'Commercialising Traditional Medicine': Ayurvedic Manufacturing in Kerala

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This is an attempt to answer two questions on the manufacture of ayurvedic products in Kerala. First, has the performance of the ayurvedic sector been impressive? Preliminary analysis shows that the ayurvedic industry, which has a concentrated market structure, is growing at a much higher rate than that of overall manufacturing. Considering the fact that the ayurvedic medicinal ingredients are sourced differently, namely, from herbal, metal and mineral substances that cannot be industrially manufactured, the second question is: what are the challenges faced by the ayurvedic medicine manufacturing sector? The paper also throws light on the economic relevance of ayurvedic knowledge and how modern firms have amassed it in a competitive environment.

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Ayurvedic practice in modern India reflects a prolonged history of standardisation and professionalisation that transformed certain aspects of this medical tradition. This revival is marked by negotiations and compromises within and outside the system. The process started with educational reform in different parts of the country and lobbying with the central and state governments to divert policy attention towards qualified practitioners of the indigenous systems of medicines. This necessarily resulted in a strong pluralistic health service delivery system, where people have better choice, but under the conditions of unequal power relations between systems of medicine (Prasad 2007). As there has been a steep increase in the cost of health maintenance under biomedicine, the indigenous health systems have become popular and this choice has been bolstered by the global consumer preference towards plant medicine and natural products. In the Indian context of medical pluralism, ayurveda has been seen as an indigenous counterpart to biomedicine, but in the global health market, it is one of the many alternatives to orthodox medicine, namely biomedicine.

In fact, developments in ayurveda during the past two centuries through organised production of medicine, institutionalisation of education and professionalisation of clinical practice have often been parallel to, or a response to developments in biomedicine in India. Manufacturing in ayurveda has passed from small-scale physician outlet to petty/cottage production and later to the industrial scale, emerging as a competing alternative to the biopharmaceutical market.

Earlier, in the initial half of the 19th century, a number of households produced and distributed ayurvedic drugs. But the production and distribution was not based on any pricing mechanism. This means that while raw herbal, metal and mineral products were traded and marketed in a big way, ready-made medicines were never considered as a "commodity" to be marketed for money. The production of medicine was concentrated in and around the physician's residence or locality and the service and production costs were not clearly distinguished. Various reasons, including the inability of the modern system to cater to the healthcare needs of a large number of villages, helped the indigenous systems to remain significant throughout the period. In the mid-19th century, demand emerged for medicines when *vaidyas* responded to the spread of epidemics, especially in the case of cholera and small pox (Varier 2002; Bhattacharya 2001). In responding to these problems in the 1880s bold initiatives were made by some vaidyas to shift from household production to bulk production.[1] The first initiatives in large-scale medicinal production were

seen in the late 19th century in Bengal[2] by Kavirajas (Gupta 1976; Bala 1991; Kumar 2001) and in Kerala by P S Varier (Varier 2002), and later, spread to different parts of the country.

Mechanised production of ayurvedic medicines initiated by the vaidya community was intended to make the medicines more palatable, improve their shelf life, and provide information about the content of medicine in the labels. In the production process, this was accompanied by centralised manufacturing systems and some amount of mechanisation. By the end of the 20th century, the turnover of the industry was more than government funding for ayurvedic and unani education, treatment and research (Bode 2004). We may delineate a second phase of commercialisation of the ayurvedic medical sector in the end of the 20th century, marked by a move from bulk to mass industrialised production. In this later phase, the process was not necessarily under the control of the vaidyas, but with the manufacturing firms. This phase was governed by the dynamics of the market and state regulations on drug development; and at this juncture, clinical testing and usage of scientific methods became a necessity. Today there are hyper modern factories of ayurvedic medicine and the production process is completely mechanised, where the phases of traditional medicine production are no longer visible, though this is not true in the case of numerous small manufacturers.

An analysis of ayurvedic manufacturing industry is germane for the simple reason that we are more or less ignorant about the dynamics of this thriving industry in the 21st century. The pluralistic healthcare market is of great relevance as a strong parallel to allopathic generic medicine market in the contemporary context. But there is hardly any authentic estimate of income generated through ayurvedic manufacturing in India. In this paper, we make an attempt to understand the organised ayurvedic manufacturing sector in Kerala, one of the prominent states, where ayurveda has its lineage. This is borne out by the fact that only 34% of the private medical institutions in Kerala (in 1995) were allopathic medical institutions, while 39% were ayurvedic, and 24.7% were homeopathic medical institutions and the share of other systems of medicine (mostly unani, siddha, etc), marginal (Sankar 2001). Hence, an analysis of Kerala would not be representative of the Indian situation with ayurvedic manufacturing sector, but certainly throws light on the conditions and coping strategies of the industry in a region which is its stronghold.

Due to non-availability of data we have to confine the analysis only to the organised sector (nine out of 12 manufacturing units) during the period 1993-05. The major sources of data for this study are from Ayurvedic Manufacturing Association of India (AMAI), Registrar of Companies, Kochi, Kerala State Industrial Development Corporation (KSIDC), Thiruvananthapuram, Confederation of Indian Industries (CII), Kochi, Drug Controllers' Office, Thiruvananthapuram and administrative documents of ayurvedic firms to name a few, from which we have compiled the information. The rationale for selection of this study period is higher growth, which is visible mainly in the last decade and many major firms have started their operations in the 1990s.

This study is presented in four sections to follow: We start with contemporary ayurvedic market and its nature; the second section discusses manufacturing sector of Kerala and its performance; the subsequent section tries to look into the exports and research and development (R&D); while the final section analyses the product pattern shift and sustainability issues and concludes with our observations.

1 Size, Structure and Product Profile

Ayurvedic manufacturing industry is different from the general pharmaceutical industry in terms of source of knowledge, nature and process of drug discovery, scientific applications, fragmentation of markets, consumer categories and pricing. It shares similarities with the pharmaceutical sector in the case of product innovation, marketing strategies, institutional development and networking. India's pharmaceutical industry is one of the fastest growing segments of the Indian economy with an average annual growth rate of 14% during 2002-05 (Greene 2007). The value of the pharmaceutical market in India was $6 billion in 2004 representing 2% of global market, and ranking fourth in terms of volume and 13th in value (Mani 2006). Though the turnover from ayurvedic sector constitutes meagre in terms of actual, it also holds 2% of the global herbal market. Unlike the biopharmaceutical industry, where we have evidence that within therapeutic category like antibiotics, the degree of concentration is much higher (Chaudhuri 2005), the market concentration is much higher in general ayurvedic sector as well as in the herbal cosmetics category. As shown in Table 1, the industrial scene in this sector has oligopolistic structure with few big firms dominating the market share and thousands of other small firms contributing very little, but having a wider social base.

Table 1: Distribution of 7,000 Ayurvedic Manufacturers in India ($)

Licensed Ayurvedic Units	Turnover
10 large units	> 12.5 $ million (Rs 50 crore)
25 medium units	Between $1.23 and $12.5 million
965 small units	Between $250,000 and $1.25 million
6000 very small units	< $250,000 (Rs 1 crore)

Source: MoHFW (2001).

The leading companies like Dabur, Zandu, Himalaya, Arya Vaidya Sala, Kottakkal (henceforth, AVS) have achieved a significant growth in the last few years. In 2003, among 9,000 ayurvedic firms, a mere 2%, constituted more than 80% of the market share, while the rest of the firms (small/tiny/household) had a smaller percentage, though they have a strong niche market in some regions, especially in rural areas. The smaller firms cater to a large spectrum of population by providing with low cost ayurvedic medicine.

Currently, ayurvedic and unani health and beauty products could be broadly divided into three categories: classical formulations, biomedical providers and consumer brands.[3] The consumer brands (over the counter products) are advertised directly to consumers through public media such as television, newspapers and magazines. In contrast, the biomedical providers are marketed to physicians, pharmacists and chemists. Liv 52, Geriforte (anti-ageing), both from Himalaya are examples for ayurvedic biomedical providers, and in principle, are available only on prescription. Classical products like Chyawanprash, Dasamularishta, Triphala are also marketed directly and purchased without the prescription of the physicians, while some of the lesser known formulations like Praval Bhasma, Chandraprabha, Vatika are

available as per vaidya's prescription. Generally, the proprietary medicines and the beauty products fall into the category of consumer brands and seem to be fast moving in the world market.

There is, however, a very thin line between the three categories and quite often manufacturers shift their products between them. A case for this is Pudinhara, a remedy for gripe, stomach aches, gas and indigestion, has recently been converted by Dabur from biomedical provider category to the consumer good category, because of its huge production costs, and now it is widely advertised through popular media. On the other hand, the same product may be positioned differently by different firms. For example, Chyawanprash is a consumer good for Himalaya, but a biomedical provider for Dabur and a classical medicine for AVS.

A comparative structure of ayurvedic and biopharmaceutical industry shows that product pattern is different in both the systems. Biomedical industry is also dominated by small firms in the category of bulk drugs[4] and vaccines and large firms are concentrated in the formulation type. In Table 2, "branded products" include both consumer good category and biomedical provider category. With AVS as an important exception, branded products dominate the sales of other firms. Within the firms there are some leading products that generate the highest income for the firm.

Table 2: Break-up of the Product Sales of the Four Large Ayurvedic Firms (in %)

Manufacturers	Dabur	Himalaya	Zandu	AVS
Consumer brands	97	100	80	None
Classical products	3	None	20	100

Source: Bode (2004).

In the current situation, most of the companies target the external market through new marketing techniques and shift in product profile to suit the global demands. Dabur attributes its growth over the last decade to the sale of its products via wholesalers in specific markets as large as the Netherlands and Greece. And now the company moved from the traditional ayurvedic status and to branded products and its product profile is like this: Dabur hair oil, Lal Danthamanjan (tooth powder) are the major items ($67 million) of the family products and the Chyawanprash and Hajmola, digestive Pudinhara include in the healthcare products ($60 million) and the ayurvedic basic medicines are the minor category of the product sections.

2 Performance Analysis in Kerala

Kerala is considered to be the home of traditional ayurvedic system, with a rich biodiversity and natural ingredients based on plant species. Kerala has the second largest number of ayurvedic manufacturing units (12% of total manufacturing units) next to Uttar Pradesh. In Kerala, AVS medicinal unit, established in 1903, was the pioneer in mechanisation and bulk production as solution to the constraints in the steady supply of medicines. While P S Varier did not envisage total centralisation of ayurvedic medicinal production, he thought it necessary to have regional centres that would supply good quality medicines to all practising physicians in the area. The developments in ayurvedic pharmacy during the past half a century focused on the enhancement of potency, changing the form of medicine (for instance, decoctions into tablets) and improving palatability. AVS initiated the mechanisation era with the initiation of AC generator in 1949 and a counter line grinding system with 12 grinders in 1952.

Table 3: Sample Firms – Ownership and Market Share

Sl No	Firm	Ownership	Market Share, 2005 (%)	Market Share, 1996 (%)
A.1	AVS	Private trust	33.02	33.33
B.1	Kerala Ayurveda, Ernakulam			
B.2	Oushadhi, Thrissur	Public	11.79	10.01
C.1	Nagarjuna Herbal Concentrates			
C.2	Vaidya Ratnam, Thrissur			
C.3	Santhigiri			
C.4	SD Pharmacy			
C.5	Pankajakasthuri			
C.6	Sitaram Ayurvedic Pharmaceuticals	Private	27.37	26.63
	Other small manufacturing units	Mostly private	27.82	30.03
Total			100	100

Source: AMAI (2006).

The sample consists of the firms under different types of ownership such as public limited, private limited and private trust. Of these, AVS constitutes more than 33% of market, while the public sector firms contributed less than 12%.

Today, almost all leading ayurvedic firms have their outlets throughout Kerala, but each firm has created its brand loyalty and niche market in particular regions within Kerala: AVS in north Kerala (Malappuram, Kasargode, Palakkad); Sitaram, Arya Vaidya Pharmacy and Vaidya Ratnam in Thrissur-Ernakulam belt; and Nagarjuna herbal concentrates in south Kerala (Ernakulam and southward), SD Pharmacy, Oushadhi and Pankajakasthuri cater to all regions of Kerala. Though concentrated in structure, it is important to note that in Kerala, medicinal production constitutes bulk of the ayurvedic manufacturing sector unlike other states, where nutraceuticals and cosmetics have the dominance. Ayurvedic manufacturers in Kerala could be broadly categorised under the following three types:

(1) Household level, small manufacturing centres run largely by vaidyas to serve the village needs. These are largely self-regulated entities, growing on the basis of the track record and credibility.

(2) Large-scale units solely manufacturing ayurvedic medicines as per the texts. Many a times, these companies draw upon traditional knowledge and selectively adopt modern technology to attain growth.

(3) Firms, which mainly concentrate on the nutraceuticals[5] and cosmetics along with medicines. However, they face regulatory problems.

The second type is the most common in Kerala though the third type of firms is new and emerging. While considering the organised large manufacturers of the second and third category, market structure is basically one of monopolistic competition because largely, each firm adopts similar range of products except for some difference in the formulation or the combination in the products. The price system is also very competitive and less barrier to entry. We have instances of huge success of several ayurvedic formulations, which are promoted as nutraceuticals like Kamilari liver tonic, Kandamkulathil Eladi Lehyam and Benatone. The prevalent practice in the industry is a large number of classical/proprietary products, in which a small addition or omission has been made from the original formulae. The alteration in the classical formula makes the product branded (case of Chyawanprash).

The third category of branded products is also poised for growth in Kerala. For instance, in the case of Pankajakasthuri, in

2000, about 92% of the total sales were shared by Pankajakasthuri medicine (granules for breathing disorders) and Illogen Excel, an anti-diabetic medicine. But the market pattern has changed towards cosmetics; Kaveri fairness cream suddenly rose to the second largest product, with 28% share of income while medicine, Illogen's share declined to 21% from 47% in the year 2002. Pankajakasthuri granules and tablets were popularised under a new name Breathe Easy, and has retained a sales turnover of Rs 2.92 crore. This is an evidence of the sudden shift in emphasis from medicine to cosmetics.

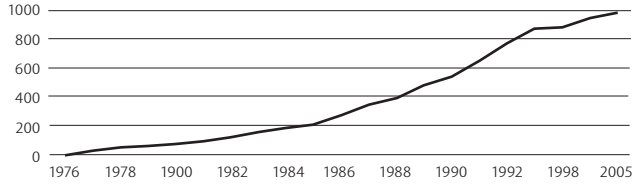
The Drugs and Cosmetic Act (DCA) of 1940 is silent on this emerging class of branded products, while they are widely used by the people.[6] This allows companies to escape the regulative hurdles of efficacy and toxicity tests; further, when they are promoted as nutraceuticals they fall into the lower tax category.

2.1 Macro Trends: Status, Profitability and Growth

There has been a sustained growth in the number of ayurvedic manufacturing units and in 2005 (Figure 1), it stands as 986 and the state comes next to Uttar Pradesh in the national scene. Recently there has been a decline in the number, but the established firms improved their market share. Districtwise data of ayurvedic firms shows that concentration of industry in the state is especially in Thrissur. There are 195 manufacturing units (more than 20% of the total) in Thrissur, because it is the home-ground of the *Ashtavaidya* families[7] who continue to exert a strong influence here and Vaidyaratnam, a major firm is connected to Thaikkattu Moosath, one of the Ashtavaidyas. Kollam and Ernakulam follow Thrissur with 121 and 112 units, respectively.

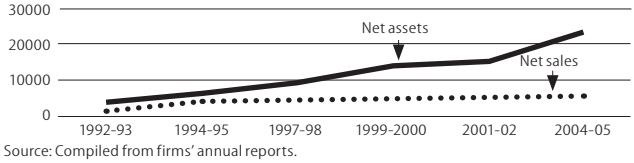
The overall trend with regard to sales is upbeat. For the whole period, sales recorded a compound growth rate (CGR) of 14.6%. During this period of analysis, there were two price revisions by the industry. First was in 1998, around 3% hike in the price level and second 9% in 2002. But the price revision did not seem to have an impact on the demand for the medicines as evident from the growth rate of over 12% in the second period. Moreover, the

Figure 1: Organised Ayurvedic Manufacturing Units in Kerala 1975-05 (in number)



Source: Drug controller's office, Thiruvananthapuram.

Figure 2: Trends in Net Sales and Net Assets (in lakh)



Source: Compiled from firms' annual reports.

period saw the entry of innovative ayurvedic non-drug products into the market, which was largely advertised in the popular media. Demand was created by the specific promotional techniques in the upper middle class, and in a short while these proprietary drugs[8] became blockbuster products of the companies (e g, Kaveri fairness cream, Anoop herbal oil and Kamilari liver tonic). In 2004-05, the sampled firms' data showed, the total sale were around Rs 300 crore approximately and constituted less than 10% of Indian market. The trend in net assets was almost stagnant after an initial increase.

Despite the constraints like increasing raw material expenditure, firms like AVS, Vaidyaratnam and Oushadhi have made significant profits. Value addition to total production in terms of factor incomes and other payments in the total value of output reveals a fluctuating behaviour, with an increase from 1993 to 1995 and then a stagnation from 1995 to 1998 then a fall till 2000 and again an increase, over time it has been hovering in the range of

Table 4: Profitability Ratios

Year	Gross Profit (In Lakh)	Net Assets (In Lakh)	Net Worth (In Lakh)	Return on Net Assets (%)	Return on Net Worth (%)	Return On Capital Employed (%)
1992-93	303.79	1,502.39	341.86	20.22	88.86	19.35
1994-95	531.50	4,291.16	769.50	12.39	69.07	11.50
1997-98	628.71	4,332.53	1,397.51	14.51	44.99	14.94
1999-2000	887.14	4,355.64	1,609.83	20.37	55.11	16.12
2001-02	742.78	5,253.24	1,446.09	14.14	51.36	10.76
2004-05	1,012.45	5,638.75	1,621.06	17.95	62.45	14.61

Source: Compiled from annual reports.

Table 5: Share of Ayurvedic Industry in State Manufacturing (in %)

	Fixed Capital	Productive Capital	Value of Output	Depreciation	GVA	NVA	Net Profits
1992-93	0.262	0.461	0.523	0.177	1.174	1.316	0.886
1994-95	0.296	0.981	0.744	0.562	1.544	1.656	0.974
1997-98	0.288	0.381	0.517	0.394	1.537	1.720	1.595
1999-2000	0.401	0.638	0.580	0.555	1.804	1.989	0.789
2001-02	0.426	0.783	0.712	0.741	2.319	2.621	1.212
2004-05	0.509	0.739	0.703	0.679	2.752	3.138	1.614

Source: Compiled from ASI and firms' annual documents.

50-55%. But, if we look into the trend of both the production and net value addition (NVA) separately, it is of an increasing trend and NVA-output ratio shows a marginal increase.

Table 4 gives the trend in the profitability ratios[9] of the ayurvedic industry. All profitability ratios declined in 2001-02 after an improvement in 2000, which shows that the rate of growth of profit is less than the growth of assets and net worth. But again, there is a spurt of growth in all the ratios in the recent years. The decrease in the total profit earning is due to the fact that some firms have made loss intermittently due to managerial inefficiency. But the recent data shows that in the year 2007-08, Kerala Ayurveda Limited (KAL) has recovered and made a net profit of more than Rs 4.5 crore[10] and that its annual revenue has crossed Rs 10 crore.

Table 5 analyses the significance and contribution of ayurvedic industry in the manufacturing sector of Kerala, using ASI data. The share of major variables like gross output, NVA and gross value added (GVA) has improved over the years. Data reveals that ayurvedic industry is contributing around 2.75% to the GVA and 3.13% to the NVA to the manufacturing sector, while the gross output comes around 0.70% of the manufacturing sector. Share of fixed capital shows an increasing trend moving from 0.26% to 0.50%, productive capital increased from 0.4% to 0.9% in 1995, and declined to 0.73% in 2004-05. This is due to the fluctuation in the share of working capital and it is improving in the recent years. The increasing share of NVA and other variables in the state manufacturing shows increased significance of this industry over

the last decade. Growth rate of these variables gives a clear picture (Table 6).

During 1992-93 to 2004-05, all variables of ayurvedic manufacturing are showing a much higher growth rate and consistency. But when we divide period into two, first time period shows the same trend except for productive capital and value of output. But in the second period, i e, 1999-2000 to 2004-05, there is a decline in the growth rate of the ayurvedic sector as compared with first period; however, the sector experienced much higher growth than the factory sector. Incidentally, this is a period in which Kerala's manufacturing sector suffered a severe crisis, but the ayurvedic industry has performed decently and more consistently throughout the period, it is visible that net profit of the ayurvedic sector is much higher than that of manufacturing sector. Thus the reduction in the growth rate during the second period may be due to an overall industrial slowdown.

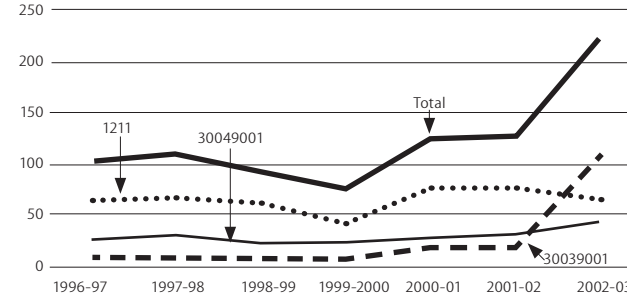
It is necessary to mention here that the crucial moves to consolidate achievements in the ayurvedic medicinal products sector and to support large number of manufacturing firms were made from 2000 onwards. The formation of the Confederation for Ayurvedic Renaissance-Keralam (CARe-Keralam)[11] is one such development. The objective of this consortium was to promote Kerala as a global destination for sourcing ayurvedic products and services of internationally acceptable standards. The consortium also facilitates the creation of common facilities for raw material supply, quality control laboratories, R&D facility and positioning Kerala Ayurveda as a brand. This and several initiatives have had major implications for Kerala ayurvedic sector.

3 External Sector, R&D and Standardisation

3.1 Exports of Ayurvedic Products: India

An estimate (Gautam et al 2002) shows that about 84% of the domestic market for Indian system of medicine is for ayurveda, 13% for homeopathy and 3% for unani and siddha. Here, the export data available with Directorate General of Commercial Intelligence and Statistics (DGCIS) (eight-digit level) has been used to understand the quantum of ayurvedic and unani exports, and they are listed under three heads. They are: Code 1211: Plants and parts of plants including seeds and fruits used for perfumery pharmacy or similar purposes, 30039001: Ayurvedic and Unani medicines (medicaments consisting of two or more constituents, which have been mixed together for therapeutic uses for bulk sale) 30049001: Ayurvedic and Unani medicines for retail sale.[12]

Figure 3: Export of Ayurvedic Categories from India (1996-97 to 2002-03)
(Exports of ayurvedic and unani products ($ million))



Source: DGCIS, Ministry of Commerce, Government of India.

Ayurvedic and unani products for bulk sales (i e, 30039001) have gone up in a substantial scale in the past seven years. It has marked 39% growth during this period, more than 5% annually. The highest point of growth occurred in 2002-03 due to an increased demand for ayurvedic products in the United States (US). The export to the US has gone up from 10% to more than 65% per year. This put the US as a major trade partner of India in the traditional medicine export front. Recently, Nepal has also emerged as a major destination with more than $5 million. Trade of medicines for retail sale added significantly to this with a growth of 7%.

In the case of plants and plant materials (Table 7), the growth of export is not very encouraging. This reflects the difficulty faced by many firms to get adequate and non-adulterated plant material for the production of medicines and other herbal products. Concerns about the depletion of biological diversity due to overharvesting and urbanisation is another factor. The US is the major export destination for plant materials as well, with more than 40% of the exports.

The export of ayurvedic medicines for retail sale has shown substantial growth and shift in the export destinations. The United Kingdom (UK) and the US replaced Russia and Nepal in the case of retail ayurvedic products. Still Russia remains the single largest importer with more than $45 million in international market.

The biopharmaceutical industry in India has attained significant growth in export market owing to high drug prices in the west. India's pharmaceutical exports grew from $1.9 million in

Table 6: Ayurvedic Industry and Kerala Manufacturing Sector – Growth (in %)

	Fixed Capital	Productive K	Output Value	Depreciation	GVA	NVA	Net Profits
CGR 1992-93 to 2004-05							
Ayurveda	8.32 (35.94)	7.54 (29.53)	8.53 (39.49)	20.55 (67.00)	8.96 (38.71)	8.77 (38.10)	5.26 (22.55)
Manufacture	2.92 (24.27)	3.70 (29.40)	6.08 (33.37)	8.70 (41.38)	2.04 (13.04)	1.74 (11.88)	0.51 (32.19)
CGR 1992-93 to 1997-98							
Ayurveda	13.85 (41.70)	11.35 (41.36)	7.32 (21.78)	28.02 (60.34)	9.49 (26.74)	9.24 (26.18)	3.96 (14.59)
Manufacture	12.07 (39.17)	14.93 (47.83)	7.54 (33.45)	12.00 (42.65)	4.68 (16.03)	4.46 (14.53)	-5.75 (26.40)
CGR 1999-2000 to 2004-05							
Ayurveda	3.55 (10.48)	2.51 (10.71)	6.45 (19.66)	10.37 (28.80)	6.58 (19.23)	6.49 (19.12)	3.18 (14.75)
Manufacture	-0.50 (3.47)	0.02 (0.43)	3.06 (13.95)	6.73 (19.31)	-0.66 (3.88)	-1.31 (6.01)	-8.42 (32.54)

Number in parentheses is coefficient of variation.
Source: As of Table 5.

Table 7: Major Export Destinations in Plant and Parts of Plants (in $ million)

	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	CGR
Total	66.87	68.52	63.88	44.18	78.24	77.78	69.05	65.75	61.66	79.29	1.72
USA	28.25	37.97	27.85	17.69	31.02	37.19	27.1	24.39	22.85	29.71	0.51
UK	4.07	3.21	3.61	1.67	3.93	2.7	3.5	2.46	2.5	2.57	-4.49
Germany	5.91	4.15	3.21	2.48	3.26	2.1	2.76	2.96	2.72	3.81	-4.30
Spain	0.87	0.84	1.55	1.04	0.94	2.4	3.43	4.58	3.05	3.11	13.59
Pakistan	1.57	1.33	1.37	1.66	1.78	1.06	1.17	1.24	2.07	5.76	13.88
Japan	2.6	3.32	2.36	3.58	4.34	5.46	6.21	4.32	2.89	3.66	3.48

Source: DGCIS, Ministry of Commerce, Government of India.

1999 to $5.2 billion in 2005 with a trade surplus of $3.8 billion and the vast majority of India's exports, are mainly to developed economies of the west, particularly the US, Germany, the UK and Russia (28%, 10%, 8%, 11%, respectively). On the other hand, most of the ayurvedic exports from India are in the form of food supplements, toiletry products and cosmeceuticals. This is because of the non-acceptance of ayurvedic medicines and drugs for want of data on its scientific proof[13] and efficacy standards. Presently, countries like Malaysia, UAE, Switzerland and Singapore have accepted manufactured ayurvedic medicines from India, subject to safety and efficacy tests. But the US does not consider these drugs as medicine but as "dietary supplements". The label has to explicitly state that they are not intended to treat any disease, nor been evaluated as a drug by the country's Food and Drug Administration. Large manufacturing units in the ayurvedic sector are concentrating on single drug formulations that are easy to validate rather than formula drugs, whose multiple ingredients make them difficult candidates for testing and validation. This is likely to result in a major shift in the composition of ayurvedic formulations.

3.2 Kerala and the International Market

In Kerala, a strict demarcation under the categories like consumer brands, biomedical provider brands and classical medicines is not available, and most often, the boundaries between these categories are very fluid and artificial since there are no official rules, which tie a product to a particular category. Manufacturers move goods freely from one category to another.

Table 8: Export of Major Ayurvedic Firms in Kerala
(2002, in Rs lakh)

Firms	Export	Sales	Export Intensity
Kerala Ayurveda Limited	150	1,200	12.50
AVS	100	6,200	1.61
Arya Vaidya Pharmacy	48	1,500	3.20
Pankajakasthuri	160	1,400	11.43
Nagarjuna herbal concentrates	17.38	1,400	1.24

Source: Balance sheets and EXIM Bank.

The markets for cosmeceuticals and the nutraceuticals are increasing in the foreign countries, and hence, many medicine-producing firms diversify their products to nutraceuticals. Pankajakasthuri and Oushadhi are examples for this. The main export destinations of Pankajakasthuri Herbals Limited (PKHL) are Malaysia, South Africa and the west Asia. United Arab Emirates (UAE) is emerging as another major destination, having recently recognised ayurveda as an official medical system. Nagarjuna's export has increased from Rs 17.38 lakh in 2002 to Rs 39.42 lakh in 2003, which accounts for a plus 100% growth rate. AVS has an export of Rs one crore only (mostly service exports) because their main products contain materials, which are banned under the Convention on International Trade in Engendered Species of Wild Fauna and Flora (CITES) agreement.[14] Otherwise, the company, which has a huge share in Kerala, could have earned more foreign exchange in the form of food supplements. KAL is rapidly expanding its export market in Europe, west Asia and the US addressing the growing popularity of ayurveda. Most of the company's products are exported as herbal and dietary supplements except one proprietary drug that is exported to Japan and has entered the Russian market recently with Chyawanprash.

3.3 R&D and Standardisation

It is evident that in the hi-tech industries like pharmaceuticals, the R&D, innovation and growth is linearly related (Mazzucato and Dosi 2006). This is of major concern especially for companies, which produce cosmeceuticals and nutraceuticals because, market for beauty and dietary product exports are highly responsive to quality and innovation.

In Kerala, the R&D in ayurvedic industry is mainly concentrated on: (1) clinical research, (2) process-related research, and (3) medicinal plant research. Clinical research is aimed at evolving new methods and procedures for dealing with acute ailments such as cancer, AIDS and rheumatic arthritis. Process researches broadly cover activities like bioactive research, standardisation of medicinal formulations from classical ayurvedic texts and development of new products. One important factor that hinders drug invention is the high cost of R&D and clinical trials. On the other hand, in "nutraceutical" category, clinical validation is not mandatory and a clearance from local authority is required. Besides, as an OTC product it could be priced high. Therefore, the incentive for converting medicine into nutraceutical is common.

Ayurvedic firms encourage research on standardisation of ayurvedic medicines, biochemical analysis of medicines with an objective to identify the active ingredients and clinical trials of new and old medicines. AVS has recently set up a Medicinal Plant Research Centre to satisfy a long-felt need of an institution for conservation and study of medicinal plants used in ayurveda in collaboration with national and state Medicinal Plant Boards. AVS has research connections with institutions like Council of Scientific and Industrial Research (CSIR), International Development Research Centre (IDRC). AVS and Pankajakasthuri signed an agreement with Tropical Botanical Garden and Research Institute (TBGRI). Arya Vaidya Pharmacy, Coimbatore collaborated with National Health Institute of the US for clinical evaluation of specific ayurvedic therapies.

AVS' R&D expenditure increased from Rs 13.19 lakh in 1992-93 to Rs 42.79 lakh in 2001-02. But their R&D intensity is less than 1%, this is a rate less than half the amount invested in R&D by the biopharmaceutical firms on an average in India (Nair 2003; Green 2007). Formation of the department of ayurveda, yoga, unani, siddha and homeopathy (AYUSH), Medicinal Plant Boards, traditional knowledge digital library (TKDL)[15] and Golden Triangle Partnership (GTP) scheme of department of science and technology (DST), CSIR and ICMR are important developments in the recent past. So far, the government of India has invested Rs 106.40 crore as its share under this programme and the industries have contributed Rs 154 crore making a ratio of 1:1.50.

Currently, there is no organisation or government body that certifies labelled ayurvedic products. Without proper quality control (QC), there is no assurance that the herb contained in the bottle is the same as what is stated on its outside label. Process and product validation and, safety and toxicity tests remain as major problems in securing a breakthrough in the European and American market for ayurvedic medicine. Research institutions are trying hard to hike the export market for ayurvedic drugs by creating a uniform process, which does not vary from batch to batch. For compound drugs, it is very difficult to find therapeutic

quality of every ingredient and their joint action. Chemical finger printing mechanism up to three ingredients is possible, but quite difficult. Most of the ayurvedic medicines contain more than three ingredients, as for example, *Dasamoolarishtam*, a preparation of 10 constituents that make testing jointly impossible. Thus the standardisation of ayurvedic formulations is ridden with several questions about its purpose.

4 Sustainability Question

4.1 Financing Pattern of Firms

Sustainability of funds is a major factor for firm's growth. There are three sources of funds, viz, equity share, loan funds (can be secured or unsecured) and reserves and surplus. Internal funding rose through equity and reserves and surplus, are considered to be more dependable sources than external funds through loans that entail high interest rate. But secured loans from the reliable financial institutions would not be a problem. Data reveals that there is an increasing move towards more internal funds among companies like Oushadhi and Santhigiri. In contrast to Santhigiri, Sitaram and SD are very less dependent on internal funds. Though in the initial years, Pankajakasthuri depended on loans, now the major portion of its funds comes from reserves and surplus. Companies like Nagarjuna, Oushadhi and KAL are generally more dependent on loans from institutions like KSIDC and banks.

4.2 Raw Material Linkage and Vertical Integration[16]

Kerala medicinal plant market has developed in tandem with the number of ayurvedic manufacturers. This is evident from the uninterrupted supply of raw material to the major ayurvedic manufacturing units. The ayurvedic pharmacies of Kerala use around 500 plant species for medicinal formulations. Around 95% of these medicinal plants are directly collected from the wild and in the rest, 20 species are under large-scale commercial cultivation. Secondary studies show that the price elasticity is positive for major medicinal plants demanded by ayurvedic firms.

The Marshallian demand curve (i e, higher the price, lower the demand) is not applicable for medicinal plants market. Apparently, the huge demand for medicinal plants is unresponsive to price changes. So to reduce the cost of production, firms adopt the strategy of vertical integration of raw material. Since there is no increase in the natural supply, there is a shift in the sourcing of raw material. Table 11 gives the direct relation between price and quantity demanded. All figures in the price elasticity column are showing an increasing non-availability of many medicinal plants. Unsustainable collection in many places and encroachments into the forest land have led to the extinction of many rare species. Scarcity of different plants has led to substitution of other parts of the same plant; similarly adulteration with plant species of same organoleptic properties or the same vernacular name.

The large expenditure on raw materials, especially medicinal plants (sample data shows it is 41%) shows how the ayurvedic sector and the medicinal plant sector are linked. That means the cost of medicinal plants has a bearing on the growth and profitability of ayurvedic industry. In Kerala, major medicinal plant markets (transactions) are in Thrissur, while Thiruvananthapuram, Palakkad and Ernakulam have minor markets. For Pankajakasthuri and other south Kerala-based pharmacies, the tribal belt of the southern parts of the Western Ghats are the major providers of medicinal plants, particularly from the areas like Palode and Kottur. As there are a large number of middlemen in the medicinal plants supply chain, the share of collectors or growers seems to be very less and it works as a negative incentive for medicinal plant conservation. This adds to the cost, without any addition to the output value (Harilal 2004). AVS mostly depends on conventional age-old suppliers (contractors) for the past few decades. But of late, the conventional suppliers have not been able to meet the increased requirements because of the phenomenal surge in the quantity demanded and the non-availability/extinction of some of the raw materials. In case of Oushadhi, National Agriculture Cooperative Marketing Federation of India (NAFED) is a major source of obtaining raw materials. The linkages of the ayurvedic manufacturing units with tribal cooperatives and other traditional collectors provide livelihood for thousands of people.

Though the manufacturing units in Kerala depend on outside suppliers, the major dependence is still within Kerala. Around 45 pharmaceutical units are linked to private suppliers, but the number of the tribal cooperatives is quite low. Tribal cooperatives are connected with only six to seven manufacturing units (Harilal 2004); in the absence of linkage with the tribal federations, the concern is that commercial suppliers from outside the state are likely to take control of herbal resources. This call for a rearrangement of the supply chain is an efficient way though the in situ character of the plants restrains this possibility.

Table 9: Share of Internal Funds (in %)

	Oushadhi	KAL	Nagarjuna	Santhigiri	Sitaram	SD	Pankaja-kasthuri	Vaidya Ratnam (VR)
1992-93	43.2	79.35	29.21	–	67.84	36.17	–	32.39
1994-95	44.4	92.81	76.22	99.53	54.8	97.88	–	48.76
1997-98	97.19	51.54	50.42	96.99	87.46	15.6	35.83	42.72
1999-2000	na	43.58	50.34	95.56	31.35	15.5	72.9	36.79
2001-02	na	37.69	57.16	96.73	31.57	22.84	76.84	31.66

Source: Compiled from firm's annual reports.

Table 10: Secured Loan to the Loan Funds (in percentages)

	Oushadhi	KAL	Nagarjuna	Santhigiri	Sitaram	SD	Pankaja-kasthuri	VR
1992-93	90.65	100	93.49		78.98	0		98.43
1994-95	90.62	100	96.70		87.81	0		4.01
1997-98	100	77.325	90.05		82.81	88.00	93.96	0.74
1999-2000		74.36	88.57	100	92.84	76.62	100	
2001-02		72.46	89.06	100	89.76	57.49	100	

Source: Compiled from firm's annual reports.

Table 11: Market Analysis of the Major Medicinal Plants

Name of the Plant	Quantity Demanded (in Tonnes)	Price Elasticity of Demand	Scarcity Ratio (Ratio of Availability to Needed)
Sida spp (*sida*)	608	0.54	2.79
Tinospora cordifolia (*gunduchi*)	282	0.35	0.00
Terminalia chibula (*black myrobalau*)	164	3.31	-3.20
Withania somnifera (*ashwagandha*)	149	0.60	-4.02
Adathoda sp (*adathoda vasica*)	141	1.46	-1.60
Cedrus deodara (*Himalayan cedar*)	138	1.98	-3.80
Woodfordia frutisoca (*shiranji tea or dhataki*)	123	0.42	-5.16

Indian names are given in the brackets, Sida is the common name of sida spp (Spp means more than one species).
Source: Devi and Joseph (2003).

5 Conclusions

The ayurvedic sector is undoubtedly emerging as medicine-centred as opposed to its basic orientation that was patient-centred, characterised as the pre-eminence of the "pharmaceutic episteme" (Banerjee 2002). Our paper substantiates this trend with regard to the state of Kerala. It is evident that as an industry, ayurveda has huge potential, but what industrialisation of medicinal production will do to the system of medicine, however, remains to be examined.

This study suggests that the growth of ayurveda in comparison with the manufacturing sector of Kerala is promising with high level of growth and consistency in net profit, value of output and NVA. The fast depletion of medicinal plant is a major concern, and higher vertical integration is required for sustaining this industry by reducing the transaction cost.

In short, ayurvedic manufacturing has better prospects with the present growth provided that, there are higher incentives for R&D, sustainable use of raw material, further linkage with medicinal plant cooperatives and successful cluster promotion. A major concern is the change in product pattern and importance given by most of the firms towards nutraceuticals and cosmetics, and the failure of regulation systems, which may hamper the spread of ayurvedic therapeutic tradition and its clinical value in future. Conscious efforts are, therefore, required to promote the therapeutic aspects of ayurveda as a system, so that it can emerge as a distinct contender in the pluralistic healthcare market, rather than a supplier of some "safe" herbal remedies for the international market for complementary and alternative medicines.

NOTES

1 Here petty production means, the physicians owned the means of production and there was use of (unpaid) labour of family members. The scale of production was small and there was little capital accumulation, but the producers received some remuneration to cover the cost of production.

2 Vaidya Gangadhar Ray in Bengal was inspired by the increasing demand for ayurvedic drugs, set up a large-scale manufacturing unit in 1884 called N N Sen and Company (Gupta 1976). By 1900, the demand for ayurvedic drugs had increased sufficiently to occupy a fair share in the country's drug market (Kumar 2001).

3 Classical formulations are based on ayurvedic treatises, which include traditional medicinal formulations like arishtams, asavams, ghruthams, lehyams, thailams, and choornams. Consumer brands are beauty products and nutraceuticals developed by the firm based on recipes or ingredients listed in the ayurvedic texts. Biomedical providers are medicinal products for biomedical disease categories developed by the firm drawing from textual indications. Ayurveda's science of substances (padartha vignana), however, does not view substances in terms of one active ingredient; rather identify several properties of each of the ingredients listed that will contribute to the formula's efficacy.

4 Bulk drugs are defined as the active chemical ingredient in powder form used for the production of pharmaceutical formulations. Formulations are medicines ready for consumption by patients, sold as a brand or generic product as tablets, capsules, injectables, or syrups. Formulations can be subdivided into two categories: generic drugs and branded/patented drugs. Vaccines are generally made from an infectious agent or its components – a virus, bacterium, or other microorganism – that is killed (inactive) or live attenuated (active, although weakened).

5 Nutraceuticals are those products, which have its origin in traditional medicine, are used as food and include in the category of food supplements, functional foods and food for special dietary purposes.

6 DCA, 1940 specifies that an ayurvedic drug is a medicine "intended for internal or external use for or in the diagnosis, treatment, mitigation or prevention of disease or disorder in human beings or animals and manufactured exclusively in accordance with the formulae subscribed in the authoritative books of ayurveda specified in the act". It lists 54 texts, including Charakasamhita.

7 Ashtavaidya families are ayurvedic physicians well-versed with knowledge on eight branches of ayurveda.

8 Proprietary/classical medicines, strictly speaking are not patented medicines. Proprietary medicines are medicines of "known composition", bearing trade mark names, given on prescription and distributed to the medical professionals. Patent/branded medicines are of "unknown composition" bearing trade mark names and advertised and sold directly to the consumer.

9 Since it is quite possible for variations to exist between the return to total resources and owned resources, we use two profit ratios: return on capital employed and return on net worth. First ratio arrives at a calculation of return independent of the composition of capital in terms of own and borrowed funds. The latter provides a yardstick for measuring the rate of return on the shareholders own capital represented by paid-up capital and reserves.

10 Information availed from KAL website http://www.keralaayurveda.biz (Viewed on 28 July 2008).

11 CARe-Keralam (Confederation for Ayurvedic Renaissance-Keralam) is formed under the auspices of Kerala Industrial Infrastructure Development Corporation (KINFRA) and KSIDC, with the help of major manufacturers of Kerala.

12 The categories, 30039001 and 30049001 are not available from 2004, as they have dropped from DGCIS.

13 The European Union rules suggest that the herbal products are required to be in traditional use for the last 30 years of which, 15 years should have been in EU itself. The 15-year use period in any EU country seems to be an unrealistic expectation given the fact that the original use of the traditional product is in some other country.

14 To ensure, international trade both sustainable and in accordance with national legislation, member countries of the CITES have also established international trade controls for some Asian medicinal species.

15 The basic idea of TKDL is to make all documented information on ayurveda available to patent examiners so as to prevent grant of patents on non-original inventions and to retrieve about 35,000 formulations of ayurveda, 30 ayurvedic experts and scientists and five patent examiners have provided the expertise for setting up of the facility and AYUSH works as a nodal agency.

16 Vertical integration is the degree to which a firm owns its upstream suppliers and its downstream buyers. It is typified by different aspects of production managed by one firm (e g, growing raw materials, manufacturing, transporting, marketing and/or retailing).

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