Is decentralization good for logistics systems? Evidence on essential medicine logistics in Ghana and Guatemala

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Efficient logistics systems move essential medicines down the supply chain to the service delivery point, and then to the end user. Experts on logistics systems tend to see the supply chain as requiring centralized control to be most effective. However, many health reforms have involved decentralization, which experts fear has disrupted the supply chain and made systems less effective. There is no consensus on an appropriate methodology for assessing the effectiveness of decentralization in general, and only a few studies have attempted to address decentralization of logistics systems. This paper sets out a framework and methodology of a pioneering exploratory study that examines the experiences of decentralization in two countries, Guatemala and Ghana, and presents suggestive results of how decentralization affected the performance of their logistics systems. The analytical approach assessed decentralization using the principal author’s ‘decision space’ approach, which defines decentralization as the degree of choice that local officials have over different health system functions. In this case the approach focused on 15 different logistics functions and measured the relationship between the degree of choice and indicators of performance for each of the functions.

The results of both studies indicate that less choice (i.e. more centralized) was associated with better performance for two key functions (inventory control and information systems), while more choice (i.e. more decentralized) over planning and budgeting was associated with better performance. With different systems of procurement in Ghana and Guatemala, we found that a system with some elements of procurement that are centralized (selection of firms and prices fixed by national tender) was positively related in Guatemala but negatively related in Ghana, where a system of ‘cash and carry’ cost recovery allowed more local choice. The authors conclude that logistics systems can be effectively decentralized for some functions while others should remain centralized. These preliminary findings, however, should be subject to alternative methodologies to confirm the findings.

Keywords Decentralization, logistics systems, Ghana, Guatemala, health systems

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KEY MESSAGES

- There is no consensus on whether centralized or decentralized logistics systems are more efficient and effective in moving essential medicines down the supply chain to the service delivery point, and then to the end user.

- The study analyzed the ‘decision space’ (degree of choice) of local officials and found that less choice (i.e. more centralized) was associated with better performance for two key functions (inventory control and information systems), while more choice (i.e. more decentralized) over planning and budgeting was associated with better performance.

- We also found that the procurement process in Guatemala, where firms and prices were fixed by national tender, was associated with positive performance, while the ‘cash and carry’ cost-recovery procurement process in Ghana was associated with negative performance indicators.

- The study suggests that logistics systems can be effectively decentralized for some functions while others should remain centralized.

Introduction

Improved availability of affordable essential drugs, vaccines and contraceptives depends on effective logistics systems to move essential commodities down the supply chain to the service delivery point and, ultimately, to the end user. In many developing countries, logistics systems for public health facilities have been centralized, with central ministry offices responsible for planning, forecasting, procurement, warehousing and the distribution of essential drugs, contraceptives and vaccines. These systems have been notoriously inefficient and in many cases incapable of providing adequate supplies on a timely basis. Experts in logistics have developed new approaches to make these logistics systems more effective and efficient; however, most concentrate on initiatives that retain central control and focus on developing better skills and systems at the central level and assuring that standard methods are used throughout the system (Bates et al. 2000). These experts tend to fear new health reform initiatives, especially the decentralization of health systems, which they see as potentially undermining logistics system performance.

As more health systems have become decentralized, however, it has become clear that logistics systems may need to adapt to the broader health system reforms. With this in mind, the DELIVER Project—a United States Agency for International Development (USAID)-funded project designed to improve logistics systems—and the Harvard School of Public Health (HSPH) developed a pioneering, exploratory approach and methodology to assess the impact of health system decentralization. The principal author’s ‘decision space’ approach to analyse decentralization in logistics systems allows for a series of different functions allowed to officials at lower administrative levels (Bosser 1998). He has applied this approach to describe decentralization of health systems in several countries and to assess the impact of decentralization on the equity of allocations in Chile and Colombia (Bosser and Beauvais 2002; Bosser et al. 2003a). Other quantitative studies have assessed rather gross functions, such as fiscal and administrative decentralization, and measured the impact of central transfers primarily on local levels of fundings (for instance: Davoodi and Zou 1998; DeMello 2000; Ebel and Yilmaz 2003). These studies demonstrate the weakness of simple indicators of both decentralization and of performance, and provide little guidance for assessing the performance of a complex system such as logistics. Similarly, the literature on decentralization of logistics systems is limited to a few qualitative and descriptive studies that do not develop a sufficiently rigorous methodology (Bates et al. 2000).

The studies of Guatemala and Ghana set out to develop an exploratory methodology, using as an initial referent the principal author’s ‘decision space’ approach to analyse decentralization in logistics systems. The decision space approach delineates a series of health system functions (financing, service delivery, human resources, governance, and sub-functions within each of these categories) and a range of choice exercised by local officials for these functions (defined as ‘narrow’, ‘moderate’ or ‘wide’). Reorienting this approach to assess the functions of the logistics system required a careful identification of logistics system functions. Logistics system experts from the DELIVER project took the lead in defining 15 logistics system functions and, working with decentralization experts at HSPH, identified the possible ‘decision space’ over those functions as well as performance indicators for the effective implementation of each function. The methodology was designed to specify associations between the decision space for different functions and the performance of those functions in order to suggest policy recommendations for effective centralization or decentralization of logistics systems. This review will also identify the limitations of this exploratory methodology.

This article first presents a brief description of the characteristics of the Guatemalan and Ghanian logistics systems, followed by a discussion of the innovative approach and
exploratory methodology used to assess the decentralization of logistics systems. The article presents the most important findings on the relationship between the decision space and the performance of the logistics system functions in a comparative analysis of the two countries. The conclusion suggests policy recommendations for the decentralization of logistics systems for low- and middle-income countries.

**Background on Guatemala and Ghana**

While the logistics systems in both Guatemala and Ghana had similar general characteristics in many of the logistics functions, they had different country contexts and unique logistics features. Guatemala is larger than Ghana, with many more facilities and a higher income level (Guatemala is classified by the World Bank as a lower-middle-income country, while Ghana is considered a low-income country). While in both countries contraceptives were provided by donor funding and vaccines were funded through the national budget, they had different means of funding and procuring essential drugs. In Ghana’s ‘cash and carry’ system, each administrative level procured their supplies from the higher levels of the supply chain or from the open market if needed (Ministry of Health, Ghana 1999; Sarley et al. 2002). Guatemala’s ‘open contract’ system involved an innovative procurement process in which the national government held a tender offering in which drug suppliers competed to provide specific drugs on demand from local administrative levels at a tendered fixed price (including transportation costs) (LaForgia 2000). This system allowed the Ministry of Health to take advantage of large quantity discounts while also allowing facilities to decide quantities and to order their drugs from one of (often) several optional suppliers at the pre-established prices.

Both countries limited the selection of commodities by imposing an essential drug list, although the rigour of the enforcement of this list was stricter in Guatemala. The purchase of essential drugs was made by health facilities in Guatemala and by district offices in Ghana. Warehousing was provided at the district level in both countries, and national norms of inventory control were more strictly enforced in Guatemala than in Ghana. Forecasting was done separately by each administrative level in Guatemala and needs were reported to the next higher level. In Ghana, store managers were responsible for determining the quantities of each item to procure at each time.

**Methodology**

Measuring ‘decision space’ is a methodological innovation that no other published research in decentralization or logistics systems has applied to determine the relationship between the amount of choice and performance of specific functions. Prior research by the first author has evaluated the general performance of different health systems given a general index of ‘decision space’ for the whole system (Bossert 1998; Bossert and Beauvais 2002). This study therefore developed a survey methodology to ask questions of local-level officials to assess the range of choice that they exercised for 15 logistic functions. The methodology was designed to evaluate the performance of the different ‘exercised’ ranges of choice for each function, as expressed by the local officials in an interview survey in each country—which we labelled logistic decision space.

Logistic decision space was determined using the Decision Space Assessment Survey (DSAS), which involved semi-structured interviews with key participants in the logistics system at the local levels. The questions in the DSAS were developed in coordination with international and local experts on logistics systems (Bossert et al. 2002). The survey measured the range of choice that local officials exercised for 15 different logistics functions: financing, budgeting/planning, product selection, needs assessment/forecasting, procurement, inventory control, warehousing, transportation, logistics information systems, human resource management, training, supervision, organizational support, quality control, and client contact. For each function, questions were developed within a reasonable expected range of options for each country so that answers could be coded as having ‘high’ or ‘low’ decision space.

Although ideally a continuous scale from high to low might be more accurate, given the low number of cases, a dichotomous indicator was selected to give the statistical analysis sufficient power.

The questions were designed to attempt to distinguish between the ‘exercise’ of legitimate choice and the failure of enforcement of centrally defined rules. In all cases, the questions were posed so that respondents would not be making illegitimate or illegal responses. For instance, although there were National Essential Drug (NED) lists in both countries, local officials were allowed, under some circumstances, to make choices to procure drugs that were not on the list. The range of choice allowed was what was being measured, not the more difficult issue of failure to enforce regulations. However, in some cases it was difficult to determine the difference between ‘guidelines’ that allowed a range of choice and ‘requirements’ that lacked enforcement. In inventory control and Logistic Management Information Systems (LMIS), for instance, there were guidelines in both Guatemala and Ghana; Guatemalan central authorities trained the local officials in these guidelines and expected adherence, while in Ghana there was no special effort to distribute the guidelines. Nevertheless, in Guatemala there were local officials who disregarded the guidelines, which they apparently did not see as ‘requirements’. Since the focus of this analysis is on the exercised ‘decision space’, we did not attempt to analyse whether the decision space that was used resulted from lack of enforcement by the centre or lack of clarity about guidelines. What was important was the difference between those who made local decisions and those who only followed central authorities.

The survey was developed with both international and local experts to create a pre-established set of possible responses that define whether a facility has a high or low degree of choice in executing/managing each of the logistics system functions. The international and local experts established a consensus on a general classification of high and low ‘decision space’ for each function. As the ‘decision space’ approach is still
in the formative stage, there were no prior criteria for these
classifications. The classifications were based on a combination
of the primary author's experience in earlier applications of
'decision space' analysis for general system decentralization
and the logistics system experts' experience with logistics
systems (see Bossert 1998). The indicators for both countries
attempted to measure similar degrees of choice but some
modification was made to be sure that the choices were
realistic and understandable to respondents in the different
logistics systems of the two countries. (See Annex A for a list
of logistic decision space indicators for each function for
Ghana and Guatemala.) Although no formal validity study
was conducted, several questions were asked within each
function in order to verify if the respondents' answers were
consistent.

To evaluate the impact of decentralization on the performance
of the logistics system, we developed a second survey
instrument to obtain data on the current performance of the
logistics system by modifying an existing assessment instru-
ment, DELIVER's Logistics Indicators Assessment Tool (LIAT)
(DELIVER/John Snow, Inc. 2002). The performance variables
were used as outcome variables in the analysis below.

Performance indicators were identified for each logistics
function and were modified to account for differences in each
country's logistics system. Although logistics system analysts
have identified some performance indicators for some key
functions for any logistics system, it was necessary to develop
system-specific indicators that were related to each of the 15
functions and to the different decision space questions asked in
each country, a task that again required the national and
international teams to combine their expertise to identify
plausible and measurable indicators without clearly validated
prior studies to guide the relationship between functions and
performance. Completing the modified LIAT required informa-
tion from a variety of data sources, including stock/tally cards,
ledgers, periodic returns/reports, requisition and issue vouchers,
and consumption and other transaction records such as
receipts, invoices and waybills. Data were also collected
directly by observation of warehouse conditions and
physical counts of the health commodities in facility stores
and clinics. The information from the LIAT was used to
create performance indicators for each of the logistics
functions. In the Results section we present the performance
indicators that were significantly related to differences in
decision space.2

A local consulting firm in each country was contracted to
implement the surveys. Survey teams, selected by the local
consulting firms, were trained and the instruments were pilot-
tested in nine facilities in each country (two at each level and
one non-governmental organization (NGO)). Questions that
needed clarifying were reworded and/or eliminated. All data
were coded and initially entered into SPSS (Ghana) or SAS
(Guatemala). A double-entry technique was used to ensure
data quality. After data entry and verification, the data were
transferred to STATA for further analysis by the Harvard team.

Both the DSAS and LIAT were administered in 32 facilities
in Ghana. An additional 25 facilities only answered the
DSAS because they were not service providers and could
not provide any performance information. An additional
40 facilities (health centres/posts) did not make decisions and
only responded to the LIAT performance questionnaire.

The responses of these facilities were linked to the responses
of the level (district or hospital directors) that made choices
for them. The total of 97 offices and health facilities included
in the Ghana study represented 17% of all facilities in the
country. Five of the total 10 regions were represented: the
Greater Accra region, Central region, Eastern region, Brong
Ahafo region and Northern region. In Ghana, the baseline
sample of facilities was based on that in a previous study done
in 1999 (Ministry of Health, Ghana 1999). The 1999 MOH
study was particularly well designed, using a multi-stage
sampling procedure that involved the selection of regions,
districts and health facilities through a combination of
purposive and random sampling. The present sample was
increased to include regional health administrations and
regional hospitals, and the number of randomly selected
districts increased from two to five per region.

The DSAS and LIAT were conducted in 281 facilities in
Guatemala, representing 23% of the countries total facilities.
The number of facilities chosen in Guatemala was propor-
tional to the total number of facilities of that type and
the population of each department. Health area offices and
hospitals were purposively selected in order to compare
results with a previous study conducted in 2001 (DELIVER/
John Snow, Inc. 2001). Health centres and health posts were
randomly selected based on the population size of each
department. NGOs were purposively selected based on size
and number of programmes.

Simple means and percentages were calculated using the
above data in an attempt to find trends and patterns in terms
of performance for those facilities reporting high and
low logistic decision space. Since this is an exploratory study
measuring the impact of a health system, there were too many
factors to try to claim causality or model any true correlations
between decision space and performance. The results from this
paper will be used to move the research toward causal
conclusions and further models.

Results of analysis of logistic decision
space and performance variables in
Ghana and Guatemala

Using the results of the decentralization survey that measured
logistic decision space, we were able to assess the relationship
between higher decision space and performance by analysing
difference of means.3 Table 1 summarizes the results of the
significant relationships between logistic decision space and
positive or negative performance by function for both
Guatemala and Ghana. The following sections will discuss
in more detail those functions for which higher logistic decision
space in both countries was associated with lower performance
(inventory control and LMIS), those functions for which
higher logistic decision space in both countries was associated
with higher performance (budgeting), and procurement which
was related to high performance in Guatemala and low
performance in Ghana.
Table 1 Higher logistic decision space association with performance by function

<table>
<thead>
<tr>
<th>Function</th>
<th>High performance</th>
<th>Lower performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing (modifications)</td>
<td>Ghana</td>
<td></td>
</tr>
<tr>
<td>Planning/Budgeting</td>
<td>Guatemala, Ghana</td>
<td></td>
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<tr>
<td>Product selection</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Needs quantification</td>
<td>Guatemala</td>
<td>Ghana</td>
</tr>
<tr>
<td>Procurement</td>
<td>Guatemala</td>
<td>Ghana</td>
</tr>
<tr>
<td>Inventory control</td>
<td>–</td>
<td>Guatemala, Ghana</td>
</tr>
<tr>
<td>Storage</td>
<td>Ghana</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td>Guatemala</td>
<td></td>
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<tr>
<td>Logistics Management Information Systems</td>
<td>Guatemala, Ghana</td>
<td></td>
</tr>
<tr>
<td>Human resources/personnel</td>
<td>Guatemala</td>
<td>Ghana</td>
</tr>
<tr>
<td>Training</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Supervision</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Organizational support</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Quality control</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Client contact and use</td>
<td>–</td>
<td>Ghana</td>
</tr>
</tbody>
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Functions for which higher logistic decision space was related to lower performance in both countries

The following section describes the specific measures used to determine the logistic decision space for each function, and the measures of performance that were used for those functions for which higher decision space—that is, more decentralization—was shown to be related to lower performance in both Guatemala and Ghana.

Inventory control

The studies showed that there are some functions in logistics systems for which centralized decisions were related to better performance. In both countries we found that granting higher logistic decision space to local authorities for inventory control and LMIS led to poorer performance in these functions.

Inventory control relates to the logistics functions of product handling and the processes involved in a product’s withdrawal or use, as well as to the information for stock management. In health logistics systems, it is recommended that products be managed on a first-to-expire-first-out (FEFO) basis. The FEFO method requires that products that will expire first be removed from inventory for use, as opposed to other inventory management systems that are managed, for instance, on a first-in-first-out (FIFO) basis. This method, in turn, drives the type of record keeping to facilitate management based on these FEFO principles. The record keeping is done on ‘stock cards’, which can be imposed by central decisions or designed locally. The authors focused the logistic decision space questions on the use of guidelines for facilities in Ghana and Guatemala.

In Ghana, although there were explicit guidelines on inventory control, facilities were not consistently required to adhere to the guidelines. The logistic decision space questions investigated how having or not having guidelines influenced behaviour related to inventory control. Some districts and facilities reported that they had received no guidelines and were instead expected to have formulated their own. These districts and facilities were interpreted as having higher logistic decision space. In addition, since the ‘stock cards’ were a key inventory control document provided from the central level as part of guidelines for inventory control, districts and facilities that had chosen not to use them were also assigned a higher logistic decision space.

In Guatemala, the Ministry of Health introduced new inventory control procedures in 1997. The two principal innovations were: (1) new stock record-keeping cards for tracking goods in storage, and (2) the imposition of standard system-wide stock levels and norms for calculating them called ‘max-min’ levels, with 6 months as the maximum and 3 months as the minimum. The ‘max-min’ system refers to the maximum (or minimum) amount of stock that the MSPAS recommends keeping at the service delivery point. Those facilities that calculated their needs based on any inventory control system other than the ‘max-min’ system of the MSPAS were considered to have high logistic decision space. Those facilities that allowed the central level to make these calculations for them, or that calculated their needs based only on the ‘max-min’ system, were considered to have low logistic decision space.

Seventy per cent of facilities in Ghana and 65% of facilities in Guatemala were categorized as having low logistic decision space for inventory control based on the measures above for each respective country. In both countries we found that facilities with high decision space in inventory control were more likely to have poorer performance. In Ghana, those facilities that did not use stock cards were less likely to have their stock levels for medicines within the required max-min levels. In Guatemala, those facilities that calculated their needs based on an inventory control system different from the max-min system were less likely to use stock cards for medicines. We also found that these facilities had a higher percentage of drugs stocked out on the day of the visit, a general performance indicator that might be affected by several functions.

Logistics Management Information Systems

Logistics Management Information Systems (LMIS) are seen by logistics experts as an essential tool for effective logistics systems. Without good information on needs and inventory, it is difficult for each level to perform its other functions well. This study found that in both countries, better performance of LMIS occurred when there was a more uniform LMIS, in contrast to those systems where local decisions led to different forms and reporting.

In Ghana, there were national forms (Quarterly Returns for Drugs, Drug Availability Form, Contraceptives Returns Forms and Vaccine Returns Form) that needed to be filled out by the health facilities. In general, reporting of these forms was often late or inaccurate, with little enforcement from higher administrative levels. The survey found that some districts did not use the national forms but rather developed their own forms for management of medicines, contraceptives and/or vaccines. These districts were defined as having high logistic decision space.
The Ministry of Health in Guatemala (MSPAS) introduced the basic LMIS source document: the Balance, Requisition and Issue Form (BRES) in 2000. Almost 90% of facilities reported that they used this form. If filled out correctly, the BRES provided the basic information required for good logistics management, that is, stock on hand, losses/adjustments and consumption. Storage facilities and health facilities used this form mostly for essential drugs and contraceptives, and less often for vaccines. However, again some facilities used the BRES, and others created their own reporting form. Those that did not use the BRES were judged to have high logistic decision space for LMIS.

In both countries, we found that higher logistic decision space in LMIS was associated with poorer performance. In Ghana, those facilities that developed their own LMIS forms were less likely to submit monthly reporting of drug availability. In Guatemala, those facilities that created their own reporting form for drugs were less likely to report on time. These results suggest that stricter guidelines on LMIS may lead to a more efficient information system.

The findings for both inventory control and LMIS are logical. Inventory control and information systems are functions that have a relatively limited range of options in order to be effectively implemented. Inventory control requires tight routines (such as ‘first-to-expire-first-out’) and consistent, detailed record keeping in order to be a useful tool for managing quantities of products and for forecasting. LMIS also requires that the same well-defined critical information be available both to local managers and to supervisors and/or procurers and forecasters at higher levels.

Functions for which higher logistic decision space was related to higher performance in both countries: planning and budgeting

In both Guatemala and Ghana, we found evidence that moderate to high logistic decision space for planning and budgeting should be granted to the local levels. In Ghana, annual work plans and budgets were usually drawn up at each level under general guidelines established by the Ministry of Health/Ghanaian Health Services (MOH/GHS). These guidelines provided guidance on sector priorities, proposed budgets, programme indicators and budget ceilings. Plans and budgets were consolidated at the national level, and there was a review process through which budgets received from lower levels were accepted (approved) or required to be amended. As part of these annual plans, each level was expected to include a procurement plan. In one region, the regional level formulated the work plans for all facilities, but this was unusual.

Some districts and facilities had more control than others over their planning and budgeting. If they reported that they prepared their own annual procurement plans, they were deemed to have high logistic decision space. A second indicator of high logistic decision space was that their procurement plans and budgets were not changed by a higher level review. Performance indicators for these functions were the cash and stock balances and stockouts at the time of the visit. If plans and budgets were effective, then their cash and stock balances should have been high and stockouts low. The study found that those facilities that had a high logistic decision space and did not change the work plan/budget, even after it was reviewed, had a higher increase in cash and stock balances. Increases in cash and stock balances were related to fewer stockouts at the time of the visit.

In Guatemala, decisions on which types and quantities of drugs to purchase were based on the planning and budgeting process, Annual Operating Plans (POA). These plans and budgets are subject to review and approval by the Central Ministry. However, the Health Area Offices did, in practice, have considerable discretion in determining programme content. The planning and budgeting process was intended to be participatory. District-level decision makers began meeting with health facility staff in March, and by May prepared a draft plan and budget. In June and July, all districts were represented in meetings at the Health Area Office, and the participants prepared the plan for the entire Health Area Office. The Health Area Office submitted the plan to the central level for approval in August. The central Ministry then distributed the first trimester’s funds. Health Area Offices and hospitals were free to purchase drugs from the assigned funds using the ‘open contract’.

Districts and facilities that reported making independent planning and budgeting decisions were judged to have high logistic decision space, while those that reported that higher authorities made planning and budgeting decisions were judged to have low logistic decision space. In Guatemala, higher levels often imposed budget cuts from the annual planned budget. These cuts forced lower levels to make adjustments. Those districts and facilities that modified their Annual Operational Plan and made budgetary transfers when faced with budget cuts were judged to have high decision space, while districts and facilities that prioritized their tracer drugs, reduced all medicines to equal amounts and gave favour to priority facilities with higher demand were judged to have low decision space. There was a positive association between those facilities that modify the POAs and make budget transfers if there are budget cuts and the percentage of the planned budget that is approved.

These findings suggest that decentralized decisions on planning and budgeting in both countries led to better performance of these functions. This finding is similarly logical to the finding for functions that should be centralized but for different reasons. Planning and budgeting requires more local knowledge than central offices generally have. Local knowledge about local conditions may be most useful in developing appropriate plans and turning those plans into realistic budgets.

Relationships between decision space and performance for the procurement function: different results from Guatemala and Ghana

Procurement involves the purchasing process for essential medicines, with a focus on placing orders with suppliers for the quantities identified by local authorities and paying for those products. Higher decision space for procurement of essential medicines was associated with better performance for procurement in Guatemala, but not in Ghana. Unlike the other logistics functions described above, the procurement functions in the two countries were very different from each other. Ghana’s ‘cash and carry’ procurement system and Guatemala’s
‘open contract’ system were so different as to require significantly different measures of decision space, as will be clear in the description below.

In Ghana’s ‘cash and carry’ system, districts and facilities were expected to use their ‘revolving drug funds’ to purchase essential drugs from public medical stores: Central Medical Stores, Regional Medical Stores, District Medical Stores (CMS, RMS or DMS). However, in some cases the medical stores were allowed to reject orders if they were deemed inappropriate (too much in volume for the target population of a facility, or non-essential drugs for that facility level, or if the facility did not have personnel skilled in use of that drug). The stores were sometimes not able to provide the drugs because they did not have them in stock. In this case, they were to issue a ‘Certificate of Non-Availability’ which authorized the facility to purchase drugs from private providers. Facilities could decide to purchase from the private sector or reorder at a later date, or they could do nothing. In some cases, facilities procured from the private sector without authorization, and if caught, they could be reprimanded by higher authorities.

Some districts and facilities had more logistic decision space than others. We assigned high logistic decision space to those districts and facilities that developed their own procurement plans, those that purchased from the private sector when their orders were not completely filled by the medical stores rather than reordering at a later date or doing nothing, and/or those that had not been reprimanded by higher administrative levels for buying from the private sector.

In assessing performance of the procurement function, we expected that facilities that purchased more from outside the public sector would be more likely to purchase drugs that are not on the National Essential Drug List (NEDL), since the public sector only supplies drugs that are on that list. Buying off the NEDL is seen as poor performance. Our findings show that those districts and facilities that purchased from the private sector were more likely to purchase drugs off the NEDL. This finding suggests that the decentralization of purchasing in Ghana led to poorer performance.

In Guatemala, the right to determine the types and quantities of drugs to buy through the ‘open contract’ was delegated to the hospitals and Health Area Offices, which then procured medicines from their suppliers every 3 months. Suppliers on the ‘open contract’ ship directly to the purchasers or the purchaser’s designated recipients. The Health Area Offices have warehouses and about 90% of all deliveries go to this level for subsequent redistribution to districts and health facilities. In some cases, however, the suppliers ship directly to the districts and even to health facilities.

There were situations in which hospitals and Health Area Offices had the prerogative to purchase drugs outside the ‘open contract’, when the designated suppliers were unable to supply the drugs requested or when the purchaser wanted a product not on the ‘open contract’. In these cases, the purchasing office had to request waivers from the Area Financial Office. In Guatemala, we assigned high logistic decision space to those districts and facilities that reported making their own procurement decisions for medicines rather than having higher administrative levels make procurement decisions, making purchases off the NEDL within the ‘open contract’, and making purchases off the ‘open contract’. The performance indicator we used for this function was the ‘order fill rate’, a logistics system indicator defined as the percentage of products that the facility receives above or below the quantity that they ordered. We found that those facilities with high decision space in making their own procurement decisions were more likely to be in the ‘good’ range for the order fill rate (between −5% and 5%) for medicines.

**Limitations and methodological recommendations**

This study is limited by its exploratory nature. It is a first attempt to develop indicators of both decision space and performance for a series of logistics system functions. There was little guidance in the literature on measures for decision space. We have used subjective expert judgment to determine general decision space and to develop specific questions for surveys to assess logistic decision space. It is likely that only a comparative study of a large number of different logistics systems using this same methodology could determine more discreet indicators and come up with a less subjective method of specifying decision space. It is hard to think of how developing the questions for logistic decision space could be done without expert judgment in each country, since the questions would have to refer to many country-specific issues.

Although there had been some work done on performance measures for logistics systems, the specific measures for performance of each function that could be linked to the specific decisions that local officials could make was less well developed. Since it was not possible to assess the same set of indicators of performance pre and post decentralization, the survey was not able to begin address issues of causality, and in any case, it would have been difficult to control for confounding factors. The relatively small number of cases in relation to the large number of variables to be examined also limited the possible relationships that were found to be statistically significant.

The fact that some of the functions of the logistics systems of both countries had inherent differences in more characteristics than the ‘decision space’ for some key functions also made it more difficult to isolate the specific effect of the range of decision allowed. For instance, the procurement processes and the financing sources were so different in both countries that it may be that characteristics other than decision space were determinant factors in the differences in performance for these functions. We were unable to control for these and other confounding variables such as levels of training, education, income, or facility type.

We recommend that future studies of decentralization of logistics systems continue to develop careful indicators of decision space in the different contexts in which decentralization has occurred. If possible, a baseline survey should be implemented before decentralization policies are initiated and followed up at least 2 years after decentralization. It would be useful to either select a larger sample of countries or to select countries with more similar procurement processes and financing mechanisms so that isolating the effect of decision space is more feasible. It is also recommended that larger samples...
of facilities in each country be studied, since many potential relationships may have been masked by the small samples, especially in the Ghana study.

Summary and conclusion
This exploratory study suggests that policy makers and planners of logistics systems, rather than seeing decentralization as a single granting of control over the logistics system to lower administrative levels, should examine in detail the range of choice and the performance of individual functions, and determine why they are not functioning optimally. It may be because the degree of decision space is inappropriate, that guidelines need to be developed and ‘enforced’, that there is weak capacity that needs to be strengthened, or that there are other factors like poor communication/management. This study provides some guidance for this assessment and findings from two countries that can help to develop policies to enhance the effectiveness of logistics systems by appropriate granting of decision space for some functions to lower levels and retention of decision authority at central level for other functions.

This exploratory comparative study of the decentralization of the logistics systems in Ghana and Guatemala suggests that logistics system performance can be improved if some functions remain centralized and others are decentralized. We found that functions that required consistent and uniform activities to be effective—inventory control and LMIS—probably should be limited by central guidelines, and that these guidelines should be enforced. We also found that more decentralization (higher decision space) for planning and budgeting had a positive impact on performance. In Ghana, the cash and carry planning and budgeting system, and in Guatemala, the local use of the planning tool and budgeting tool (POA), were related to better performance. This finding suggests that local knowledge is an important contribution to effective performance. In addition, the findings from Guatemala suggest that the ‘open contracting’ mechanism of procurement, which grants a moderate range of choice to local officials, can also lead to positive performance.

This study is exploratory and needs to be confirmed by future research. The choices of both indicators of ‘decision space’ and performance for each function need further testing and validation in other studies. However, as an initial implementation of a methodology and approach to a quantifiable and systematic investigation, this exploratory study is a contribution to knowledge in an area that had been dominated by anecdotal and ideologically driven policy recommendations.

This study shows the importance of looking at decentralization in terms of the decision space allowed for different functions. No logistics system is fully centralized or decentralized. What we have found are tentative conclusions about the advisability of granting more local choice over some functions and retaining central control over other functions.

Endnotes
1 This article is based on the individual country reports of two DELIVER studies. The complete studies are found in Bossert et al. (2003b) and Bossert et al. (2004).
2 For more complete listing of, and justification for, all performance indicators, see Bossert et al. (2003b) and Bossert et al. (2004).
3 We related the decision space for the lowest level at which decisions were made (district or hospital directors) to the performance indicators for facilities at that level. District officials made decisions for the non-hospital facilities and the hospital directors had similar decision space as the district officials. We did not disagggregate facilities for performance variables in order to have a larger sample for analysis; however, we did not find significant differences in performance between hospitals and non-hospital facilities.

Acknowledgements
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References


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### Annex A

Logistic decision space variables for essential medicines in Ghana and Guatemala

<table>
<thead>
<tr>
<th>Functions (#)</th>
<th>Logistic decision space, Ghana</th>
<th>Logistic decision space, Guatemala</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financing</strong></td>
<td>• Modify guidelines for the revolving drug fund (high = 17%)</td>
<td>No available decision space, therefore no indicator identified</td>
</tr>
<tr>
<td><strong>Cost recovery</strong></td>
<td>• Include additional criteria in the GHS/HQ guidelines on exemptions as a result of local needs/circumstances (high = 57%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Percentage price mark-up of drugs purchased from medical stores (mean = 36%)</td>
<td>No indicator identified</td>
</tr>
<tr>
<td></td>
<td>• Percentage price mark-up of drugs purchased from private sector (mean = 32%)</td>
<td></td>
</tr>
<tr>
<td><strong>General planning and budgeting</strong></td>
<td>• Prepare own annual plans and budgets (high = 70%)</td>
<td>• Make own budgetary decisions (high = 88%)</td>
</tr>
<tr>
<td></td>
<td>• Did not change work plan/budget after its review (high = 35%)</td>
<td>• Modify POA and make transfers if budgets are cut (high = 32%)</td>
</tr>
<tr>
<td><strong>Product selection</strong></td>
<td>• Have a separate local EDL (high = 17%)</td>
<td>• Select own products (high = 79%)</td>
</tr>
<tr>
<td></td>
<td>• Have a shorter EDL based on disease patterns (high = 50%)</td>
<td>• Have own EDL (32%)</td>
</tr>
<tr>
<td><strong>Needs quantification/forecasting</strong></td>
<td>• Forecast annual requirement of essential drugs on their own (high = 81%)</td>
<td>• Participate in needs quantification of drug needs (high = 91%)</td>
</tr>
<tr>
<td><strong>Procurement</strong></td>
<td>• Purchase from private sector if 100% of order not provided (high = 46%)</td>
<td>• Make their own procurement decisions (high = 89%)</td>
</tr>
<tr>
<td></td>
<td>• Reprimanded for buying from private sector (high = 90%)</td>
<td>• Made purchases off EDL but within open contract (high = 57%)</td>
</tr>
<tr>
<td></td>
<td>• Made purchases off open contract (high = 81%)</td>
<td>• Made purchases off open contract (high = 81%)</td>
</tr>
<tr>
<td><strong>Inventory control</strong></td>
<td>• Not given guidelines on inventory control (high = 30%)</td>
<td>• Calculate needs using a system other than max/min (high = 32%)</td>
</tr>
<tr>
<td></td>
<td>• Not using stock cards (high = 45%)</td>
<td>• Use data other than logistics data to calculate needs (high = 47%)</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>• Make their own guidelines (high = 31%)</td>
<td></td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>• Use the revolving drug fund to pay for transport (high = 58%)</td>
<td>• Use alternate transport if normal transport does not arrive (high = 77%)</td>
</tr>
<tr>
<td><strong>Logistics Management and Information Systems (LMIS)</strong></td>
<td>• Develop own LMIS forms (high = 20%)</td>
<td>• Create own BRES form (11%)</td>
</tr>
<tr>
<td><strong>Human resources/personnel</strong></td>
<td>• Transferring staff without approval (high = 12%)</td>
<td>• Assign personnel to logistics (high = 83%)</td>
</tr>
<tr>
<td></td>
<td>• Using internally generated funds to motivate staff (high = 63%)</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
### Annex A  Continued

<table>
<thead>
<tr>
<th>Functions (n)</th>
<th>Logistic decision space, Ghana</th>
<th>Logistic decision space, Guatemala</th>
</tr>
</thead>
</table>
| Supervision and staff development | • Design own supervision guides  
(high = 31%)  
• Create own supervision schedules  
(high = 71%)  
• Assign staff on own to supervision  
(high = 81%) | • Design own supervision guide  
(high = 29%)  
• Apply own supervision guide  
(high = 69%)  
• Decide supervision staff (high = 71%)  
• Allocate financial resources to supervision (high = 48%)  
• Schedule supervision visits (high = 81%)  
• Decide frequency of visits (high = 81%) |
| Training | • Identify training needs (high = 89%)  
• Use own resources (high = 31%)  
• Select own participants (high = 28%) | No indicator |
| Organizational support | No indicator | • Solve organizational problems on own  
(high = 91%) |
| Product quality assurance | • Percentage of facilities that disposed,  
sent a report, and/or returned (as opposed to doing nothing with)  
damaged, near expired drug, wrong product, or poor quality product  
(high = 88%)  
• Percentage of facilities that kept a product with less than 18 months of shelf life instead of returning it  
(high = 77%) | No indicator |
| Treatment protocols and client contact | • Percentage of facilities with national protocols for drugs (high = 86%)  
• Percentage of facilities that are able to modify national protocols to suit local conditions (high = 51%) | No indicator |

BRES = Balance, Requisition and Issue Form; EDL = Essential Drugs List; GHS = Ghanaian Health Services; POA = Annual Operating Plan.