, this observation still remains relevant for low-income countries. National ideology is needed more in the field of pharmaceutical research and development, production, procurement and distribution of pharmaceuticals, given the economic and political relevance of these products that have made the low-income countries entirely dependent on their developed counter-parts for supply of their pharmaceutical needs. The picture becomes clearer and disturbing when one considers that pharmaceutical demands are most often inelastic.
In a critical report, Gunaratne [3], suggested how developing nations can improve their health-care system through introduction of cost-effective measures in procurement of pharmaceuticals by adopting essential medicine list and effective monitoring of their distributions. The same report revealed there was an increase in pharmaceutical products marketed into developing countries most of which were without due consideration to the health needs of such countries, reflecting clear cases of misplaced priority at the detriment of their citizens. This indiscriminate procurement was due to non-availability of policies for procurement of essential medicines,

that give rise to aggressive but effective promotion of all kinds of pharmaceuticals by the sales agents of the multinational pharmaceutical companies based solely in developed countries. Curiously, the promotion of these pharmaceuticals, especially new ones, usually involves amounts that are more than the budgetary allocations to the health sector of these developing countries and cannot be lost in their sales. Such was the case in 1977 that resulted in a high sale of pharmaceuticals to developing countries amounting to the tune of 75 billion dollars (Gunaratne, [3].

Despite this seemingly effective consumption, there was (and still) wide difference in effective economic demand for pharmaceuticals between the high-income and low-income countries. Annual expenditure on pharmaceutical per person was lowest for low-income countries such as Nigeria ($1.2), India ($0.75) and Sri-Lanka ($0.58) as against those of high-income like Germany ($53.4), Japan ($38.5) and USA ($35.10). This clearly revealed the disparity in access to pharmaceuticals between the developed and developing nations, though low-income countries are said to spend more with total pharmaceutical expenditure of 24.9 % on the average, with a range from 7.7 % to 67.6 % [4]. This trend still exists as reports on access to essential medicines in both public and private sectors revealed that the world's population without access remains high, in spite of reducing from 37 % in 1987 to 30 % in 1999.

II. THE NEED FOR PRIORITY EXPENDITURE ON PHARMACEUTICAL CONSUMPTION.

According to Kaplan and Mathers [5], most countries are currently facing a shift in their disease burdens from acute diseases towards one dominated by chronic diseases that has profound implications for pharmaceutical supply and demand. This is more evident in developing countries where there is continued growth in population. Indeed, it was observed that the distribution of pharmaceuticals for communicable and non-communicable diseases within many developing countries makes it inadequate to meet the health care needs of large sectors of the population, due mainly to unavailability of essential medicines [6, 7]

Developing countries have over the years experienced high pharmaceutical expenditures with little impact on the health of their citizens. To halt this unpleasant experience, rational and cost-effective approach to procurement, distribution and consumption of medicines was considered. This, to some little extent, improved the situation in some of these developing countries that led to a reduction in their medicine expenditures. However, some of such low-income countries, mainly from SE Asia, that could not adopt such measures remained with high pharmaceutical expenditures. Such was the case with Bangladesh that had pharmaceutical expenditure of 63 %, Nepal (44.3 %), Thailand (30.5 %), Burma or Myanmar (24.5 %) and India (18.8 %) [8]. Because of this ugly trend on pharmaceutical expenditures, it was advocated that developing nations must not only learn the meaning of self-reliance, but must also effectively put it in practice. This is imperative since majority of people in developing countries use traditional medicine that mainly involve the use of medicinal plants rather than orthodox for reasons of culture, cost and availability [9, 10]. Indeed, the use of medicinal plants is widespread in many developing countries such as Nigeria [11, 12, 13]. This is because many of such developing countries are rich sources of medicinal plants that are potential sources of many pharmaceuticals [14]. A report by WHO showed that in 1999, the 15 % of the then world population who live in high-income countries, purchased and consumed about 90 % of the total medicine by value. This pattern has been consistent with the share of low-income countries falling and that of the high-income countries growing. Indeed, the report revealed that the market share of the USA alone rose from 18.4 % of the world total in 1976 to over 52 % in 2000 while in low-income countries, the share of pharmaceuticals consumed fell from 3.9 % of the total in 1985 to 2.9 % in 1999 [15]. This trend may perhaps partly explain the increase usage of medicinal plants by citizens of low-income countries and the need to explore these resources as a way of growing the economy while improving the pharmaceutical needs of the citizens.

In most developing countries prices of pharmaceuticals are usually unaffordable for the larger proportion of the population to such an extent that the liberty of choice by majority of the citizens becomes restricted.This is premised on the fact that high-income countries presently dominate the global pharmaceutical production with shared value of 89.1 % in 1985 and 92.9 % in 1999 as compared against the combined shared value of 10.9 % and 7.1 % over the same period for low-income countries [16]. This trend has raised serious moral and socioeconomic challenges to policy makers and health professionals in low-income countries. Consequently, most citizens are forced to depend on public health sector for their pharmaceutical needs, but pitifully, such products are always unavailable in spite of promises by policy makers that they will make it available, sometimes to the extent of it being free. The private health sector that is to complement that of the public is most often associated with high cost of services. This therefore explains the recurrent shortage of pharmaceuticals that resulted in circulation of fake pharmaceuticals by unscrupulous agents [17, 18].

Developing nations depend on importation of pharmaceuticals from their developed counter-parts to meet their demands. This has always been inadequate that fails to achieve the purpose. Indeed, the world medicine situation report, 2004 indicated that 188 countries were classified according to their medicine production capability among which only 10 were classified as having "sophisticated industry with significant research". These 10 countries were expectedly the principal sources of new medicine discoveries through the

pharmaceutical companies headquartered in them and also through the large amount of publically funded research. The top companies by value of sales accounted for almost half of estimated world sales for 2001 (173.3 billion USD) out of 364.0 billion USD. Consequently, it is reported that 16 % of the world population living in high-income countries account for 78 % of global expenditure on medicine [6, 19]

III. GLOBAL PHARMACEUTICAL CONSUMPTION

According to reports, large segment of the world's population in developing countries do not have access to essential medicines because the medicines are either unavailable in their respective countries, inadequately distributed or too expensive as a result of high importation cost [20]. This is usually reflected on the consumption pattern of pharmaceutical products between the developed and developing nations [see table 4 & 5]. It was reported that 77 % of the world population (then 5.3 billion) were living in developing countries with a consumption capacity of only 21 % of the world's total pharmaceuticals.This might have been due to high cost of the pharmaceuticals or lack of procurement by governments because of high importation cost. On the other hand, the developed countries with then a population of 1.2 billion (23 %) consumed nearly 95 billion USD worth of medicines as against only 25 billion dollars for developing countries.

The same report indicated that of the world's total population, 1.5 billion in developing countries had little or no regular access to essential medicines. This was in contrast with the situation in developed countries where most, if not all of the 1.2 billion people living there were said to have regular and adequate access to essential medicines. As earlier mentioned, this pattern has been consistent, with shared value of the developed countries increasing and that of the developing countries decreasing. This trend alone must inform developing countries to look inward to exploit the abundant medicinal plants naturally existing in their countries as solution to the precarious pharmaceutical supply. This is because the total number of people without access to essential medicine remains between 1.3 and 2.1 billion and this is particularly concentrated in Africa and India, due mainly to the fact that global trends in pharmaceutical spending and financing has been dismal low in developing countries at less than 4 USD compared to that of developed countries of 400 USD [15].

Several attempts have been made in the past by WHO to narrow the parity that continues to exists between the developed and developing nations. The World Health Assembly (WHA) passed a resolution in 1975 [21] that directed WHO to develop means of selection and procurement of medicines according to the national needs of developing countries. In compliance, WHO to that effect published a first model list in 1977. However, because the first measure could not make the desired impact, another resolution, [22] was passed that saw the establishment of essential medicines (and vaccines) list in 1981 which to some reasonable extent addressed the issue of irrational use of medicines. Nevertheless, these resolutions, good as they were, could not adequately improve the developing nations healthcare system, despite attempts by some of such countries establishing their national medicine policy, as was the case with Nigeria in 1990. This again explains why majority of people living in developing countries do not currently have access to essential medicines despite the continued emphasis by WHO [23, 24, 25, 26]. According to the World Medicine Situation report for 2011, increase in life expectancy, change in fertility and disease risk factor will contribute to a change in pharmaceutical use and health care delivery for some time. The same report opined that the relative contribution of global burden of diseases of HIV/AIDS, of tuberculosis and malaria is relatively low on a global scale [5]. However, it goes on to say that the region input of these three infectious diseases is still huge, specifically in the WHO African Region. The report therefore alerted that the implication for the delivery and use of pharmaceuticals are profound as there will be continuing increase in demand for chronic diseases medicines, regularly provided and use for lifetimes of individuals with these chronic diseases. Indeed global spending on medicines is expected to grow as much as 32 % over the next few years to hit 1.4 trillion USD in 2020 as more than 225 new medicines will be introduced by that year [27]. According to the same report, by 2020, more than half of the world population will live in countries were medicines consumption will exceed one dose/person/day that will total annually to 4.5 trillion doses, up by 24 % from 2015. That will be a 31 % from 2005, thereby making a significant narrowing of the so-called medicines gap between developed and "pharmerging" (developing countries where use of pharmaceuticals is growing rapidly) markets that include nations like China, India, Brazil and Indonesia. These "pharmerging" countries will drive nearly half of the growth in drug spending by 2020 thereby making them attractive for multinational pharmaceutical makers [28]. However, there has been apprehension recently that a deal reached by Canada and 11 other pacific nations on Trans-Pacific Partnership (TPP) could drive up cost of medicines worldwide [29]. Therefore, as has been suggested [30], there is the need for evolving appropriate drug distribution system as a key step towards ensuring effective and affordable drug treatment of many third world countries. It is our opinion that a desired solution to this seemingly perennial problem may lie on the vast but unexplored medicinal plants in developing countries [1, 31]

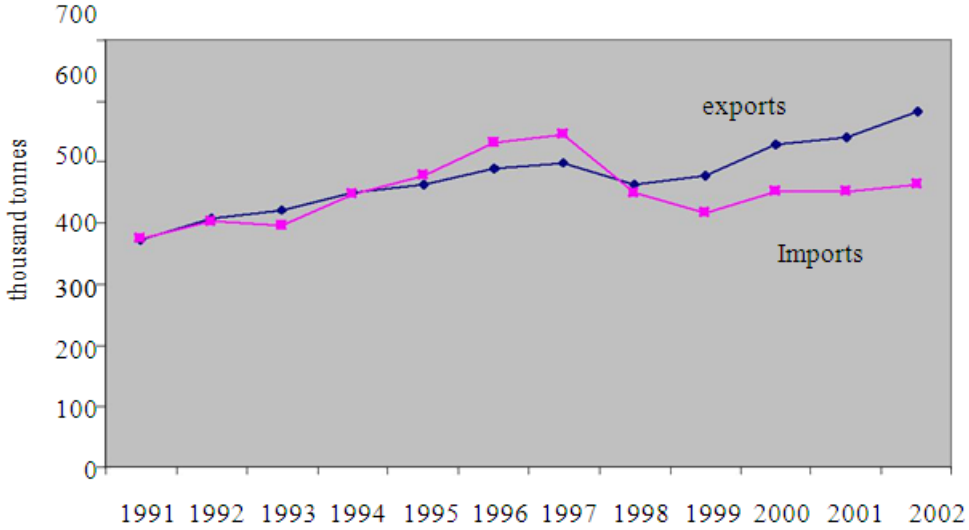
IV. RESEARCH ON MEDICINAL PLANTS ASHEALTH AND ECONOMIC PRIORITY

According to a 2003 WHO report, 30 % of pharmaceuticals sold worldwide contained compounds derived from plant materials as global sales of herbal products totaled an estimate of 600 million USD in 2002

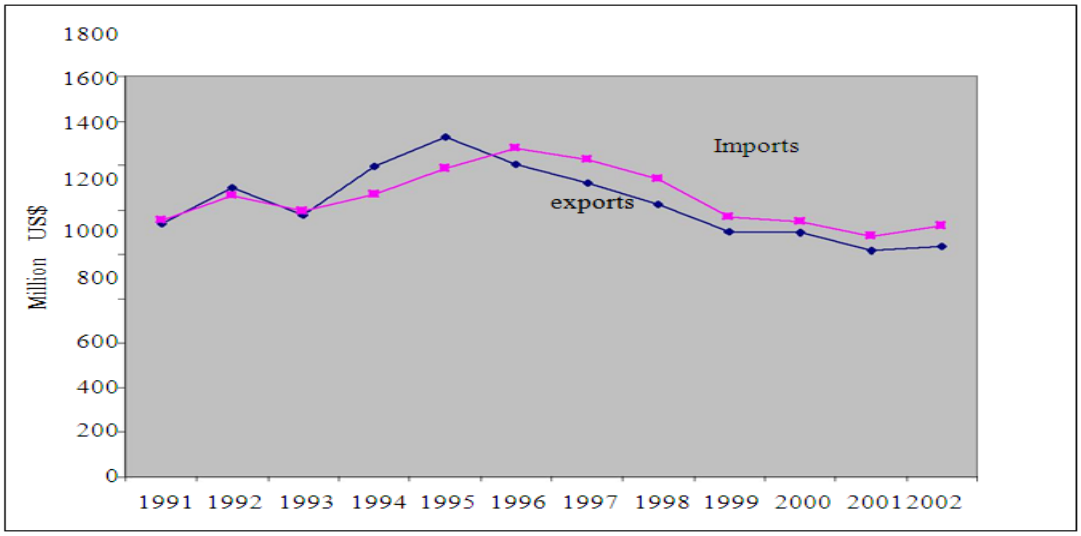
with 80 % of the population in developing countries relying largely on plant-based pharmaceuticals for their healthcare needs. Therefore, the commercial factor in medicinal plant use probably provides the incentive and a key developing strategy that could best safeguard the interest of the low-income countries [32]. As observed by the World Bank [33] and later Hoareau and DaSilva [34], interest in medicinal plants as a re-emerging health aid has been fueled by the rising cost of prescription drugs in the maintenance of personal health and well being and the "bio-prospecting" of new plant-derived pharmaceuticals. In their opinion, and this sounds convincing, medicinal plants will continue to play an important role as health aid based on prevailing research and financial instruments. Indeed, recent and renewed interest in medicinal plants coupled to development in information technology had fueled an explosion in the range of electronic information concerning medicinal plants as a re-emergent health aid. This resulted in a call for screening program dealing with the isolation of bioactive principles and the development of new pharmaceuticals from medicinal plants [35].

Plant-derived pharmaceuticals have been tipped as becoming the next major commercial development in biotechnology because the advantage they offer in terms of production scale and economy product safety, ease of storage and distribution cannot be matched by any current commercial system as they also provide the most promising opportunity to supply low-cost pharmaceuticals to the developing world [36]. In a review, Hefferon [37] fashioned an outline for the next step for plant-based pharmaceuticals to achieve their goals of providing safe, efficacious and inexpensive pharmaceuticals to the developing world, just as Gomez [38] observed that proper use of medicinal plants can bring health and well being. Also, Pamplona-Rogers [39], said that "*medicinal herbs, ignored during some ages and even dismissed in others, have been waiting quietly and patiently for several thousand years for humanity to turn their eyes to them in order to know, to study, to use and to love them"*. A report by FAO [40], succinctly expressed the trends and conditions relating to medicinal plants, their production and market presentation as an initial effect to increase awareness of both the potential and problems associated with trade in medicinal plants

Figure 1. World imports and exports volume of medicinal plants (1991-2002)

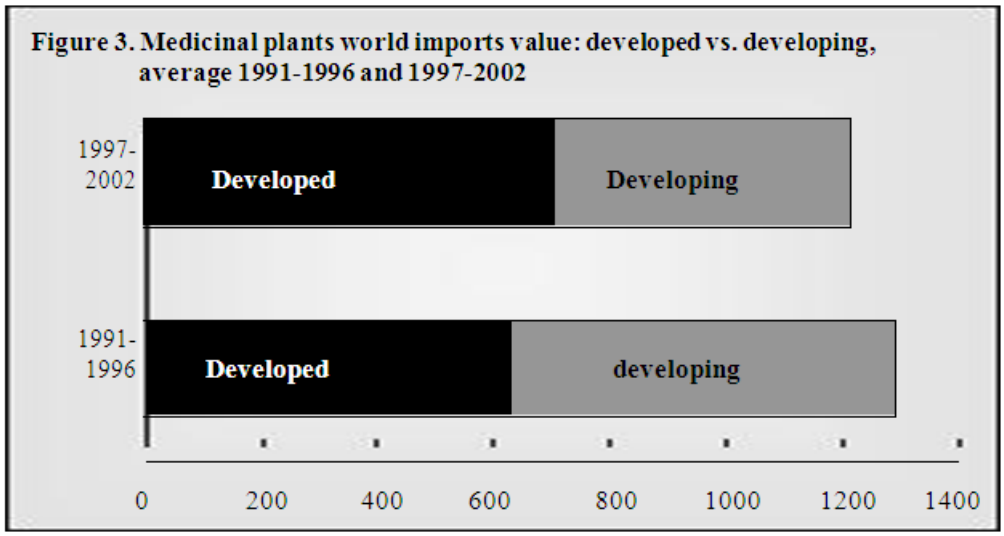


Source: Adapted from ref [40]

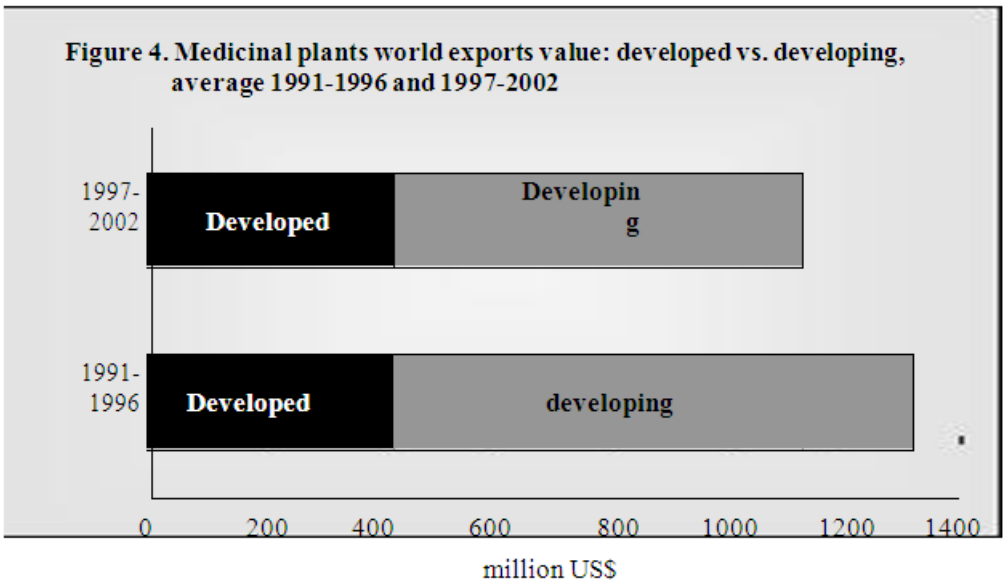


Source: Adapted from ref [40]

Figure 2. World imports and exports value of medicinal plants (1991-2002)



Source: Adapted from ref [40]



Source: Adapted from ref. [40]

Scientists from developing countries need to put more interest and efforts than the present interest in research on medicinal plants, instead of doing so for immediate personal gratification as appears the case currently in many developing countries. On the other hand, policy makers and health administrators should ensure such research works on medicinal plants are given top priorities as suggested by Weniger [41]. This can be achieved by way of legislation, improved public funding and utilization of results from the research works to develop new drugs that the raw materials would be locally source. While this would ensure availability of medicines that will meet the demands, it could also lead to industrial revolution that will improve the economy and health care delivery system [42, 43]. Such a step by the developing countries will no doubt reduce the economic burden imposed by importation of all kinds of pharmaceuticals, some of which are not relevant to the health needs of a large segment of the population [3]

Indeed, a national drug policy that has as a guiding principle the fact that most health problems in developing countries (most of which are within the tropics) are largely infectious will go a long way in addressing the health needs of majority of the citizens. Such a drug policy can hardly be complete, acceptable or economically viable without incorporating medicinal plants [44]. This will be more relevant if the policy encourages practices that are socially blended with the cultural practices of the people [31]. Such has been the case in China where medicinal plants have long become integral parts of the formal health care delivery system and were employed in over 40 % of cases at the primary healthcare level [45]. The need for such a step is more convincing given the fact that 80 % of the world population employs herbs as primary medicines. For over 5 billion people worldwide, natural plant-based remedies are used for both acute and chronic health problems. Consequently, plant-based medicines are said to remain indispensable to modern pharmacology and clinical practice. As succinctly observed by Gunaratne [3], factors such as disease pattern within a given geographical area, economic condition of the countries, strong political will, co-operation between the scientific community and policy makers or health administrators and reduction in over-dependence on imported finished pharmaceuticals, when considered together will adequately address the continued deteriorating health conditions in developing countries. According to WHO [15], it is for this reason and many others that the traditional medicine (TM) program of the WHO is based on the reality that:

i. Majority of the world population depends on TM for primary health care.
ii. The manpower represented by practitioners of TM is a potentially important resource for the delivery of health care.
iii. Medicinal plants are of great importance to the health of individuals and communities.

To underscore the growing economic importance of plant-based pharmaceuticals, it was shown that developed countries dominate their import and export either as raw materials or finished products [see figure 1-4, table 1-3]. It was reported that in 1980, consumers of pharmaceuticals in the USA spent more than 800 million dollars on prescriptions containing active principles of medicinal plant origin [46]. Interestingly, there was an earlier indication of this observation in another report by Farnsworth and Morris [47] that showed that from 1959-1980, 25 % of prescriptions in USA contained plant extracts or their active principles. It was similarly revealed that 119 distinct chemical substances derived from only 91 species of medicinal plants were in use as important drugs in various countries, while about 62 distinct therapeutic categories were distinguished

from such principles [48]. Yet in another finding, Farnsworth [49] reported that of 76 compounds from higher plants usually found in USA prescriptions, only 7 % were commercially produced by total synthesis, thus signifying the need for cultivation and research on medicinal plants. This was corroborated by a report by Principe [50] that showed that imports of medicinal plants and their products worldwide by the USA was estimated at 355 million USD in 1976 which increased to 556 million USD in 1989, thus signifying the growing economic value of medicinal plants. As a matter of fact, global international trade in medicine grew rapidly between 1980 and 1999 from 5 billion USD in 1980 to 120 billion USD in 1999 [15]. Global pharmaceutical revenue from 2008 to 2014 revealed that in 2008 global pharmaceutical revenue was 712 billion USD and in 2014 it stood up at 940 billion USD. This may not be unconnected with herbal medicines becoming more successfully used in treatment of diseases than allopathic drugs as this has reflected in growing trade of herbal medicines [51]. Interestingly, some of the developing countries were among 12 leading countries of exports of medicinal plants classified as "pharmaceutical plants" for the period 1991-2003 [52]

TABLE 1: Top 10 pharmaceutical importing countries in Africa, in US million, 1998

Importer	Industrialized country sources	Developing Country sources	Imports from Developing countries as % total
South Africa	565	36	6.0
Tunisia	164	8	4.7
Nigeria	79	39	33.1
Kenya	78	27	25.7
Uganda	20	34	63.0
Senegal	49	2	3.9
Tanzania	19	22	53.7
Mauritius	32	6	15.8
Madagascar	13	3	18.8
Togo	13	1	7.1

Source: Adapted from ref. [25, 26]

TABLE 2: Global pharmaceutical consumption by countries' level of income, in US$ billion,* 1985–1999

Country Income Level	1985			1990			1999		
	No.	Value	%	No.	Value	%	No.	Value	%
Low	8	3,512	3.9	8	4,675	2.7	8	9,222	2.9
Middle	14	5,884	6.6	19	13,121	7.5	18	18,614	5.9
High	22	79,006	88.9	20	156,578	89.8	22	289,822	91.2
Total	44	88,402	100[1]	47	174,374	100	48	317,658	100

Source: Adapted from ref. [25]

TABLE 3: Global sales of prescription medicines by countries' level of income, in US$ billion, 1990 and 2000

Country income group	Value 1990 US $ billion	%	Value 2000 US $ billion	%
Low (n=4)	1.25	1.0	1.81	0.6
Middle (n=23)	13.21	10.3	29.38	10.4
High (n=25)	113.28	88.7	251.30	89.0
Total (n=52)	127.74	100	282.49	100

Source: Adapted from ref. [25].

TABLE 4: Measured world pharmaceutical spending, by per capita income clusters,1990–2000

Income cluster	Measured expenditure level		Share of world total		Share of Expenditure on health	
	US$ million at exchange rate		%		%	
	1990	2000	1990	2000	1990	2000
WHO Member States	245,000	440,300	100	100	14.2	15.2
High-income	196,019	345,758	80.2	78.7	13.0	13.8
Middle-income	41,916	82,740	17.1	18.8	22.5	24.8
Low-income	6,568	10,675	2.7	2.4	20.8	19.2

Source: Adapted from ref. [25].

TABLE 5: People without access to essential medicines, by countries' level of income

Country income group	Number of countries	Population	Population without access to essential medicines		
		Number (million)	Number (million)	As % of Country income group	As % of global total without access
Low-income	63	3548	1369	38.6	79.4
Middle-income	86	1447	350	24.2	20.3
High-income	34	859	5	0.6	0.3
Total countries and population	183	5854	1724	n.a	100

Source: Adapted from ref. [25].

Therefore, it was observed that the success of any health system depends on the ready availability and use of suitable drugs on a sustainable basis. Medicinal plants have always played a prominent role in healthcare and plant-based medicines are used in all cultures.

In another report by Murray [53], it was shown that in 1990, the world spent close to 1.7 trillion USD on health in low-income countries of the world and yet health provision in such countries are still inadequate especially in the area of medicine supply. For leaders of such developing countries to address these challenges, research on medicinal plants must be taken seriously because most of the medicinal plants have been used by the communities for long with most of their early uses as poisons [46, 54]. With this background knowledge, plants exhibiting poisonous effects need not be abandoned for research since the beneficial and toxic effects are in most cases dose-dependent. Considering the fact that most of these medicinal plants are obtained in developing countries at cheap prices while on the other hand most of the developing countries paradoxically import between 80 % and 90 % of medicines, and even for those manufactured locally, more than 90 % of the raw materials were imported [55]. This also underscores the need for developing countries to intensify research on medicinal plants in order to first check the huge loss due to foreign exchange and secondly to improve the health care delivery system. The urgency for this was indicated in a UNIDO statistic report which showed that as at 1976, among the top 20 world medicine markets, none was from Africa, and only two (Venezuela and India) were from the developing countries. The situation was the same in 1985 when it was shown that USA topped the list for both periods with total sales of 7.96 billion USD (18.3 %) of the world market in 1976 and 26.451 billion USD (28.1 %) in 1985 [56].

It is obvious that priority research on medicinal plants by developing countries could turn out to be the only significant contribution such countries can make to the advancement of health to their citizens and the world in general [57, 58]. This is more convincing when one considers that transportation of medicines following importation from countries with different climatic conditions have been associated with excessive loss of stability and potency of such medicines [59, 60].

V. LIMITATIONS

For this review to be realistically meaningful, low-income countries need to identify and maintain suitable research policies that will be sustainable from both public and private resources. The current chaotic

methods of procurement and distribution of medicines resulting mainly from conflict of interest in areas of priority needs and most often involving wrong personnels with little or no experience in the international pharmaceutical markets constitute a serious problem in the health delivery system. The dimension of political ineptitude characterized by poor legislation on medicines is also a serious hindrance. A system where medicines are only regarded as commercial products that end up in the hands of the few rich, usually questions the rationale of research as policy makers may consider it expensive and time-consuming. As an additional drawback to importation of medicines by most developing countries, issuance of import licenses are usually characterized with fraud and political patronage resulting in the issuance of such licenses to non-trained persons. It is pitifully observed that in developing countries, while competent scientists drawn from mainly the Universities and other research institutes carry out most of the researches, such studies are normally funded and controlled by international donors that usually control the ownership of results from the studies. In some cases, it was observed that the researchers in developing countries are sponsored to carry out the studies in developed countries where the pharmaceutical companies are headquartered because research techniques in developing countries are considered sub-standard or out-dated due to obsolete equipment and low grade experimental animals that make reproduction of results in clinical settings unpredictable [47]. This situation is easily made possible because most government policies on health are not usually stable since the governments of such developing countries usually do not have clear agenda on health. This policy instability coupled with lack of clear-cut legislation usually creates unfavorable climate for investors.

VI. CONCLUSIONS

From the review, it is obvious that there is growing economic value of medicinal plants that the developing countries need to harness in order to improve their economic and health care delivery systems. The "pharmerging" nations appear to understand this economic dynamics and are living up to the challenges. In particular, developing countries from African region need to put in more effort in order to face these health and economic challenges especially in the face of resurgence and/or emergence of resistant strains of pathogenic micro-organisms and cancers that have become serious threat to our collective survival [61].

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