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**WILLIAM DAVIDSON INSTITUTE**  
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## **25 YEARS OF MARKET-BASED SOLUTIONS**

**ARTICLE SERIES**

# 25 Years of Health Product Supply Chain Reform: Market Forms of Organization versus Public Ownership

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# 25 YEARS OF MARKET-BASED SOLUTIONS

## ARTICLE SERIES

*A failed coup attempt in August of 1991 left former Soviet leader Mikhail Gorbachev's power irreparably damaged and he resigned in December. The Soviet Union crumbled and Boris Yeltsin took over in Russia where, in the beginning of 1992, he lifted most of the remaining price controls.<sup>i</sup> In 1991, India's economy was, as one author put it "on the brink of collapse."<sup>ii</sup> That year, PV Narasimha Rao took over as prime minister. Rao and his Finance Minister, Manmohan Singh, are credited with putting reforms in place that would fundamentally change the economic landscape in India. Deng Xiaoping engaged in a series of speeches designed to ensure the continued economic liberalization within China,<sup>iii</sup> and a 1992 vote in South Africa ended Apartheid and created a multiracial government. This was also the year that William Davidson established the William Davidson Institute (WDI) at the University of Michigan. Much has changed in the years since WDI was first established, but the Institute continues its commitment to the mission William Davidson laid out 25 years ago: "to equip economic decision-makers in...emerging countries with the tools of commercial success."*

*This is one of a series of articles, collectively titled "25 Years of Market-Based Solutions," that presents an overview of the activities and research that has taken place over the past 25 years in Health Care Delivery, with an eye toward what we can expect in the coming years.*

—Paul Clyde, WDI President

i [www.washingtonpost.com/archive/politics/1992/02/28/russia-set-to-remove-most-price-controls/b8f4237f-34e7-49c5-bcb5-a743dbf3d1d3/?utm\\_term=.2156d93c3745](http://www.washingtonpost.com/archive/politics/1992/02/28/russia-set-to-remove-most-price-controls/b8f4237f-34e7-49c5-bcb5-a743dbf3d1d3/?utm_term=.2156d93c3745).

ii [www.qz.com/799883/how-narasimha-rao-fixed-the-indian-economy-and-the-congress-party-only-to-be-forgotten](http://www.qz.com/799883/how-narasimha-rao-fixed-the-indian-economy-and-the-congress-party-only-to-be-forgotten).

iii [www.ft.com/content/a1b03b56-f33c-11e0-8383-00144feab49a](http://www.ft.com/content/a1b03b56-f33c-11e0-8383-00144feab49a).

## 1.0 Introduction

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Strong supply chains are essential to effective health care delivery and form the backbone of a country's health system. In Organization for Economic Cooperation and Development (OECD) countries, health product supply chains are largely market-oriented, including countries which have a health system that is largely or exclusively publicly funded and operated. Supply chains for health products are complex everywhere. More stakeholders, greater public scrutiny and need for equity mean that no health product supply chain is perfect. With the exception of stock-outs more recently, supply chains in OECD countries work reasonably well in ensuring consistent availability of high-quality medicines and other health products. In contrast, health supply chains in most low- and middle-income countries are fraught with persistent problems of poor availability and stock-outs. Improving health product supply chains has now become an important component of development assistance for health, and discussions abound regarding the use of market-oriented organizational forms versus state ownership of health product supply chains.

As part of the William Davidson Institute's celebration of 25 years of market-based solutions, this paper reviews the changes that have taken place in health care supply chains in low- and middle-income countries over the years, with an emphasis on the role of market-based solutions.

This paper has two objectives: (1) to provide an understanding of the evolution of health product supply chains in developing countries over the last 25 years, and (2) to highlight areas where market-oriented reforms have succeeded or failed in improving supply chain performance. It is based on a review of peer-reviewed and policy/practitioner literature on health product supply chains.

We define "health supply chain" as the network of entities that plan, source, fund, and distribute products and manage associated information and finances from manufacturers through intermediate warehouses and resellers to dispensing and health service delivery points.

Reviewing developments in healthcare supply chains is an enormous task. This paper focuses primarily on the supply chain for health products with significant population health benefits. It highlights only developments that were most relevant to an enhanced market-oriented focus of the health product supply chain.

## 2.0 Basics of Supply Chain Organization in Developing Countries

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Before delving into the last 25 years' trajectory of supply chain reform, it is important to start with an overview of how health product supply chains are organized in developing countries.

In most developed countries, a few privately owned national wholesalers/distributors distribute a wide assortment of pharmaceutical products from multiple manufacturers to clinics, hospitals and pharmacies. Such wholesalers make deliveries to retail pharmacies and hospitals several times a day. There is a very well organized flow of information and financing among the retail pharmacies, insurance companies (or agents who negotiate on their behalf), wholesalers and manufacturers.

Unlike in OECD countries, in low- and middle-income countries health products are distributed by a combination of government, non-profit and for-profit actors. **Figure 1** illustrates commonly observed structures. In low-income countries, especially in sub-Saharan Africa, the predominant distribution model for government-funded medicines is government ownership and management of the supply chain, including procurement/purchasing, warehousing, distribution and transport to hospitals and primary health clinics. Typically, a government-owned agency known as the central medical store (CMS) with its underlying regional, provincial or district-level stores and a government-owned transport fleet are the main entities involved in the supply chain (Yadav and Smith 2013).

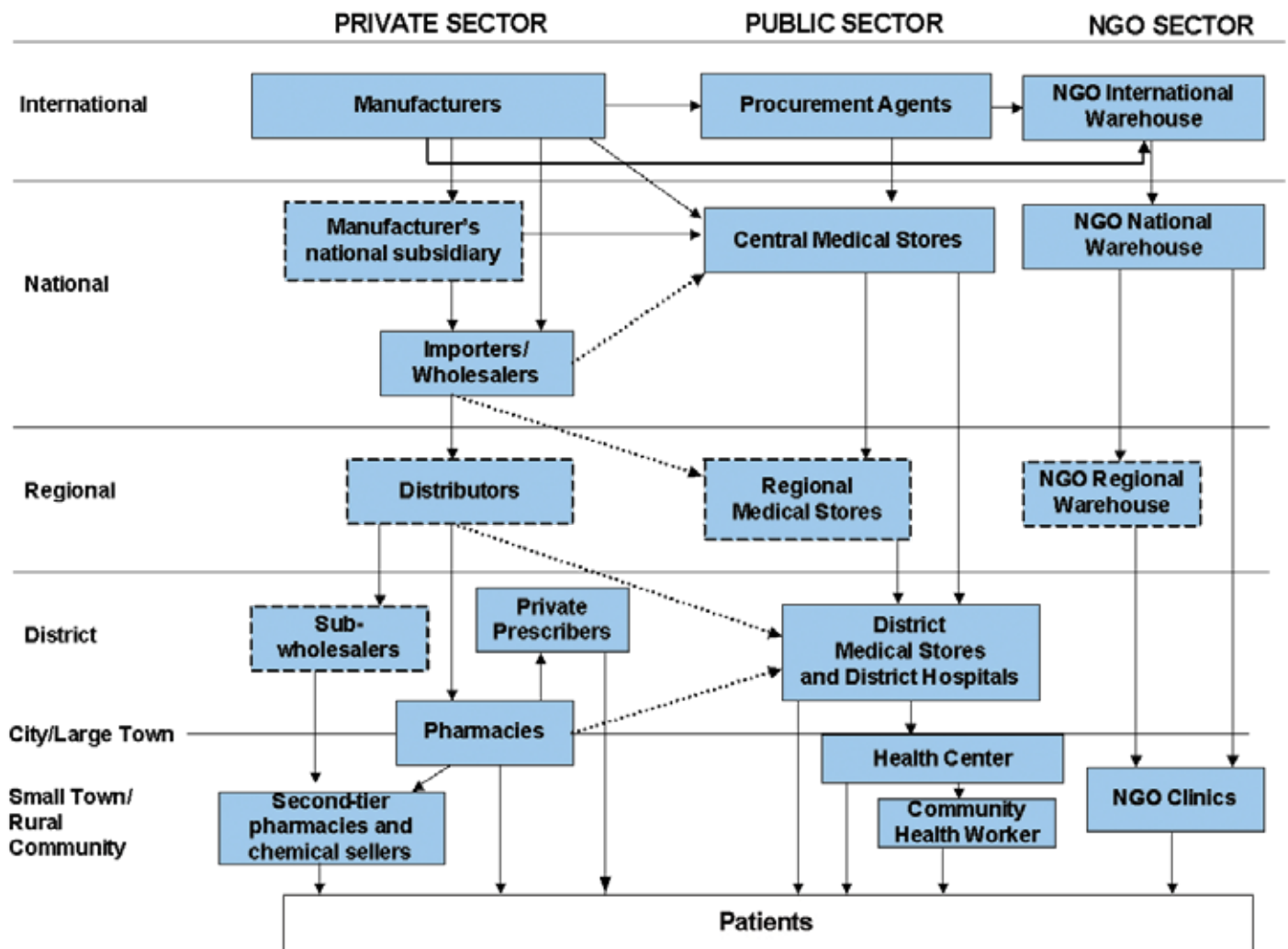
## 3. Key Developments in Health Product Supply Chains pre-1990

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### 3.1 Public ownership in newly independent states

Several countries in Asia and Africa became independent in the 1960s and almost all of them organized their health supply chains (and health systems) with a strong inclination toward public ownership. Independence and socialism were intrinsically connected in the independence movements of most former European colonies. From India to Ghana, Tanzania and many other countries, it was believed that capitalism was too complicated a system for a newly independent state and that private enterprise could quickly derail the vision of the leaders of independence. This meant healthcare delivery, including medicines distribution, was part of large government-sponsored social infrastructure improvement projects, often with worthy goals but limited resources and management capacity. The now common Central Medical Stores model of the supply chain was born in this context (Vogel and Stephens 1989; Yadav, Tata, and Babaley 2011; Blaise et al. 1998). Alongside government-sponsored health delivery infrastructure improvement projects were mission hospitals and clinics run by faith-based groups. The faith groups providing healthcare in underserved areas also organized themselves into the equivalent of today's group purchasing and distribution organizations (Vogel and Stephens 1989; Blaise et al. 1998). Some attempts were starting

**Figure 1:** Supply chains for essential medicines in developing countries (Yadav, Tata, and Babaley 2011)



Source: Prepared by Authors.

to take shape in the form of more organized international assistance to developing country governments for their health sector programs but, by and large, governments of developing countries managed their own health supply chain systems.

### 3.2 Evolution of social marketing as a discipline

While medical care and provision of medicines and other health products remained largely public in most newly independent countries, the provision of contraceptives for population control started looking at private channels for distribution since the mid-1960s. Post-independence India's economy was based on the premise of allocation of state resources through central five-year plans. These plans recognized that rapid population growth would adversely affect the rate of economic advancement and the rate at which essential social services could be provided to the population. Population control through contraception was included as a key developmental priority very early (circa 1950-1960) in India's central plans but its provision required reaching people through other channels (not government-run hospitals and clinics). In 1961 the government of India, in collaboration with the School of Management at MIT and the Ford Foundation, started the Indian Institute of Management in Calcutta (IIM-C). During its initial years, several prominent MIT faculty were visiting professors at IIM-C. Peter King was a visiting professor at IIM-C who, in 1965, with assistance from the Ford Foundation, USAID and the Swedish International Development Agency (SIDA), created a plan for distributing and promoting the use of condoms through existing private sector channels in India (Harvey 1999). In addition to marketing and supplying through private channels, they developed a strategy for distributing free branded condoms to government health centers. Overall, this created a stronger focus on understanding and developing distribution systems for healthcare products. In particular, it led to the birth of "social marketing," relying on already-existing commercial networks of distributors and retail shops to provide products for better population health (Harvey 1999).

In parallel, Philip Kotler and his colleagues were working to find ways to apply their work on marketing as a technology to non-economic settings and to address social issues (Elliott 1991; Cheng, Kotler, and Lee 2011). Social marketing formally began as a discipline in 1971 with the publication of "Social Marketing: An Approach to Planned Social Change" (Kotler and Zaltman 1971). After the early success of the first large-scale contraceptive social marketing program in 1967, the idea took form as relying on an established commercial partner (supplier or distributor) who is provided with incentives (e.g. marketing support) to start stocking and selling a product with social benefits, but who continues to operate as an independent, commercial, for-profit player.

Social marketers were the first market-oriented supply chain specialists in the health sector. In order to create a system that works in balancing price, margins and channel incentives to promote the product, many of them studied the distribution chain—retailers, wholesalers, distributors—in great detail.

### 3.3 Emergence of global programs with strong activities in supply chain and logistics

In 1968, the still relatively new U.S. Agency for International Development (USAID) started purchasing contraceptives to distribute in developing countries. This created a supply chain where procurement was carried out internationally and distribution was carried out using a government-owned system. Therein originated the need for “supply chain technical assistance.” USAID slowly started organizing programs to provide technical assistance for demand forecasting, inventory management and stock reporting to countries that received USAID-procured contraceptives. Accounts about the nature of this support vary and literature on it is scant, but early technical support was focused mostly on needs reporting and supply status, as these were the key tenets of the accountability required by the U.S. government.

In 1974, the World Health Organization’s Expanded Program on Immunization (EPI) was set up (Keja et al. 1988). Its goals of vaccinating against tuberculosis, polio, diphtheria, tetanus, pertussis and measles required strong vaccine delivery systems. Many of the efforts of the EPI program included activities that today are called supply chain management. WHO-EPI staff and their country counterparts worked on establishing the national cold chain systems, managing logistics from capital city to vaccination points in rural and urban areas, and training mid-level managers, supervisors and field workers.

### 3.4 WHO, essential medicines programs and pooled procurement

Newly independent countries in Africa and Asia lacked the infrastructure or human resources to ensure the quality of medicines that many of them largely imported. In response to this, the WHO started a “certification scheme” in 1969 with the objective to encourage good manufacturing practices (GMP) and ensure the quality of the global drug supply (Yudkin 1978).

Later, some WHO member states raised issues about poor availability and prohibitive costs of drugs impacting their drug budgets. In 1978, the WHO started the essential drugs program, which was based on the three key tenets that 1) governments centralize drug purchases at the national level or, in the case of countries with small populations, at the regional level; 2) governments order drugs deemed essential to primary health care and hospital care; and 3) as important purchasers of a limited list of generic items, governments take advantage of competition on the international market by issuing tenders (Reich 1986, Turshen 2001; Foster 1991).

Motivated by these developments and the premise that pooling volumes, or bulk purchasing, can help obtain lower prices, many countries and some regions started national or regional drug procurement initiatives. In Central America, an essential drugs revolving fund known as FORMED was created in the mid-1980s to carry out pooled procurement for many countries in the region. Around the same time, small island states in the eastern Caribbean established the

Eastern Caribbean Drug Service (ECDS). UNICEF also developed a system of bulk purchasing of pharmaceutical and medical supplies to secure the lowest prices and offered them as a catalog supply service to countries.

### **3.5 Global pharmaceutical companies' engagement model**

During the colonial period and immediately following independence, some global pharmaceutical companies such as Sanofi, GSK and Pfizer had established some limited presence in the form of commercial offices and the occasional manufacturing plant in some developing countries (Foster 1991, Steenkamp 1979, Lambert 1967). The predominant model of participating in these markets was selling to a few large hospitals and high-end retail pharmacies located in affluent urban areas, as health infrastructure was so weak in rural areas that there was very limited demand. Panadol, Fansidar and few other OTC branded generics were exceptions to this rule. Most companies did not have a full-fledged distribution operation in the countries but worked with importing agents who carried out sales, marketing, credit collection and distribution on behalf of the company for a margin of the price.

### **3.6 Bamako Initiative, charging for pharmaceuticals and decentralized procurement**

During the 1970s and early 1980s, some practitioners and experts began to realize the challenges of centralized financing and procurement. The government purchasing and distribution entities (CMS or other) relied primarily on budget allocations from the government. Budget outlays were often less than what was needed and there was a gross mismatch of what was expected of these government medicine supply departments and what was possible with the finance actually provided. Many developing-country economies were largely informal and the governments had control over only a small part of the economy. They had limited ability to effectively allocate resources for carrying out functions such as providing medicines as universally as their political leaders claimed in promises to their constituents. Even when financing was available, it was disbursed late due to bureaucratic delays.

In 1987, UNICEF launched the Bamako Initiative, under which the served population shares the cost of obtaining drugs and health services that they obtain at government primary health facilities (Kanji 1989; Vogel and Stephens 1989). The facilities obtain these drugs from a revolving drug fund and procurement agency at a wholesale price and sell them at a nominal markup, and international donors subsidize part of the costs, if needed. The idea was adopted by many countries in sub-Saharan Africa. Foreign currency fluctuations (due to most drugs being imported) and slow flow of money from peripheral health facilities to the central procurement agency meant that drugs were not always available. Because of this, peripheral health facilities then started using the money they collected to purchase drugs from private wholesalers and retailers. As the revenue of health facilities was derived from drug sales, they had the incentive to prescribe more, and the underlying perverse incentives worked



against the principle of rational drug use (“Managing Drug Supply” 1982). Some also argued that this situation worked against the principle of equity, as the poorest paid for the provision of drugs and health services for all (Lancet 1988, Kanji 1989).

### **3.7 Local manufacturing of medicines**

In the 1980s many developing countries had shown interest in developing their domestic manufacturing industries. India, Egypt, Cuba and a few other countries had established their domestic manufacturing industry with state subsidies in the first two decades of their independence and this was providing an impetus for countries in Africa and Central Asia to follow suit. Interestingly, the development of domestic pharmaceutical industry did not have the same political/economic impetus as other more labor-intensive industries with unskilled or semi-skilled jobs, where country governments gained political capital from greater employment (Reich 1986). The pharmaceutical industry is not labor-intensive and instead is skill- and capital-intensive. Neither of those key inputs were in abundance in many of the countries that were pursuing this agenda. Nevertheless, having a local pharmaceutical industry was considered an important pre-requisite for affordable healthcare by many countries, even if the drugs produced were not cheap or of high quality. A few UN agencies, most notably the United Nations Conference on Trade and Development (UNCTAD) and UNIDO, started projects to facilitate knowledge transfer and skill building in this area. This development led to shift of scarce public investments away from improving the asset infrastructure for stronger supply chains to publicly funded manufacturing units. Literature in the 2000s demonstrated that each country manufacturing its own medicines in fact hurt the patients in the country, as prices were higher (Kaplan and Laing 2005). However, this continues to be an area of debate in this field.

### **3.8 Some early research interests**

Growing interest in this field took researchers with training in quantitative methods to study medicine procurement, distribution system, and inventory systems in low-income countries. Notable figures were Hogerzeil, Quick, Foster, van der Geest and others who studied government-run (or faith-based-organization-run) medicine distribution systems in specific countries (Hogerzeil and Lamberts 1984; van der Geest 1982; Foster 1991). Many also tried to use scientific methods for forecasting, inventory management and product selection and also to comment on reasons for dysfunctionality.

### **3.9 Slow realization of the X-inefficiency associated with government ownership**

Slowly there was a realization that assumed benefits of government bulk purchasing and government-run distribution were not realized in practice, due to the lack of competitive pressure and other issues related to X-inefficiency (Vogel and Stephens 1989; see Leibenstein 1966 for X-inefficiency). Cameroon lost 5% of medicines in its central medical stores due to poor storage conditions and expiration resulting from poor inventory control (van der Geest 1982). In 1984, Guinea estimated a loss of 70% of the government’s drug supply between the central medical stores

and health centers (Turshen 2001). Numerous such reports started coming out that highlighted how government procurement and supply systems were not functioning well (Vogel and Stephens 1989, Lambert 1967).

## 4.0 Health Product Supply Chains circa the 1990s

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### 4.1 Beginning of supply chain management as a discipline

The 1990s marked the beginning of supply chain management as a formal discipline, both in practice and in academia. Prior to this, both business logistics and operations management were the terms used to describe what we now call supply chain management. Two trends fueled this. Firstly, the emergence of personal computers in the 1980s allowed huge improvements in planning the flow of materials and solving optimization problems, as supply chain software platforms became widely available. Such platforms until then had largely been the privilege of academic labs.

Second, the growth of global trade, especially manufacturing in China, highlighted the need for people, processes and technology to deal with complex product, financial and information-flow networks spanning multiple firms located in different countries. Latin America, China, south Asia and southeast Asia integrated into the global supply chain early, and along with the integration came the rapid development of supply chain skills and know-how within the countries. New consulting practice areas emerged, new degree granting and executive education programs were developed, and large multinational companies created supply chain training programs for their staff located at every node in their global supply chain. However, Africa and central Asia remained largely disconnected from this new wave of interest in developing global supply chains. As a result, investments in skills and know-how were almost nonexistent.

### 4.2 Outsourcing discrete supply chain functions to NGOs or private companies

Outsourcing discrete supply chain functions to third-party logistics companies had gained ground and become an almost established practice in most large commercial companies by the 1990s. Cost, efficiency and return on asset expectations had incentivized commercial companies to outsource the asset-heavy areas of transport, warehousing and distribution to third-party companies. This trend also started getting realized in some limited way in healthcare supply chains in developing countries.

Bangladesh was an early example where the government outsourced the transport of family planning commodities. The government realized that substantial savings could be obtained if the government-owned and -operated fleet of vehicles was replaced with a third-party company that would achieve better cost efficiency.

There were also examples where outsourcing had led to very poor outcomes due to a lack of companies with adequate governance, fiduciary robustness, technical know-how and capital/infrastructure that governments could outsource key supply chain functions to. Anecdotal examples of wrongful outsourcing in Zambia and other places created a high degree of risk aversion toward such approaches.

As capable third-party companies with the right financial and technical muscle were in short supply, the form of outsourcing that was seen usually involved outsourcing select management functions of government assets in warehousing and distribution to international NGOs and development organizations like Crown Agents. This was usually part of a package of assistance by Nordic donors, and in some cases the World Bank, to improve the capacity of central medical stores.

### **4.3 Recognition of private retail supply without any focused programmatic attention**

There were bodies of work that demonstrated that large fractions of the population obtained their medicines from private retail drug shops (Vogel and Stephens 1989, Foster 1991). However, the consensus was that such drug shops were run by unqualified persons who sold expired and adulterated drugs. Some policy makers argued that the prices charged by retail pharmacies (and the wholesalers who supplied them) were exorbitant and this channel was not worth investing public (global or country) dollars in. Social marketing continued to be a model for leveraging private wholesalers and retailers for distributing health products, as it guaranteed some more control and visibility to the program funders over product price and quality.

## **5.0 Key Developments in Health Product Supply Chains circa 2000-2010**

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### **5.1 HIV/AIDS and the architecture for global health aid**

By the early 2000s there was widespread recognition of HIV's potential effect on the fragile progress of development in resource-poor settings. This triggered important new global donor commitments for healthcare in developing countries and a large part of it provided health products, most notably ARVs for treating patients or condoms for prevention. UNAIDS had been formed in 1996 and the Commission on Macroeconomics and Health demonstrated the need for improving health in developing countries as a prerequisite of development (Sachs 2001). Soon the Global Fund to Fight AIDS, Tuberculosis and Malaria was established and started providing low- and lower-middle-income countries with resources to purchase and distribute medicines for HIV/AIDS, TB and malaria to their populations. In 2003, the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) was created with very strong bipartisan support in the United States and initially pledged \$15 billion over five years for AIDS support. Soon these commitments were increased substantially, and in 2005 the President's Malaria Initiative (PMI) was also established. The Bill and Melinda Gates Foundation had now started providing remarkable levels of financial resources to health

in developing countries. A new alliance called the Global Alliance for Vaccines and Immunization (GAVI), with significant financial resources and innovative financing for addressing immunization in developing countries, was created in 2000.

In early 2006, UNITAID, a new initiative financed by an airline tax levy, was founded by Brazil, Chile, France, Norway and the United Kingdom. Its focus was on using market approaches to help countries purchase new drugs for HIV/AIDS, TB and malaria. As will be evident in the following sections, this architecture has significant implications for the supply chain for health products.

## **5.2 Emergence of new philanthropy**

Philanthropy is not new to global health. The Rockefeller Foundation and the Ford Foundation have been important actors in the field of international health since their start in the early 1900s. A significant new entrant to the field of private philanthropy for global health was the Bill and Melinda Gates Foundation, which was formed in 2000. Even though its larger global health programs did not start till the mid-2000s, publicity surrounding the new foundation started renewing attention on the issues of healthcare delivery. In its work in global health, the Gates Foundation initially focused largely on funding research to prevent and control diseases that predominantly affect developing countries, but over time also became an important player in financing multiple aspects of healthcare delivery. Besides bringing additional resources, the Gates Foundation brought the attention of leaders from business, government and academia to start focusing on global health issues – including supply chain and delivery. In addition to the Gates Foundation, the Children's Investment Fund Foundation (CIFF), the Dutch Postcode Lottery, the IKEA Foundation, Bloomberg Philanthropies and the Hewlett Foundation are large private philanthropic groups that have a significant focus on health care delivery and supply chain improvement.

## **5.3 New global supply chain architecture**

A year after its establishment in 2003, the new PEPFAR program awarded a \$6-billion contract to a consortium of companies and organizations to carry out procurement and the first leg of distribution and warehousing for products financed by PEPFAR. It included approximately \$800 million to provide technical assistance to countries to build up their supply chains to support the massive scale-up of HIV treatment programs. Government-run central medical stores were inefficient in a large number of countries and the private sector was very fragmented and opaque. As a result, the consortium that won the award for PEPFAR's supply chain established a novel approach to distribute. Regional distribution centers owned and operated by the private South African company PHD were established in three regions of Africa and separate distribution channels were set up in places where the performance of government systems was extremely weak or the risk of product leakage was high.

The Global Fund initially took the approach of providing financial support to recipient countries for them to buy and distribute medicines for HIV, malaria and TB supply chains. Perverse incentives and lack of country capacity in supply chains meant widespread problems were reported in purchasing, supply chain and general financial management. Over time, this forced the Global Fund to start conducting procurement of medicines and health products on behalf of countries centrally (Hausman et al. 2011).

UN agencies such as UNICEF and UNFPA firmed up their global procurement programs and equipped more of their country support offices to start providing supply chain technical support to countries. Often multiple supply chains were set up within countries by different agencies and programs to achieve their program objectives.

The initial premise of government ownership of supply chains was to avoid over-fragmentation (see **Figure 2**). Soon the lack of coordination across different agencies working on procurement and supply chain led to structures that obliterated that benefit. Donor coordination around supply chains started becoming an area of focus (Kraiselburd and Yadav 2012).

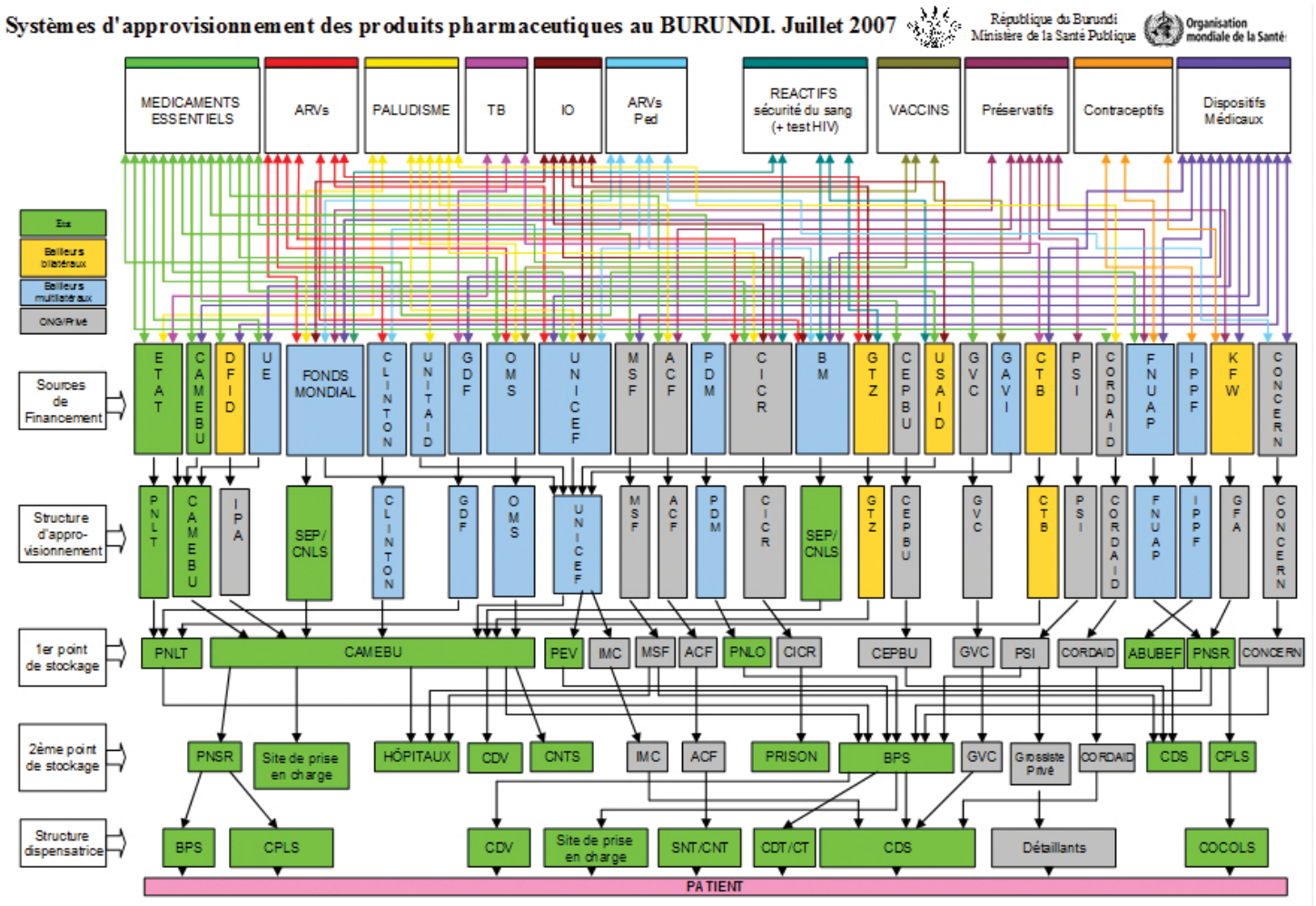
#### **5.4 Pricing, market access and procurement**

AIDS also spurred a heated debate about the price of anti-retroviral (ARV) medicines. Scale-up of HIV programs in developing countries relied on the availability of lower-priced ARVs. Global pharmaceutical companies initiated programs of differential pricing, allowing low-income countries to obtain HIV medicines at prices much lower than paid by high-income or middle-income countries. This approach, while sound in economic theory, was critiqued by many civil society organizations (Yadav 2010).

In 2002/2003, the Clinton Health Access Initiative (CHAI) started a new approach to incentivize early generic product entry into the ARV market and to bring economies of scale to generic manufacturers. Sales volumes were unpredictable and this made it impossible for companies to plan for efficient production (Levine et al. 2008). CHAI made volume commitments to generic ARV manufacturers, and in return negotiated lower prices for countries that were part of their procurement platform. Pharmaceutical production costs are highly scale-dependent and, with CHAI's help, manufacturers realized that with more certain demand they could achieve better economies of scale. The significant savings in the per-person per-year cost of ARVs achieved as a result of this work later became a key contributor to HIV treatment scale-up. With the start of UNITAID, the early work of CHAI was expanded manyfold. Both Yadav and Levine presented strong economic rationale for why risk-sharing with manufacturers was a way to balance the needs of lower costs with manufacturer incentives to participate in the market (Levine et al. 2008; Yadav, Sekhri, and Curtis 2007).

The issue of ARV medicines pricing and access was also fraught with debate regarding intellectual property and patents.

**Figure 2: Extreme fragmentation in government/public supply chains. Example from Burundi**  
(Yadav, Tata, and Babaley 2011)



Source: Prepared by Authors.

## 5.5 Attempts at reforming government-run supply chains through autonomy and limited competition

Central medical stores (CMS) were still the mainstream model of health product procurement and distribution in the early 2000s. Traditionally, the CMS were government departments, but starting in the early 2000s more of them were being given greater managerial autonomy with the hope that they would start performing better (World Health Organization 1998; Govindaraj and Herbst 2010). The hypothesis was that when CMS are government departments, the managers have difficulty hiring people with business experience and skills because of the poor wages and incentive systems within the public sector. They also often lack the authority to remove incompetent workers.

In some instances, there were attempts to create limited competition for the CMS in the form of NGO-run procurement and distribution (e.g. NMS in Uganda, MEDS in Kenya). Very few of them, however, were about truly bringing competition to the government-run CMS, but rather to work as marginal attempts at reducing complacency.

A large number of African countries, including Benin, Burkina Faso, Cameroon, the Congo, Democratic Republic of the Congo, Ghana, Guinea, Kenya, Mali, Nigeria, Rwanda, Senegal, Sudan, Tanzania, Togo, Tunisia, Uganda, Yemen, Zambia and Zimbabwe, tried improving the performance of their medicines procurement and distribution system through greater managerial autonomy to their CMS. A subjective analysis of the impact of such initiatives is presented in **Table 1**.

**Table 1: Impact of autonomous/semi-autonomous CMS on operational performance (Govindaraj and Herbst 2010)<sup>iv, v</sup>**

Management aspect	Burkina Faso		Cameroon		Senegal	
	Pre	Post	Pre	Post	Pre	Post
Drug selection	-1	2	-1	2	-1	1
Quantification	NIA	2	-1	1	-2	0
Supplier selection, monitoring	-2	2	1	1	-2	0
Procurement	-1	1	0	1	-1	0
Inventory management	0	1	1	1	-1	1
Storage	0	2	0	2	-1	-1
Dispatch and delivery	0	1	1	2	-1	1
AVERAGE SCORE	-0.6	1.6	0.1	1.4	-1.3	0.3

Source: Prepared by the author.

The increase in scores for different management aspects before and after the CMS were made autonomous/semi-autonomous reflect a clear increase in overall performance, although the impact of better management of individual functional areas on improved availability is not as clear.

iv Used here from The World Medicines Situation 2011: Storage and Supply Chain Management (Yadav, Tata, and Babaley 2011).

v Key to performance ratings: -2=very poor, -1=poor; 0=adequate, 1=good/moderate improvement; 2=very good/substantial improvement; NIA=no information available.

## 5.6 Supply chain network design for public health supply chains

During this time period, most countries used a government supply chain network design that mimicked the administrative and governance structures in the country. As a result, often there were too many layers of stocking (e.g. at the federal, provincial, district, and local government levels) in between the central stocking point in the capital city and the health clinics located in peripheral areas. This led to diffuse accountability and loss of operational efficiency (Yadav 2015). A series of attempts to quantitatively capture these inefficiencies through simulation and analytical modeling started in the 2000s. Some modeled the cost and availability benefits from redesigning the vaccine supply chain to have fewer tiers and others were attempting to implement this in practice (B. Lee et al. 2015; Brown et al. 2014; B. Y. Lee et al. 2016). Additionally, Vledder and colleagues carried out a randomized control experiment in Zambia to understand the costs and potential benefits of fewer levels in the supply chain as compared to equipping intermediate levels with more technical capacity (Vledder et al. 2015).

## 5.7 Modern technology tools come to public health supply chains

From 2000-2010, computerized ordering, warehouse management and inventory management started to become more mainstream as compared to ad-hoc implementation of modules. This trend in logistics management information systems (LMIS) was fueled largely by financing, technical and training support from USAID, PEPFAR and the Global Fund. The premise was that replacing antiquated paper-based stock requisition systems with computerized forms, electronic ordering and their regular use in supply chain planning would lead to: 1) better performance due to better information for supply chain planning and 2) improved labor productivity in the supply chain. Realizing the benefits of better information for planning depended on the ability to obtain stock and flow data from the health clinics. However, reporting such data to the higher levels of the distribution system for better supply planning proved to be more difficult than was originally imagined. Most health clinics were not computerized and there was no way to report the data they recorded on store ledgers, stock control cards and requisition forms to higher levels in the system. There were some ingenious attempts at using digital images and mobile phone-based forms (Gallien, Leung, and Yadav 2016; Dell et al. 2013; Barrington et al. 2010). However, these were fairly limited in scope of products covered or scale, i.e. the number of health clinics that they involved. There are no studies that capture whether the new tools led to improved labor productivity at central medical stores.

An ingenious attempt to work around the lack of computerization and poor capacity at peripheral health clinics was a system first used in Zimbabwe called the Delivery Team Topping Up (DTTU), where instead of health clinics doing stock management and ordering, a delivery truck loaded with supplies arrives at the health facility, counts the stock, and tops up inventory levels accordingly (USAID | Deliver Project 2003). In 2009, JSI reported that the stock-out rates for nevirapine tablets decreased from 33% to 2% after the DTTU system was implemented. A similar model was used in Mozambique by Village Reach and later in Senegal (B. Y. Lee et al. 2016; Daff et al. 2014).



## 5.8 Transport outsourcing gains further momentum

The idea of outsourcing selected discrete activities in the government supply chain to market actors had already started in the 1990s but increased recognition of lack of functioning transport continued to be a key challenge for the public-sector distribution system, both from the CMS to the regional or district stores and even more from the district/regional store to the health facility level. The availability of vehicles for distribution of medicines was limited due to lack of transport planning, poor vehicle maintenance and noncompliance with vehicle use policy within the public-sector distribution system. Some countries, such as Kenya, contracted a third-party transport company instead of using a CMS fleet of vehicles to distribute stock to the health facilities. The Gambia outsourced its transport function to an NGO that maintains a vehicle fleet and charges the government on a cost per kilometer (CPK) basis. In some geographies and contexts, a third-party logistics provider can offer higher frequency of delivery at better rates if contracting and service level agreements can be appropriately structured. Such initiatives require ongoing monitoring of the transportation contractor and enforcing the pre-established performance standards – activities that are not always easy within the public sector.

## 6.0 Health Product Supply Chains 2010 Onwards

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### 6.1 Stronger evidence on private sector retail as source of supply and the AMFm experiment

Even stronger evidence emerged in the 2000s to show that private health care providers are more frequently consulted than those in the public sector for diseases such as diarrhea and malaria.

The private sector accounted for over 50% of all outpatient visits in Vietnam (Ha, Berman, and Larsen 2002).

Tangcharoensathien et al. 2008 reported collated estimates from multiple sources to show that a vast majority of children (in some cases as high as 90%) affected by common acute illnesses (diarrhea, respiratory infections, malaria) sought care outside the public sector in India, Nigeria, Nepal, Egypt, Bolivia, Guatemala and Paraguay. Strong evidence also emerged to show that even poor households often seek care for their children from private practitioners (Gwatkin et al. 2000).

Especially for malaria, a very large fraction of patients seek treatment in the private sector, where medicines dispensed are either ineffective or very expensive. Arrow and colleagues had proposed the idea of a global subsidy to reduce the price of an effective combination therapy for malaria (artemisinin combination therapy) (Arrow, Panosian, and Gelband 2004). This idea resurfaced in 2006 and in 2009 through a program called the Affordable Medicines Facility-malaria (AMFm). AMFm was set up to first negotiate the price of ACTs with pre-qualified manufacturers and couple that with a factory-gate buyer subsidy to reduce the retail price of ACTs to patients (Matowe and Adeyi 2010). A key concern of this program was that the subsidies might not get passed along to patients in the form of lower retail prices for ACTs, but instead would be “captured” by wholesalers and retailers in the chain. This led first to large-scale systematic efforts in

mapping the supply chain for anti-malarials (and medicines more generally) in the private sector (Patouillard, Hanson, and Goodman 2010). There were also attempts at modeling the pass-through of different types of subsidies (Taylor and Yadav 2011). The AMFm program was accompanied by a rigorous independent evaluation that measured the changes in prices, availability and market share. The evaluation reported large improvements in availability as a result of the program and modest decreases in retail prices (Cohen et al. 2013; Tougher et al. 2014). While the program was scaled back due to considerations about malaria diagnosis in the private sector and other funding reasons, it enabled a much stronger understanding of the private sector supply chains for medicines and product stocking behavior (Larson et al. 2013).

The start of the universal health coverage movement brought increased recognition for separating the functions of financing health services from actually delivering healthcare (WHO 2010). During this period, there was a slow shift from hiring staff in the public sector and delivering health services in-house to strategic contracting with private providers of health services. This included reimbursement models for medicines obtained at private clinics, pharmacies and drug shops. As a result of this development, there was increased focus on understanding the private retail sector for pharmaceuticals.

## 6.2 Market shaping evolves and gains further momentum

Post-2010, there was increased recognition that true long-term efficiency in procurement of health products is not limited to obtaining the lowest price alone. It requires manufacturers to produce high-quality products in the most efficient way possible and have sufficient capacity to serve developing country markets. Manufacturers, payers and purchasers often face high transaction costs, information asymmetry or lop-sided risks, which lead to poorer market outcomes. Countries, donors and procurers can use a range of interventions to better align the market toward a more stable and better equilibrium. Pooled procurement, advance market commitment volume guarantees, forecast information sharing and coordinated ordering evolved as ways to intervene in markets for health products with the intent to nudge them toward better market and health outcomes (USAID Center for Accelerating Innovation and Impact 2014; Chau et al. 2013). New volume guarantees for vaccines and family planning products were institutionalized and pooled procurement became the mainstream form of procurement at the Global Fund (Suzman 2016; Bank 2016). Misalignments between the timing of funds availability and the timing of procurement (Gallien et al. 2016) were addressed through innovative bridge financing and supplier financing models such as the Pledge Guarantee for Health (PGH USAID), UNICEF VII and others.

All global agencies working in health instituted some form of market dynamics activities that aimed toward the competing objectives of affordable price, a competitive and diverse supplier base, sufficient supply, and incentives to innovate and create products suitable for use in developing countries. Most global health agencies have created technical functions that focus on the understanding of markets, accurate demand forecasting and a stronger engagement with the pharmaceutical industry. Partnerships with the private sector, especially suppliers, are now a critical part of all successful health initiatives.

### 6.3 Country “graduation” and supply chains

Development assistance for health from both multilateral donors such as the World Bank, GAVI and the Global Fund and many bilateral donors depends to a large extent on the income classification of the recipient country. Economic growth in the mid-2000s led to increased GDP per capita figures in a number of countries that depended on aid for their health programs. Many countries with high concentration of the infectious disease burden now were classified as middle-income. Bilateral donors are reluctant to support middle-income countries, and key multilateral agencies and global health partnerships also became selective in the kind of support they can provide to middle-income countries.

The most direct impact of this on procurement and supply chain would have been for countries graduating from GAVI support. Not only would graduating countries lose GAVI financial support, they would also lose access to GAVI’s specially negotiated low prices for vaccines. So GAVI negotiated that graduating countries would have continued access to the GAVI-negotiated price for a period of five years (Kallenberg and Cornejo 2015).

While this was respite for vaccine prices, countries that have been largely reliant on aid-funded products for their health programs have weaker capacity to engage in procurement negotiation, and in some cases their supply chain and distribution depend extensively on technical support and resources provided by bilateral or multilateral donors. This will become particularly important for HIV/AIDS, TB and malaria in the medium term.

### 6.4 Noncommunicable diseases (NCDs) and supply chain

One of the most fundamental shifts in the last decade is the increase in the burden of disease and mortality caused by NCDs. In part because of the recent achievements in combating infectious diseases, this epidemiologic transition has seen NCDs displace infectious diseases as the world’s leading causes of both morbidity and mortality (Bollyky et al. 2017). The technical tools for ordering, requisitioning product, procurement and market shaping were largely designed for infectious disease programs. While many of the concepts and systems apply directly to NCDs, the number of stock-keeping units are higher for NCD medicines and the nature of titration/dose adjustment makes forecasting demand more difficult (Smith and Yadav 2013). For NCDs such as cancer, prices of medicines remain significantly high and out-of-pocket purchasing, which was the predominant form of obtaining medicines for infectious diseases such as malaria and diarrhea, cannot be used. This reinvigorates the debate on differential pricing (Yadav 2010). New programs for cancer care and initiatives for CVD like Global-HEARTS attempt to use the core principles of pooled procurement, better forecasting and risk-sharing contracts to improve the overall supply chain for NCD medicines (McNeil Jr. 2017).

## 6.5 Supplier direct delivery and new models

In most developing countries where the government manages procurement and distribution, health products arrive at a central warehouse; from there they are transported to one or two levels of intermediate warehouses, and then eventually distributed to the hospitals and other health facilities. In such a system, flow times are long, and there is limited visibility or accountability.

South Africa has successfully experimented with distributing medicines directly from manufacturers and/or suppliers to health facilities. In this model, the supplier delivers products directly to the health clinic by contracting a logistics service provider. This transfers the burden of storage and transport to the supplier and helps bring greater efficiencies. A few countries now purchase from their suppliers on decentralized delivery terms and report enhanced availability and lower prices (USAID | DELIVER PROJECT Task Order 1 2010). South Africa has also successfully developed a model for direct delivery of chronic care medicines to patients at pickup points. The Central Chronic Medicine Dispensing and Distribution (CCMDD) program has demonstrated that supply chains that deliver directly to patients are technically feasible and can lead to improved outcomes (Meyer et al. 2017).

The growth of e-commerce, especially in urban areas of many developing countries, has significantly enhanced the logistics infrastructure and new delivery and distribution companies have emerged. Some of these have high reach and low overheads, making them suitable for supply chain partnerships with public sector agencies. There has also been considerable social innovation applied to improving government-owned supply chains or creating alternative channels of distribution in the private sector (Yadav, Stapleton, and Van Wassenhove 2013).

## 7.0 Conclusion

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Over time, supply chains for health products have gone through significant changes. The pendulum has swung back and forth between state ownership and management of the supply chain to a more market-oriented supply chain. Country governments and the international donor community still remain split between the appropriate role of market actors in the health product supply chain. There are those who strongly advocate for the use of private sector actors to run the supply chain; those who sit on the sidelines and welcome limited private sector engagement in selected activities, and those who believe greater efficiency can be achieved only with stronger technical support to government-run supply chains. Efficiency and equity are used as reasons for preferring one approach over another. Both market-oriented reforms and improved efficiency of government supply chains depend on the existence of strong institutions in the country. This coupled with weak measurement methods does not allow for the rigorous examination of which approach would work best in which country environment.

Overall, there is a shift away from the rigid hierarchical, command and control processes of government-owned supply chains to some flexibility and managerial freedom to supply chain functions through autonomous supply agencies and state-owned enterprises (Yadav 2014). However, there are still very few models where supply chain services for population health products are delivered primarily by for-profit private sector companies. Key reasons include lack of government contracting capacity, lack of qualified supply chain service providers, and perverse political incentives (Agrawal et al. 2016). Universal health coverage and strategic purchasing may create further impetus for this to change. A new wave of social entrepreneurs may create models that improve the efficiency of the private sector supply chain that serves those who purchase medicines largely out-of-pocket.

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