

Factors Determining Agility of Pharmaceutical Supply chain Management of Local pharmaceutical Industries in Ethiopia.

By

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Department of Pharmacy; in Partial Fulfillment for the Requirements of Master of
Science (MSc) in Pharmaceutical supply chain management (PSCM).

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the Pharmaceutical Supply Chain Pharmaceutical Industries in Ethiopia.

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panies which have long been regarded as the laggards in
be an option: either they can get rid of the short-term
pressures they encounter, or they can have a long perspective and recognize the real
contribution the supply chains can bring about. There are some government compulsory forces
in Ethiopia in order to increase the local pharmaceutical productions and the supply chain to be
agile. Since Agile Supply Chain (ASC) is considered as critical competitive advantage in recent
years, yet the agility and the influencing factors are not well studied in these local
pharmaceutical manufacturing industries.

Objective: To assess determining factors of agility in supply chain management of local
pharmaceutical manufacturing industries in Ethiopia.

Materials and Methods: a quantitative descriptive cross-sectional study and phenomenology
research design were employed. A semi-structured questionnaire was used to collect the
quantitative data and in-depth interview method for qualitative data. The data was analyzed
using descriptive analysis, bivariate analysis using Spearman's correlation and using thematic
content analysis.

Results: From the survey on attitude of skilled professionals and managers on factors
determining agility in the supply chain management of local pharmaceutical industries having a
response rate of 94.79%, it is identified and categorized as: Intra-organizational factors,
External factors and Environmental pressure factors are influencing agility of local
pharmaceutical manufacturing industries: the specific factors implied with their spearman's
correlation coefficient are: cost reduction(0.540), delivery speed(0.242), planning and
reordering(0.596), Assessment and prioritizing of suppliers for purchasing(0.462), Material
quantity adjustment(0.314), trust development(0.503), Strategic supplier partnerships(0.714),
customer relationship(0.299) and Environmental pressure(0.384).

Conclusion and Recommendation: To survive and succeed, the local pharmaceutical companies
have to clearly identify and understand the underling Intra-organizational factors, external
factors and environmental pressure factors of agility in their supply chain.

The local pharmaceutical manufacturing firms in Ethiopia has to make use of the opportunities
on time by focusing on their supply chain strategy so that they can gain the ability to be flexible
and respond quickly to unpredictable changes.

Key words: uncertain demands, supply chain, supply chain management, development chain,
agility, pharmaceutical manufacturing industries.



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	I
	II
	III
	V
	VI
List of acronyms and Abbreviations	VII
1. Introduction	1
1.1. Back ground.....	1
1.2. Statement of the problem.....	4
1.3. Significance of the study	5
2. Literature Review.....	6
2.1. SCOR Model/ Supply chain operations reference model/.....	6
2.2. Agility in supply chain management	7
2.3. Conceptual frame work.....	12
2.4. Objectives of the study.....	13
3. Materials and Methods	14
3.1. Study area and period.....	14
3.2. Study design	14
3.3. Source population:	15
3.4. Study Population.....	15
3.5. Exclusion criteria	15
3.5. Sample size and Sampling Procedures.....	15
3.6. Variables	16
3.6.1. Outcome variable	16
3.6.2. Independent variables.....	16
3.7. Data collection procedures (Instrument, personnel, data collection).....	16
3.7.1. Data collection procedures for quantitative study.....	16
3.7.2. Data collection procedures for qualitative study.....	17
3.8. Ethical consideration.....	17
3.9. Pretest.....	18
3.10. Data quality management	18
3.11. Data processing and presentation.....	18
3.12. Dissemination plan.....	19
4. Results	20
4.1. Quantitative study results	20
4.2. Qualitative Information (results)	24
4.2.1. Intra-organizational factors.....	24
4.2.2. External factors	28



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.....	29
.....	31
.....	34
.....	35
.....	36
.....	37
Annexes:	41
Instruments.....	41



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Supply chainí í í í í í í í í í í í í í í í í í í 2

Figure2. SCOR Model (Supply chain operations reference model)í í í í í í í íí í 7

Figure3. Stages in a generic value chainí ..9

Figure4. Conceptual framework of agility from some essential component of SCM practiceí 12



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Manufacturing firmsí í í í í í í í í í í í í í í í 20

Table2.General information of the Manufacturing firmsí í í í í í í í í í í í í í í í .í í í í .21

Table3. Quantitative survey results.í ...22

Table4. Shows results of Agility capability Attributesí ..22

Table5. Spearman's correlation Bivariate Analysisí ...23

Table6. List of Local Pharmaceutical Manufacturing Companiesí í í í í í í í í í í í í í49

Table7. Bivariate Analysis using Spearman's correlation of all the variablesí í í í í í í .50



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AM	Agile manufacturing
API	Active pharmaceutical ingredient
EPHARM	Ethiopian Pharmaceutical Manufacturing
FMHACA	Food, Medicine and Healthcare Administration and Control Authority
GDP	Growth and development plan
GTP	Growth and transformation plan
NCE	New chemical entity
PSCM	Pharmaceutical Supply chain management
R&D	Research and development
RSC	Responsive supply chain
SCM	Supply chain management
SCOR	Supply Chain Operations Reference model
SC	Supply chain
EDI	Electronic data interchange



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model (SCOR): a cross industry structure for the supply chain management and execution. It encompasses five processes: sourcing, making, delivering and returning.

Skilled professionals: a critical mass of skilled human resources. These include pharmacists, but also include graduates from universities with chemistry and biochemistry degrees, as well as technicians who are experts in the use of precision scientific equipment and engineers that are familiar with the machinery used to manufacture medicines and quality control and quality assurance processes.

Finished product: finished dosage form that has undergone all stages of manufacturing including packaging in its final container and labeling.

Pharmaceutical product: Any material or product intended for human use presented in its finished dosage form or as a starting material for use in such a dosage form, that is subject to control and this includes medicines, medical device, cosmetics etc.

Production: All operations involved in the preparation of a pharmaceutical product, from receipt of materials, through processing, packaging and repackaging, labeling and relabeling, to completion of the finished product.

Manufacturing industry: A company that carries out operations such as production, packaging, repackaging, labeling and relabeling of pharmaceuticals.

Local production: shall mean the manufacture of pharmaceuticals in Ethiopia, whether by a locally owned firm, by a joint venture or by a foreign firm.

Formulation: refers to the process by which active pharmaceutical ingredients and excipients are combined to make the final pharmaceutical product.



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1. Introduction

1.1. Back ground

A scientific and technological transformation is occurring in the pharmaceutical industry that will make it possible for drug producers to produce profitable new medicines for conditions that cannot be treated very well today and for conditions which have formerly persisted against all treatments. But transformations require adjustments, and this revolution needs the supply chains to be regulated with it. The pharmaceutical companies which have long been regarded as the laggards in supply chain management (SCM) have an option: either they can get rid of the short-term pressures they encounter, or they can have a long perspective and recognize the real contribution the supply chains can bring about. In the past, pharmaceutical companies did not consider supply chain management concepts (1).

The Agility-Forum, 1994 has defined 'agility' as the ability of an organization to thrive in a continuously changing, unpredictable business environment. Simply put, an agile firm has designed its organization, processes and products such that it can respond to changes in a useful time frame. Despite the obvious benefits of agility, firms that operate in complex environments such as international markets, face challenges in implementing the measures necessary to increase their agility. These challenges stem from the expense associated with the complex operations and management structures necessary to support the desired attributes (2).

To balance customers' requirements with the need for profitable growth, many firms are aggressively focusing on improving supply chain management (SCM). The supply chain involves 'all activities associated with the flow and transformation of goods from the raw material stage, through to the end user, as well as the associated information flows'. SCM is the integration of these activities through improved inter- and intra -firm relationships to achieve sustainable competitive advantage (3).

Co-operation among firms belonging to the same supply chain is now days recognized as a powerful source of competitive advantage. Leading-edge companies realized that by transferring

they are actually not increasing their competitiveness, since consumers. Hence, SCM tasks firms to co-operate with the channel sales and profitability, rather than competing for a bigger share of a fixed profit. A growing acceptance of these concepts has led to significant changes in the way business is done (4).

Companies in any supply chain must make decisions individually and collectively regarding their actions in five key areas: production, location, Inventory, transportation and information .The sum of these decisions will define the capabilities and effectiveness of a company's supply chain. The right combination of responsiveness and efficiency in each of these supply chain drivers allows a supply chain to increase throughput while simultaneously reducing inventory and operating expenses (5).

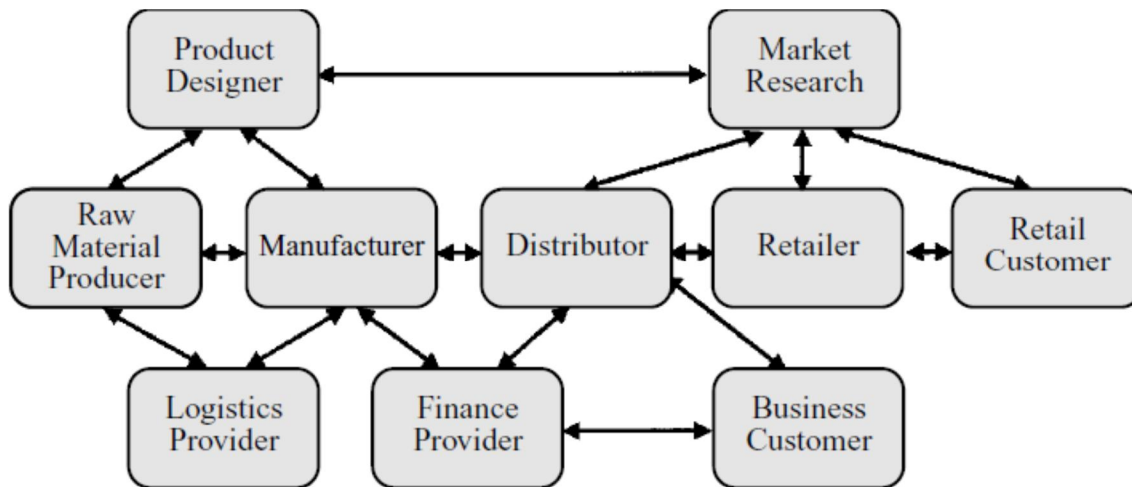


Figure1. Frame work of an extended supply chain (5).

Supply chains in the pharmaceutical industry, one typical industry of products with a high added value per mass unit, comprise two manufacturing stages: primary manufacturing for active ingredient (AI) production and secondary manufacturing for formulation and packaging. As very high-value products, AIs are usually produced in low amounts and in few centralized locations worldwide. Secondary manufacturers prepare and formulate the products in a suitable form for final consumers. This involves adding the AI to some "excipient" inert materials along with further processing and packing (6).

with an estimated population of 82 million, Ethiopia has the potential to become a significant market for pharmaceutical products in sub-Saharan Africa. The Pharmaceutical Fund and Supply Agency (PFSA) of the Federal Ministry of Health under take procurement for public health facilities throughout the country. Although recent figures are missing, estimates on the share of the market held by local producers of pharmaceuticals vary between 15 and 30% of the market. Ethiopian Pharmaceutical Manufacturing Company (EPHARM) was the first pharmaceutical company established in the country, having been founded in 1964. It was nationalized in 1975 and is currently privatized. Following the market reforms of the 1990s, 17 private companies were established, producing a range of pharmaceutical-products, excipients, medical supplies and veterinary products. These companies were frequently financing acquisition of technology and production of pharmaceuticals through a combination of bank loans and joint venture investments. The local producers engaged in final formulation of drugs combining the API with excipients. Of the 17 private companies that were producing pharmaceuticals and medical supplies, 4 have gone out of business. Five of the companies still in operation are joint ventures (7).

Ethiopia has been considered as having potential to manufacture quality medicaments at a reasonable cost for both the domestic and export markets. As a culmination of various reform efforts in the pharmaceutical sector that have been taking place since 2007, the Ethiopian Government has now included the pharmaceutical manufacturing sector as a priority sector for industrial development and investment for the first time in its August 2010 Growth and Transformation Plan. This categorization will make it easier for local firms in the sector to receive priority treatment for access to credit, tax holidays, upgrades of infrastructure and availability of technical support and technology transfer(8)

Even though, in the recent years it has seen a major upsurge in the development of pharmaceutical manufacturing in Ethiopia, but the local industry faces several constraints which hinders them for being agile. At the same time the pharmaceutical market in Ethiopia and the sub-region is quickly developing in response to address the priority endemic diseases in the sub-region.

Even though there are some government compulsory forces in order to increase the local pharmaceutical productions, there is still big gap in pharmaceutical market share because of unexpected demands, less manufacturing firms' capacity and little knowledge about agility and influencing factors of agility in the supply chain practices.

In the current pharmaceutical market, the local pharmaceutical manufacturing industries have to make use of the advantage which can be gained by applying the modern supply chain practices in the accomplishment of their organizational goal. But the local pharmaceutical manufacturing industries have less capacity and limited response to local demands due to many factors. There is delay in responding to local pharmaceutical demands and also less awareness to the influencing factors of agility in the supply chain.

The purpose of this study is to address the following research questions:

What are the factors determining the agility of the supply chain management of local pharmaceutical manufacturing industries in their supply chain practices?

What are the unfavorable factors determining agility in the path to market that exist at every stage of the supply chain management for the local pharmaceutical industries.

What are the favorable factors to be agile in the pharmaceutical supply chain (PSC) in order to invest in and increase their share in the domestic market as well as export market for local pharmaceutical industries in Ethiopia?

What are the ways that the local pharmaceutical industries in Ethiopia have to adapt or built in order to enhance their competitiveness by understanding the agility factors through their strategic decisions?



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Strong pharmaceutical sales growth is expected across Ethiopia in line with rapid growth in GDP and health facilities expansion. In return this necessitates the requirement of modern agile pharmaceutical supply chain management practices. The national goal as stated in the GTP is to raise the share of the domestic market from around 20 % by local manufacturers to 50%. However, the country's pharmaceutical industries are not without challenges: income inequality and varied infrastructure strength between urban and rural settings imply that companies must carefully assess their target population and the existing infrastructure in place to reach it. These all enforce the need of application of modern supply chain management in line with the development of the local pharmaceutical industries (9).

This study had tried to identify the factors determining the agility of SCM in local pharmaceutical industries in Ethiopia, in order to respond to emerging as well as unstable demand for surviving with current dynamic pharmaceutical market of the country as well as the East African sub-region. The study also implied how were the agility and its associations with the influencing factors of agility in the SCM practices of the local pharmaceutical industries in Ethiopia and also the need for such modern supply chain management.

The study can enhance the attentions of the policy makers on the application of agile supply chain management on the capacity building strategy of the local pharmaceutical manufacturing firms by the government of Ethiopia. The study can also help as base line for further studies in the areas of supply chain in manufacturing sector.

...ers determining to be agile in the pharmaceutical supply chain. The factors mentioned in some articles. We try to relate some studies done in other industries using this modern agile supply chain model and also review related general survey on challenge and opportunity factors on local pharmaceutical industries conducted in Africa from the supply chain perspective. Part of the ASC process is agile manufacturing. Cai-feng (2009) points at four pivotal objectives of agile manufacturing: customer enrichment ahead of competitors, achieving mass customization at the cost of mass production, mastering change and uncertainty through routinely adaptable structures, and leveraging the impact of people across enterprises through information technology (10).

Today's highly competitive environment in which the manufacturing firms operate is characterized by growing world competition and increasingly demanding customers. Further, as the new competitive environment changes to more global, technologically oriented and customer driven, as product life cycles shrink and new products get introduced rapidly, as customers continually demand higher quality, faster response, and greater reliability of products and services, the new world market demands a more customer responsive behavior by companies. Sabath (1998) argues that supply chains need to be managed in a way that enables quick response, so as to cope with volatile demand. The underlying factor is the need to focus on time, flexibility, and speed of response of the supply chain to succeed in this increasingly global marketplace thereby creating competitive advantage for the firm (11).

2.1. SCOR Model/ Supply chain operations reference model/

In the current study, we will employ some parts of the Supply Chain Operations Reference (SCOR) model according to Supply Chain Council in 2001. The SCOR makes a cross industry structure for the estimation and improvement of supply chain management and execution. Five main supply chain processes are captured by the structure of the SCOR model. The processes are planning, sourcing, making, delivering and returning.

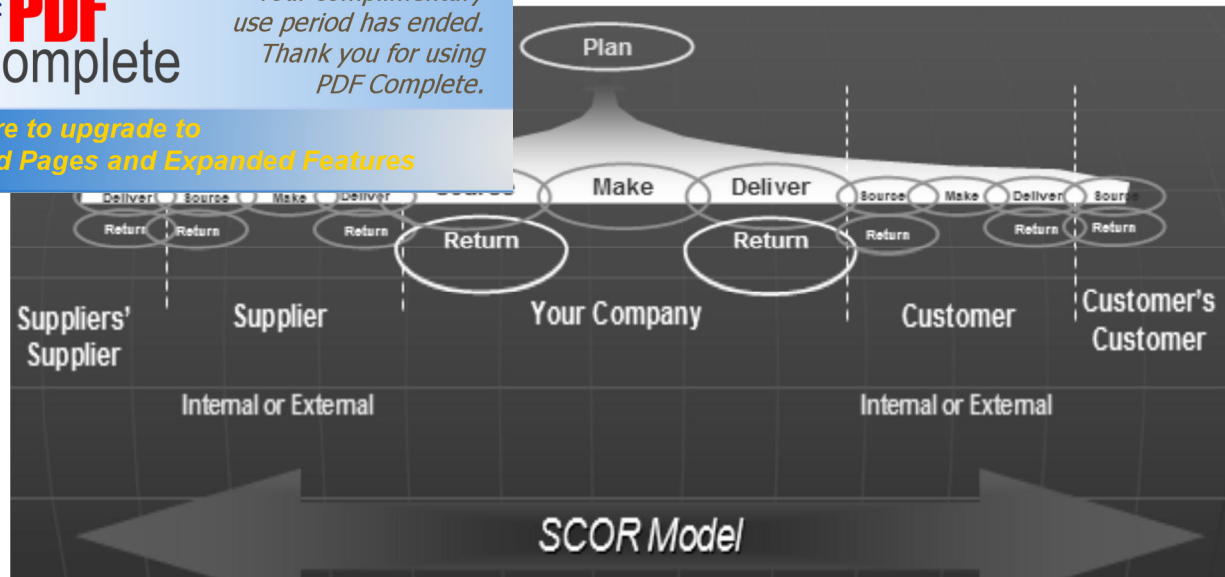


Figure 2. SCOR Model (Supply chain operations reference model) (12)

2.2. Agility in supply chain management

In the early 1990s, agile manufacturing (AM) gained momentum and received due attention from both researchers and practitioners. In the mid-1990s, SCM began to attract interest. Both AM and SCM appear to differ in philosophical emphasis, but each complements the other in objectives for improving organizational competitiveness. AM relies more on strategic alliances/partnerships (virtual enterprise environment) to achieve speed and flexibility. But the issues of cost and the integration of suppliers and customers have not been given due consideration in AM. By contrast, cost is given a great deal of attention in SCM, which focuses on the integration of suppliers and customers to achieve an integrated value chain with the help of information technologies and systems. Agility should not only be based on responsiveness and flexibility, but also on the cost and quality of goods and services. This requires the integration of AM and SCM to develop a RSC with the objective of achieving agility in a supply chain environment (13).

In a study done in Iran it is indicated that agility helps providing the right product, at the right time to the consumer and also they adopt the agile supply chain for Pharmaceutical Supply Chain based by employing some parts of the Supply Chain Operations Reference (SCOR) model according to Supply Chain Council in 2001. And they mentioned that there has been no study on the agility of pharmaceutical supply chain in any of the developing countries. Their research aim



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mentioned studies and also it extends agility scale as a key countries and in to a new sector (14).

Ganizheiyazkov in his study of Agile Supply Chain described that application of agile supply chain in whole process of the supply chain in Zara; product organization and design; purchase and production; product distribution; sales and feedback help them to lead their competitors. Over the last decades Zara introduced agile supply chain (ASC) in the fast fashion industry and positioned itself third in the world retailers ranking. All these prove that ASC is an aspect enhancing competition among organizations. Another lesson is that efficient production organization with a good balance between in house and outsourcing task leads to minimum lead times and increase in market share for Zara (15).

Survey of local manufacturing of Africa, by Cardno Emerging Markets,Belgiums.a.(Formerly Emerging Markets Group, s.a.) and Enabling Environments Ltd., Indicate that Ethiopia is one of the most populated countries of Africa with a high demand for pharmaceutical products and the industrial base is not well developed and the manufacturing companies have relatively low production capacities. Even if local manufacturers tend to be given preference in the case of procurement from the government. The prices of the locally manufactured products are actually higher than imported products. These really urges for improvement in performance in the local industries by adopting modern and effective supply chain after studying the determining factors of agility of supply chain management of local pharmaceutical manufacturing industries and also tackle the challenges in the SCM perspective and needs quick utilization of local as well as global opportunities(16).

African Development Bank Group, OCED development center, UNDP, on their Global Value Chains and Africa's Industrialization African Economic Outlook 2014, Thematic edition, described the Opportunity factors and benefit factors from the modern supply chain practice in its description of values chain that production networks has changed the way goods and services are produced which are driven by firms which use the advances in communication and regulation to optimize their sourcing strategies through geographic re-organization and the separation of production stages. Ideally this leads to opportunities to upgrade through knowledge transfers, product differentiation and the addition of adjacent stages of the value chain. Measures of trade in value added as opposed to traditional gross measures of trade can provide insights

gains and the benefits this entails. The interconnected services undergo from conception and design through production is often referred to as a global value chain or an

international production network (17).

Each stage carries, to varying degrees, opportunities for new local activities, jobs and corporate profits, as well as the associated new skills, technology and public revenues in the form of taxes. Successful integration into a value chain potentially allows a country to seize a bigger share of those benefits and accelerate its industrialization process.

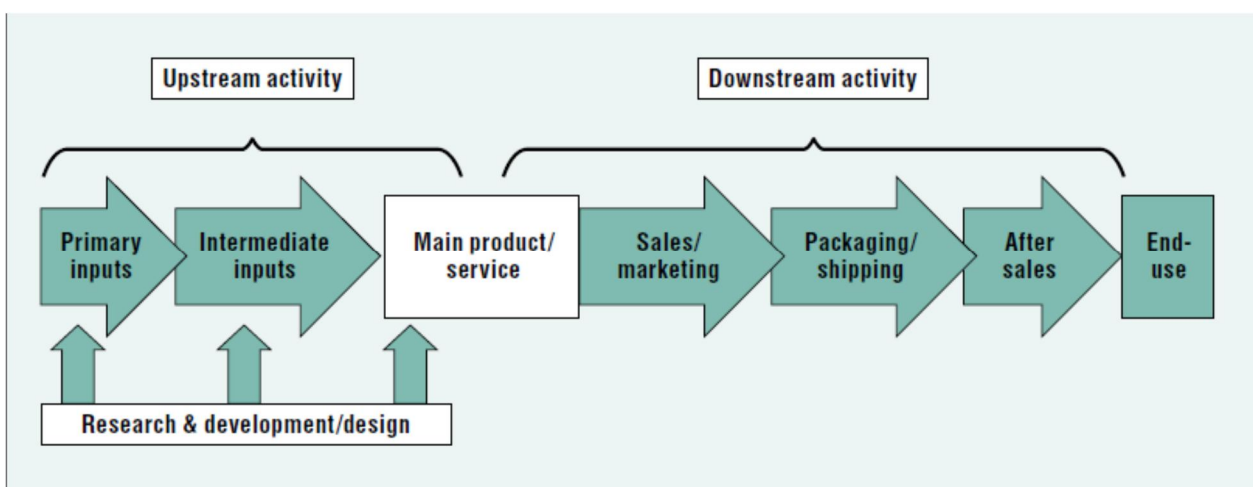


Figure 3. Stages in a generic value chain (17).

From Case studies done on local pharmaceutical manufacturing of South America, Asia, and Africa which include ;Argentina, Bangladesh, Colombia, Indonesia, Thailand, Jordan and Ethiopia , Uganda from Africa by the UNCTAD Secretariat; It is discussed that Local production of pharmaceuticals and vaccines has been a subject of intense discussion in international, regional and national forums since the 1970s. A variety of interests ó economic, legal and political economy oriented ó have been responsible for varied, often contradictory, perspectives on what constitutes local production and whether or not it should be fostered. It is indicated that even if the influencing factors are not clearly studied and agility attributes are not common and there are identified factors which highlights specific country conditions. Local production may increase price-based competition in the market, contributing to ensuring lower prices of drugs and greater affordability (18).

According to this study Efficient and widespread distribution networks and pharmaceutical supply chains controlled by many local companies by definition enhance access by developing



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al areas. But the existence of distribution networks and a starting point for the development of formulation into other niche areas.

From the study on the viability of local pharmaceutical industries in Tanzania, and the viability of local pharmaceutical industries Ghana "These studies, argues that there is a case for promoting the local production of pharmaceuticals in Tanzania and Ghana. Especially the donor market in Tanzania itself is sufficiently big to accommodate Tanzanian producers and offers realistic options for a viable business. However, in regional or international markets, where Tanzanian producers have to compete with producers from India and China, their prospective success is at least questionable and the associated factors of agility of SCM perspective of the local pharmaceutical firms are not studied in detail (19).

In a study done in India, on The Indian Pharmaceutical Industry, indicate that fast response to demand by adopting different agile manufacturing practices; after 1970, the Government introduced legal factor which is the new Patents Act. This has excluded pharmaceuticals and agrochemical products from eligibility for patents. This exclusion was introduced to break away India's reliance on imports for bulk drugs and formulations and provide for development of a self-reliant indigenous pharmaceutical industry. Under the process patent system no active pharmaceutical ingredient can be patented but the different processes to make that molecule can be patented. That has led to flexibility and gives opportunities for Indian pharmaceutical industries that have paved the ways to the growth of Indian pharmaceutical industries. Authors have concluded that; Indian pharmaceutical industry has benefited tremendously from the liberal patent law of 1970. It enabled India to supply cheapest generic drugs. Stronger patent protection would limit imitation and thereby inhibit technological change (20, 21).

Survey done on local pharmaceutical industries in Ethiopia by Zerayakob has assessed and identified the unfavorable factors and opportunities in Local pharmaceutical industries in general view in Ethiopia. Even if it is not in the perspective of supply chain, it examine unfavorable factors as well as opportunities which also encompasses some factors determining agility of SCM in local pharmaceutical industries, it addresses the huge market gap for pharmaceuticals and medical supplies so that domestic market is highly dependent on imports. Also local manufacturers are highly dependent on imported raw materials and other essential inputs as there



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industry in the country, most of the manufactures don't
the government has recognized the importance of the
close policy support and follow up and also decided that
the sub-sector to be as one of the five top priority area that require major focus and support for
pharmaceutical industry. Thus, a strategic plan has been developed which makes the sector more
attractive for new investor to fill the gap as well as for the existing ones to promote capacity
utilization. The local manufacturers will receive up to ten years tax holiday for special
investment in pharmaceuticals, and no tax on locally produced pharmaceuticals for export. The
Federal Government Investment Commission's new directive in which all technologies for
manufacturing and for R & D activities will be exempt from paying duty and related taxes(22).

This model is adapted from the models developed on agility factors both from the supply side of the supply chain and demand side of the supply chain from literature review of different articles in the area of agile supply chain.

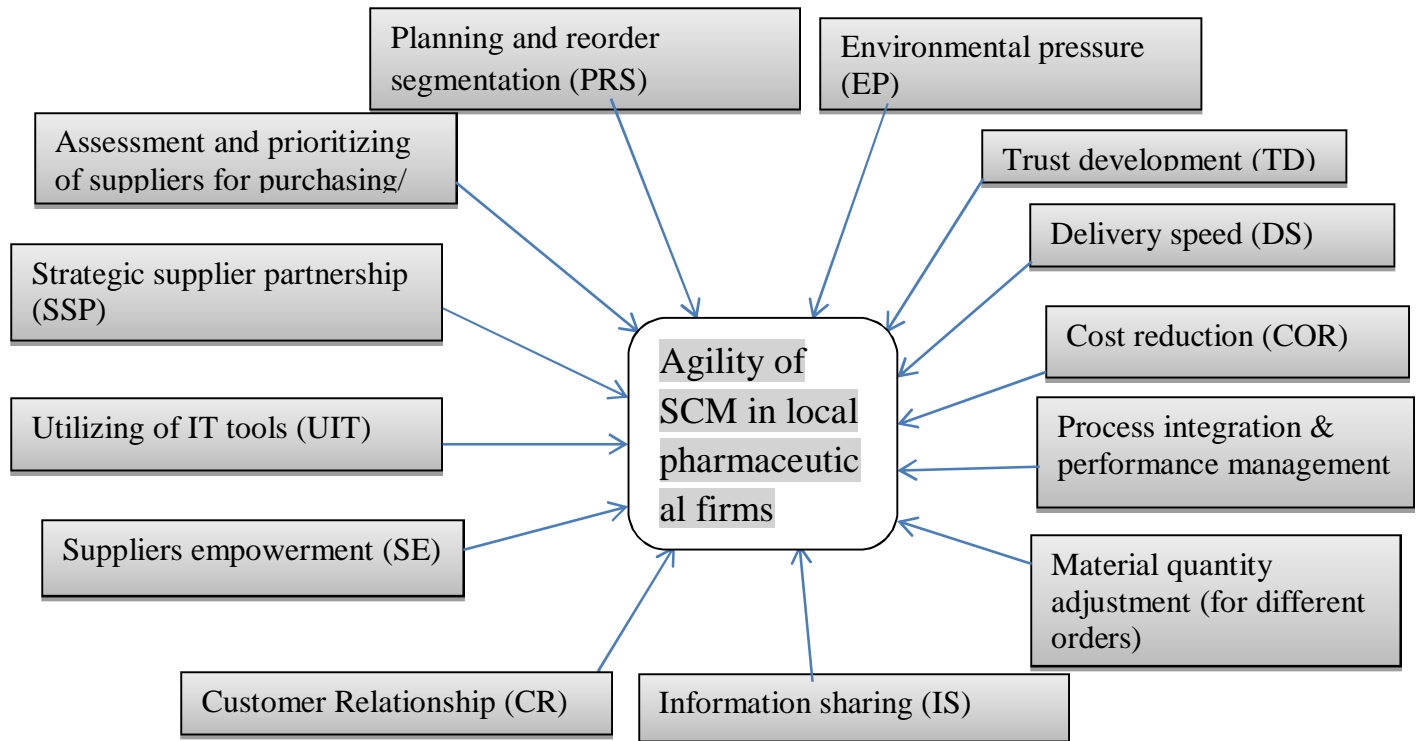


Figure4. Conceptual framework of agility from some essential components of SCM practices



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... of supply chain management in local pharmaceutical industries in Ethiopia by considering the supply chain perspective.

Specific objectives

- To identify factors determining agility in the SCM of local pharmaceutical industries for responding to uncertain situations.
- To identify the factors of agility that influences responsiveness in the supply chain of local pharmaceutical industries for being agile.
- To assess the perceptions of skilled professionals in pharmaceutical manufacturing firms on the factors influencing agility of supply chain management in local pharmaceutical industries.
- To pinpoint the supply chain as well as development chain practices of local pharmaceutical industries.



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Materials and Methods

The Ethiopian pharmaceutical industry currently consists of 13 pharmaceutical and medical supply manufacturers; about 10 of these produce pharmaceuticals while the rest are engaged in producing medical supplies such as syringes, absorbent cottons and laboratory equipment. The industry is very small in size and has limited capacity; it serves only a small part of the domestic market (less than 20%) while imported drugs cover the rest of the market. Considering Profiles and lines of business of large firms, Ethiopian Pharmaceutical Manufacturing and Addis Pharmaceutical Factory are the largest and oldest firms, and produce various medicines in relatively large quantities. These firms have about 570 employees and about 600 employees respectively. From Profiles and lines of business of mid-size firms, most of the firms in the pharmaceutical industry fall in the mid-size category, with numbers employees ranging from 50 to 150 (23).

The active local pharmaceutical manufacturing plants are located at Addis Ababa city, Gelan town, Mekele city, Adigrat town and Debrezeit town. There is also new pharmaceutical industry which has started production recently in Ethiopia called Julphar pharmaceutical industry, which is planted by investors from United Arab Emirate and it is located in Addis Ababa. The study areas are where the manufacturing firms are located.

The study data collection period was from 1- March-2015 to 30-March-2015.

3.2. Study design

For quantitative study, descriptive cross sectional research design was used. Agility factors of supply part of the supply chain as well as demand part of the supply chain was adapted from literature based on the basic SCOR Model for this study. The quantitative questionnaires were designed based on 13 critical factors, which were adapted from relevant literature reviews.

For Qualitative study, phenomenology research design which focuses on the lived experience of individuals using in-depth personal interview data collection method by using interview guide was deployed. The qualitative study was conducted on professional and managers working in three selected local pharmaceutical industries in Ethiopia, to deeply investigate their experience and opinions to understand the factors influencing agility in PSCM of local pharmaceutical manufacturing industries.

pharmaceutical manufacturing industries in Ethiopia and working in the local pharmaceutical manufacturing firms.

3.4. Study Population

All selected managers and skilled professionals who are key personnel in active local pharmaceutical industries.

3.5. Exclusion criteria

Respondents from the non-functional pharmaceutical industries were not considered.

Non skilled professionals who are not directly involved in professional jobs were not considered.

Firms which produce non- human medicines were not considered.

3.5. Sample size and Sampling Procedures

For quantitative survey;

The main targets were Managers and skilled professionals, key personnel who were involved in company decision making regarding production and supply chain management and have comprehensive knowledge about company's process, production and general pharmaceutical supply chain related issues. They were selected based on the stated basic minimum key personnel requirement for Medicine Manufacturing Establishment Directive of FMHACA and from the perspectives of supply chain strategy requirement of an organization/Pharmaceutical industry in Ethiopia.

Therefore the demographics of the respondents (skilled professionals, Key personnel) were ; Quality assurance head, Quality Control Head ,Production Head / Responsible of production, Engineer Head, Manufacturing General manager, Financial head, Research and Development head and Marketing and sales head or inbound logistic head. All the study population has been considered that is all the managers and skilled professionals; who are key personnel in the manufacturing firms, were taken. All currently functional local pharmaceutical industries in Ethiopia have been considered for the purpose of this study. From each local pharmaceutical industries 8 respondents are taken and the target population size is therefore 96. No need of sampling technique because the study considered all the study population and also the study population was not too large to be studied.

The Sampling technique employed for qualitative study was Purposive sampling to select three manufacturing industries; one oldest manufacturing firm, one of the largest manufacturing firm, and one new pharmaceuticals manufacturing industries. Then Snow ball sampling method was

respondents. Each respondent after being interviewed was
nts in the manufacturing firm. There were 12 respondents
rience, as well as background and insight in the supply
chain management of the pharmaceutical manufacturing industries.

3.6. Variables

3.6.1. Outcome variable

The key dependent variable of interest is Agility of SCM in local pharmaceutical manufacturing industries that are expected to be influenced by some independent variables. These variables have some sub factors; as a result, agility can lead to competitiveness.

3.6.2. Independent variables

Planning and reorder segmentation (PRS)

Assessment and prioritizing of suppliers for purchasing (APS)

Strategic supplier partnership (SSP)

Utilizing of IT tools (UIT)

Information sharing (IS)

Suppliers empowerment (SE)

Material quantity adjustment (for different orders) (MQA)

Process integration & performance management (PIPM)

Cost reduction (COR)

Delivery speed (DS)

Trust development (TD)

Environmental pressure (EP)

Customer Relationship (CR)

3.7. Data collection procedures (Instrument, personnel, data collection)

3.7.1. Data collection procedures for quantitative study

All variables that were adapted from literature reviews were measured by semióstructured questionnaire. The questionnaires were submitted to the respondents by the data collectors. The constructs were measured using five-point Likert scales (strongly agree = 5 through strongly disagree = 1).The questionnaires were prepared using constructs of SCOR model. The quantitative questionnaires were designed based on 13 critical factors, which were adapted from relevant literature reviews, with -questionnaires measuring attitude. The questionnaires on

from pharmaceutical industry profiles, practices and structured questionnaire. The questionnaire designed to capture the SCM activities related to factors determining agility of SCM in their production and their supply chain as whole were administered to the respondents. In addition to the above questions, the information related to the basic profile of the interviewees was requested at the end of the questionnaire.

Four data collectors and one immediate supervisor who were pharmacists having working experience as pharmaceutical company medical representative and have understanding of the pharmaceutical sector were recruited. Training was given by the investigator on the objective, purpose of the study and proper administration of questionnaire.

3.7.2. Data collection procedures for qualitative study

For the qualitative survey, Interview guide for the in-depth interview was deployed based on the information need of this study. In-depth personal interview method was conducted by using unstructured interview guide. The interview guides were developed in English and the in-depth interviews were also conducted in English with 12 selected male respondents by the principal investigator. The selected informants have appropriate experience, as well as background and insight in the supply chain management of the pharmaceutical manufacturing industries.

Based on the objectives of the study, the main parts of the guides include sections on general information which indicate areas of experiences of the informants, list factors determining agility, how to understand the factors and their association with agility.

The interviews were conducted as much as possible in the natural settings, keeping the privacy of the individuals, mostly at homes of the managers, and in the private offices of some the professionals.

A sound recorder is used for capturing the information properly.

3.8. Ethical consideration

Ethical clearance and formal letter was obtained from Jimma University, Institutional ethical review board (IRB) of the college of public health and medical sciences. Participants and firms were assured that their name will not be stated, data will be kept confidential and used only for research purpose.

verbal consent to respond to the questionnaire, after their respondents who were not present during data collection in until three times and if they were not present still they were considered as non-respondent.

3.9. Pretest

The interview guides were piloted in one of the manufacturing firms and some factors which were not related to supply chain agility were reduced from the interview guides.

The questionnaires were subjected to some experienced pharmacists in the supply chain operations as well as decision making and after their review some of the questions have been omitted and final measures were developed.

The questionnaire were subjected to the respondents from one of the local pharmaceutical industries for pretest prior to conducting the whole survey .Cronbach's alpha reliability test was done and for each scale Cronbach's alpha () score is > 0.70 .It is good reliability measure of internal consistency of items on the scale.

3.10. Data quality management

Data quality was ensured during collection, coding, entry and analysis. The data collectors were trained about the purpose of the study and how to administer the questionnaire. On daily basis questionnaire was checked for its completeness by the supervisors. Incorrectly filled or missed questionnaire were sent back to the respective data collectors for correction. Some of the questionnaires were returned incomplete initially, but during field survey back tracking of the data was carried out and then finally all the questionnaires have become completed. The investigator has also rechecked the completed questionnaires to maintain the quality of data.

3.11. Data processing and presentation

At the end of every field day the supervisor were reviewing the filled forms for any inconsistencies, non-response, and incomplete questionnaires. Data cleaning, coding and tabulation were performed before proceeding to analysis. Cleaned and coded data were analyzed using SPSS software; version20. Analysis of the collected data was conducted by descriptive analysis and bivariate data analysis/correlation analysis. Frequency and percentage was used to explore data at the initial stage, to present demographic profile and the descriptive statistics to describe the factors determining agility of the supply chain of the local pharmaceutical



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to present the demographic characteristics and general

represented by text narration method, the narrated text data were broken down into parts and then subjected to thematic content analysis. The output was used to explore and get deeper understanding and then to augment the study finding of the quantitative survey.

3.12. Dissemination plan

The findings will be disseminated to Jimma University, college of public health and medical science and department of pharmacy. The findings will be disseminated to different stakeholders who work on SCM of local pharmaceutical industries. Lastly, attempt to present on various seminars and workshops and for publication in national and international journals.

4. Results

In the quantitative survey, from 96 questionnaires distributed only 91 were completed and collected from the currently functional local pharmaceutical industries in Ethiopia. There was a response rate of 94.79%. All the obtained data have been included in the analysis. The respondents' job title is mainly managers (85.7%) who were involved directly or indirectly in supply chain management decisions. The highest work experience of the respondents is 5-10 year work experience in the pharmaceutical manufacturing firms (42.9%) followed by 1-5 year work experience (39.6%).

Table 1. Demographic information of the respondents.

General information	Category	Frequency	Percent
Job Titles of the respondents	CEO/President	4	4.4
	Vice president	2	2.2
	Manager	78	85.7
	Senior officer	7	7.7
Job functions of the respondents	Company executive	11	12.1
	Marketing and sales	12	13.2
	Production	13	14.3
	Engineering/Maintenance	12	13.2
	Quality control	12	13.2
	Quality assurance	11	12.1
	Research & development	3	3.3
	Finance	12	13.2
	Inbound logistic officers	5	5.5
Years worked at the organization	1-5	36	39.6
	5-10	39	42.9
	10-15	14	13.2
	>15	2	4.4

The general information of the firms have indicated that the largest length of implementation of the local pharmaceutical manufacturing firms are belong to 5-10 years (33.3%) followed by 10-15 years length of implementation (25.3%) this implies that the majority of the local pharmaceutical manufacturing firms have started their production in past 5-15 years which is not too long. The dominant production system of the firms were both make to order & make to

to stock (33.3%). Small number of firms follows the make to order system. In their production system it is understood that majority of firms is driven by holding their inventory at their warehouses and the production system is not rather designed by their customer expectations or requirements. Large number of the manufacturing firms has number of employees in the range of 101-150(33.3%) (table2).

Table2: General information of the Manufacturing firms.

General information	Category	Frequency	Percent
Length of implementation/years/	1-5	2	16.7
	5-10	4	33.3
	10-15	3	25.0
	15-20	2	16.7
	>25	1	8.3
Production/Formulation system	Make to order	2	16.7
	Make to stock	4	33.3
	Both make to order and make to stock	6	50.0
No of employees in Mfg firms	51-100	3	25.0
	101-150	4	33.3
	151-250	2	16.7
	501-1000	3	25.0
Annual sales in million birr	<5	1	8.3
	5-10	2	16.7
	10-25	1	8.3
	25-50	3	25.0
	50-100	2	16.7
	>100	3	25.0

the influencing factors from the perception of the skilled firms are delivery speed, cost reduction, planning and development, environmental pressures, material quantity adjustment, assessment and prioritizing of suppliers for purchasing, customer relationship, information sharing, and strategic suppliers partnership in descending order of the mean. This is based on the data from Likert scale from the respondents' perception on the factors determining Agility in local pharmaceutical manufacturing firms in Ethiopia (Table 3).

Table 3. Quantitative survey results.

	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	Std. Error
DS	91	1.00	5.00	4.3077	.09814
COR	91	1.00	5.00	4.2143	.09574
PRS	91	1.00	5.00	3.8901	.12448
TD	91	1.00	5.00	3.8571	.10256
EP	91	1.00	5.00	3.8242	.12063
APS	91	1.00	5.00	3.8242	.11756
MQA	91	1.00	5.00	3.8187	.10052
CR	91	1.00	5.00	3.6703	.10861
IS	91	1.00	5.00	3.6538	.10058
SSP	91	1.00	5.00	3.5000	.15070
UIT	91	1.00	4.00	2.9451	.04519
SE	91	1.00	5.00	2.5495	.09792
PIPM	91	1.00	4.00	1.9670	.06712
Valid N (list wise)	91				

Table 4. Shows results of Agility capability attributes

	N	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	Std. Error
SC responsiveness	91	1	5	3.21	.135
SC cost efficiency	91	1	5	2.84	.120
SC flexibility /adaptability	91	1	4	2.56	.114
SC quickness /speed	91	1	5	3.07	.122
SC reliable delivery	91	1	5	3.51	.118
Valid N (list wise)	91				

g Spearman's Correlation has showed that UIT (p=0.344) significant correlation whereas most of the independent variables with these dependent variable. There are positive and significant correlations between agility in the SCM and delivery speed (0.242), cost reduction (0.540), planning and reordering segmentation (0.596), trust development (0.503), environmental pressures (0.384), material quantity adjustment (0.314), assessment and prioritizing of suppliers for purchasing (0.462), customer relationship (0.299), strategic suppliers partnership (0.714).

There are a negative correlations between Agility in the SCM and suppliers empowerment and process integration and performance management with the spearman's correlation coefficient of (-0.273) and (-0.221). These factors have similar interpretation with the descriptive analysis having a mean statistic value below the non-discriminating value on the likert scale.

Table5. Spearman's correlation bivariate analysis.

Variables	p-value	Spearman's correlation
DS	0.021	0.242
COR	0.000	0.540
PRS	0.000	0.596
TD	0.000	0.503
EP	0.000	0.384
MQA	0.002	0.314
APS	0.000	0.462
CR	0.004	0.299
SSP	0.000	0.714
SE	0.009	-0.273**
PIPM	0.035	-0.221**
UIT	0.344	0.100
IS	0.134	0.158

* Correlation is significant at the 0.05 level (2-tailed).

(ts)

The interview participants in the in depth interview from the three local manufacturing firms have an average age 42 with an age range of 34-65 years. The durations of interviews were range from 40 minutes to 1 hour and half. They have been participating in decision making regarding production and supply chain operations and their average experience in manufacturing industry was 10 years ranging from 5 to 16 years. They had worked in different positions; production, as manager in the firm, on procurement and in bound logistics of the manufacturing firm, marketing and sales, quality assurance management, and an experience in technical management of manufacturing firms. They have a lot of experiences in the pharmaceutical manufacturing sector challenges and also they have been involving in the supply chain management decision of the local firms. For instance One of the informant described how he understand about Agility and factors influencing agility as: *“I understand what agility is, or modern supply chain management is and also what are determining factors of agility in terms of productivity and the production time lose due to shortage of input materials.”*

The interview participants from all the three manufacturing firms list and describe the factors determining agility as categorized in three broad theme as intra-organizational factors, external factors and environmental pressure factors:

4.2.1. Intra-organizational factors

4.2.1.1. Cost management/reduction factor

One of the informant raised sourcing cost as *“Because of Location of the manufacturing firm and suppliers; sourcing of raw materials, and less interest by suppliers to small orders from our firm. So getting suppliers is difficult, they incur high cost, so sourcing cost is key influencing factor in this regard.”*

The main factor one of the interview participants has raised was *“cost management/minimization of cost to be agile. He pointed out as *“in selecting type of raw materials, we prefer quality with less waste, we try tender to have price advantage, try to minimize demurrage cost during clearance, and also inventory cost and storage cost have been considered during planning, the products should not overstocked and lead to expiry and also should not lead to high storage cost. These influence our efficiency and agility in general”*’.*

...ive been importing 100% of the raw materials, sourcing
...re is no chemical manufacturing industries which can
provide pharmaceutical grade chemicals, this subject us to all raw materials importing which is
lengthy and challenging task which is highly influencing our cost reduction.”

Another informant identified cost reduction as: *“Cost reduction is important factors to be efficient, the main cost is material cost unless we became cost efficient we cannot survive in the current market. Cost reduction leads us to market competitiveness, the government support in this area also help us to be responsive to the market. The major cost is sourcing of raw materials cost, logistic is helpful here. More than 95% of the raw materials are imported. There are no ancillary firms which can supply small simple raw materials for pharmaceutical manufacturing firms.”*

4.2.1.2. Planning and reordering

All the informants from the manufacturing firms have identified proper planning as well as on time planning are key factors for being agile in the supply chain management of the manufacturing firm. For instance one of the informants in the first manufacturing firm cited as *“Planning efficiency, proper quantification, planning of purchasing process as well, and communication effectiveness or ability, are key influencing factors for agility.”* The other informant raised the factor as *“There are internal factors like; not better way of forecasting and quantification, planning is not efficient and effective, the processes are not supported by IT usage. Improper Material quantity planning, and demand assessments, over all less organized quantification are main factors which hinders our agility.”*

One of the informants has described the planning and reordering as: *“doing analysis of the demand and supply (demand gap) in the supply chain segment is influencing factor. PFSA tries but not in well-organized manner which is also a key factor. Even though substituting the imported products is the main strategy, the local firms are fulfilling the local demand still not up to 50% as targeted on GTP.”*

Another informant described planning and reordering factor as: *“We are managing our inventory which makes us better by improving our Inventory management systems.so having optimum inventory and ‘working on what inventory to maintain was helping our firms. Making null*



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because of not reliable distribution channel; there are a lot of factors in bringing and reordering segment is key factors in bringing agility.”

4.2.1.3. Material quantity adjustment

One of the main factors identified by some of the informants is material quantity adjustment for instance one of the informant raised as: *“materials quantity adjustment in our supply chain management leads to bottom line profit, it will have positive impact. Like consolidating and by changing packaging and by making ordering in full container load make us to save cost, which helps our efficiency and responsiveness.”*

On the contrary, another informant described material quantity adjustment as: *“Consolidations at the custom transport some time subject us to delay. The process of identifying the product for inspection at the custom takes time.”*

4.2.1.4. Utilization of IT application

All the informants in the Manufacturing firms have sited that Utilization of IT applications in the supply chain management of their manufacturing firms are at the infant stage. There is a start of using EDI, but not yet advanced use of IT applications.

4.2.1.5. Delivery speed

Delivery speed was identified as one of the main factor determining agility of their firms supply chain management by all informants. One informant said *“timely responding to customers is crucial, but Procuring API and another raw materials from china on average take 3-6 month, it is not easy to conduct in short time”*. The other interview participant described as: *we basically import materials from India and china. Suppliers fail to supply on time. Delivery on time is challenging to be agile delivery speed is mandatory”*

This key factor is described by the other informant as: *“Even having proper suppliers is not easy because some of the items are not attractive to suppliers, due to less scale of production. Sometimes raw materials stay around 5 months to reach our store.”*

Customer relationship is explored as one of the factors influencing agility by most of the informants. For instance one informant said *“We have communication with our customers to keep documents distributed and also communicated by suppliers the transportation documents but we cannot know the status of the supply chain instantly i.e. no adequate information sharing from.”* Another informant said that *“We frequently interact with our customers specially the distributors to be responsive to the market as much as we can.”*

The other informant explained customer relationship factor as: *“Logistic and distribution partnership with our customers positively influence our agility in SCM, it leads us to cost reduction, decrease in wastage, also helps for on time delivery.”*

4.2.1.7. Information sharing

Some informants identified information sharing factor as the other factors. For instance one informant cited as *“Regarding information sharing we do have good information sharing with our customers where our products are going, but somewhat less on time information sharing with the raw material suppliers.”*

One informant said *“Even if information sharing is a key factor, no well systematized information sharing with the suppliers for follow up of the entire supply chain. Information sharing practice is by a set schedule and some communication with suppliers and banks. No applied means of online tracking of the materials status. Frequently there is no direct involvement of the suppliers in production planning or any development chain in our firm.”*

Another informant said: *“the information sharing is based on the financial documents mainly, from information from bill of lading, airway bill, etc. but less way of knowing online status of status of the products.”*

The other informant cited information sharing factor as: *“We have sharing of information with main suppliers, but so many parties involved (banks, regulators, shipping lines, customs, Insurance) less integration of the stakeholders in importing materials are hindering factors to have an agile supply chain system”*

All the informants have identified Strategic supplier partnerships as one of the factors determining agility in the supply chain management of their manufacturing firms. For instance one respondent said *“We have list of prequalified suppliers and we have strategic supplier partnerships they come and visit our firm and also we visit their firms but not as strong as needed.”*

To be flexible or agile one informant described strategic suppliers partnership as *“we have created partnership and also strengthen our partnership with raw material suppliers .We regularly visit our suppliers there is supplier audit, usually in India and china, there is a technical team which visit the suppliers and their premises which helps us to prepare prequalified approved suppliers list. This save costs by shortening purchase cycle time, and delivery time, decrease our storage cost. So these positively affect our business which helps us to be responsive to our customers.”*

4.2.2.2 Assessment and prioritizing of suppliers for purchasing

Most informants identified Assessment and prioritizing of suppliers for purchasing is one of the major factors determining agility in the supply chain management of their firms. One of the informants has raised this factor as: *“we regularly conduct assessment and prioritizing of suppliers for purchasing that help us to have prequalified reliable suppliers at least for main inputs.”*

4.2.2.3. Trust development

Most informants identified that trust development with the suppliers is key helpful factors determining agility of SCM. For instance, one informant stated trust development factors as: *“Because of small quantity of procurement creating partnership with suppliers is not easy. We send questionnaires and also send quality assurance personnel then after we include in the prequalified suppliers list which is lengthy, so difficult to change them easily. Trust development is mandatory factor.”*

of foreign exchange some time wait 3-6 months, having such problem.so maintaining trustful suppliers. By doing this we can reduce production down time so minimize delay to the customers.ö

The other informant sited that: *öWe have trusted suppliers, strategic partnership with the suppliers, we have key suppliers, but not strong enough. But some help us in cases of trouble shootings. practical example ; 'last year there were stringent environment pollution control in china ,the suppliers were temporarily obliged not operate or partly operate, some of our supplier give us from their stock after informing ahead, some give us information where we can find the raw materials from other sources. This has great impact on our agility.'"*

4.2.3. Environmental factors

4.2.3.1. Environmental pressures (political, economic, social factors)

Almost all of the informants in the pharmaceutical manufacturing firms have explored the Environmental pressure factors as *öThere are also positive factors; push or need of the government to boost the pharmaceutical manufacturing firms, free taxation, facilitating the marketing part through PFSA/PFSA tenders give 30% advance, local tenders for local manufacturers only, potentially secured buyer, government initiative to support local manufacturers. But for the huge local pharmaceutical market, the capacity of the local firm is limited especially in terms of capital. Our firm is unable to compete with products in the market from India and china with less cost which hinders us to reach the market' even if there is support from the government.'"*

On the economic factors in the internal processes of the firm, one of the informant said *"The machineries which have been used are old and have their own effect to be agile in manufacturing process which has its own impact on production flexibility and also the capability of professionals in pharmaceutical industries and lack of advanced Technology are also contributing factors.'"*

One of the interview participant has raised environmental pressure factors determining agility as *"infrastructure or the economy by itself is one factor, the information systems, foreign currency shortage (economic factor), delay in approval of foreign currency, and political support is*



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higher priority but for pharmaceutical sector not adequate, y.”

The other informant raised Policy issues in the areas of regulation as : *“due to high requirement of controlled products, and even labeling and document requirements are very stringent and leads to longer staying of the raw materials in ports, even if some requirements are very minor but its implementation delay leads to demurrage costs. And also further requirement on API suppliers on which the suppliers are not willing to submit the dossiers for API also hinders our agility, so policy issues are also key factors.”*

There are also positive environmental factors which can influence the agility; for instance one of the informants described as *“support from ministry of industry is positive factors they give support letters to customs to import ‘by francovaluta terms’ no payment is required if there is no foreign currency at national bank. And investment agency allows us to import by duty free for any industrials machinerries, raw materials. These are positive factors which enhance our agility.*

5. Discussion

The result of the quantitative part of the study indicates that, the main factors determining agility in the supply chain of local pharmaceutical manufacturing firms are: delivery speed, cost reduction, planning and reordering segmentation, trust development, environmental pressures, material quantity adjustment, assessment and prioritizing of suppliers for purchasing, customer relationship, and strategic suppliers partnership. The result of the respondent imply that the most influencing factors from the perception of the skilled professionals in local manufacturing firms are: delivery speed, cost reduction, planning and reordering segmentation, trust development, and environmental pressures in descending order of the mean. The reasons for these factors to be rated higher are accounted to internal as well as external sub factors which are contributing. For instance the factor cost reduction with its sub factors are described as: lack of ancillary industries and week related pharmaceutical industries in the area and less capital of the firms contributes to high sourcing cost of raw materials. The other contributing factor are the less developed infrastructure of the country and also less focus on the impact of the supply chain practices may lead to less delivery speed of the manufacturing firms. Difficulty of obtaining raw materials due to lack of ancillary chemical manufacturing industries which are capable to provide pharmaceutical grade chemicals have been addressed by most interview participant in the qualitative interview.

The Spearman correlation test was used to test the correlations between the variables. Results showed that there is a positive and significant correlation between agility in the supply chain management and independent variables. The key factors with their correlation coefficient with agility in the supply chain are: delivery speed (0.242), cost reduction (0.540), planning and reordering segmentation (0.596), trust development (0.503), environmental pressures (0.384), material quantity adjustment (0.314), assessment and prioritizing of suppliers for purchasing (0.462), customer relationship (0.299), strategic suppliers partnership (0.714).

There is a negative correlation between Agility in the SCM and suppliers empowerment (-0.273) and process integration and performance management (-0.221). The correlation coefficient of these variables implies that there are monotonic decreasing relationship between these factors and agility of supply chain management. Therefore, the unfavorable factors identified are suppliers empowerment and process integration and performance management which were

factors in the local manufacturing firms. However the influencing factors are in contrary to many literatures in the areas of supply chain management of manufacturing firms in different countries. This result may be due to the reason that the processes in the local manufacturing firms are not well advanced or not automated and also due to location of the manufacturing and supplier firms which are not favoring the early involvement of raw material suppliers in the operational plan of the local pharmaceutical firms in Ethiopia.

The findings from the qualitative information have helped to explore some of the most important information regarding factors determining agility in the supply chain management of local pharmaceutical industries in Ethiopia. Based on that, this research attempted to broaden our understanding of the knowledge, based on perception of skilled professionals who are decision makers in local manufacturing firms on factors determining agility in the supply chain management which also identified: cost reduction, delivery speed, planning and reordering, Environmental pressures, trust development, Assessment and prioritizing of suppliers for purchasing, Material quantity adjustment, Strategic supplier partnerships, information sharing and customer relationship as key influencing factors of agility in the supply chain management of local manufacturing firms.

Triangulation of the qualitative information and findings of the quantitative study is one of the ways of increasing the trustworthiness of information gathered. At last, the qualitative study that is conducted at about the same time of this study would provide and describe how the opinions and views expressed in the quantitative study.

Both methods of study identifies almost the same main factors determining agility in the supply chain management of local pharmaceutical industries, but detail description and more specific factors and sub factors are explored in the qualitative study. Delivery speed, cost reduction planning and reordering, trust development, Environmental pressures are the main key factors identified by most of the informants in the qualitative study .These factors are similarly identified and prioritized as the determining factors of agility in the supply chain of local pharmaceutical industries in the quantitative survey.



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identified by almost all the respondents were: cost reduction, environmental pressures, trust development, assessment and prioritizing of suppliers for purchasing, material quantity adjustment, strategic supplier partnerships, and customer relationship as key influencing factors of agility in the supply chain management of local pharmaceutical manufacturing firms in Ethiopia. Which is in consistent with a research on Pharmaceutical manufacturing in Iran by Ali Rajabzadeh which illustrate that the delivery speed, cost reduction, trust development and planning and reordering are key influencing factors of agility and also delivery speed was identified as the first influential factor for agility of manufacture process. It refers to the ability of firm to deliver products faster than competitors (27).

Delivery speed along with sub-indicators which is a key measure in agile supply chain (high rate of response to orders and reliability of delivery) will directly increase speed of supply chain. Another effective factor for agility of manufacture process was related to sensitivity to market and customer requirements which can increase responsiveness, flexibility and agility of supply chain which are in consistent with a study by Sharifi and Zhang(28).

Cost management and Environmental pressure are also key factors in our findings. Similar result was identified by World Health Organization and ICTSD (International center for trade and sustainable development) regarding Cost management and Environmental pressures with its sub factors inadequate infrastructure and human resource constraints as key factors which influence local production and access to medicines in low- and middle-income countries (29).

The environmental pressure factor is a broad factor which incorporates; political factors, economic factors and social factors, a practical influencing factor in local manufacturing firms in this country. The environmental pressure factors with its sub factors economic factors; inadequate infrastructure and human resource constraints, the old operating equipment of local pharmaceutical manufacturers which lead to extra operating cost has significant influence in local pharmaceutical industries of Ethiopia. This finding is consistent with qualitative study in Tanzania by Robert M. Mhamba and Shukrani.M(30)



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6. Limitations

This research has limitations, which should be noted.

The measures used in this research are based on managers or decision makers perception, which might be to some extent subjective.

The study did not include stakeholders view on the factors determining agility of supply chain management of local pharmaceutical industries.

Despite the above limitations, this study is the first attempt to make identification of influencing factors of agility in the SCM of local pharmaceutical manufacturing firms in Ethiopia. Therefore, the mentioned limitations should be viewed as opportunities for future research.

The study propose a need for conducting more empirical studies about the impact of perceived usefulness, attitude towards, intention to use, status and actual use on supply chain agility in pharmaceutical industries. Also, other moderating and intervening variables can be added to the framework.



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7. Conclusion

According to this survey it is implied that there are Intra-organizational factors, External factors and Environmental pressure factors influencing agility of the supply chain management in local pharmaceutical manufacturing industries. The specific factors; cost reduction, delivery speed, planning and reordering, environmental pressures, trust development, assessment and prioritizing of suppliers for purchasing, material quantity adjustment, strategic supplier partnerships, and customer relationship are identified as the main influencing factors of agility in the supply chain management of local pharmaceutical manufacturing firms in Ethiopia from the perspectives of the skilled professionals in the firms.

Therefore to survive and succeed, the manufacturing firms have to clearly identify and understand agility influencing factors both in the supply side as well as demand side of their supply chain and also make use the supply chain management as core strategy of competitiveness or as a means of their organizational goal accomplishment.

8. Recommendations

Local Pharmaceutical firms have to select a new way of operating that give them ability to be flexible and respond quickly to unpredictable changes. Or to succeed, pharmaceutical firms should be agile, in order to become competitive in the current dynamic economic Environment.

For the local pharmaceutical firms in Ethiopia great effort is needed by themselves to intervene each factors of agility in their firms and also all stakeholders have to cooperate in order to adapt some of agility factors to compete with modern global pharmaceutical manufacturing firms.

The Ethiopian pharmaceutical Association has to enhance its effort to unite the pharmaceutical industries.

The mangers in the local pharmaceutical firms have to consider in their plan these key agility influencing factors.

The local pharmaceutical manufacturing firms in Ethiopia has to make use of the opportunities on time by focusing on their supply chain strategy so that they can gain the ability to be flexible and respond quickly to unpredictable changes.

The government specifically the ministry of industry has to increases its commitment for the implementation and to make use of the supply chain advantage in the strategy of local pharmaceutical capacity building on the areas of economic, policy and legal factors which affect agility.

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PRINCIPAL INVESTGATOR

This thesis paper is my original work and agree to accept responsibility for the scientific ethical and technical conduct of the research project and provision of required progress reports as per terms and conditions of college of public health science in effect at the time of grant to forward the result of this application.

Name of the student: Zelalem Nigusse

Date-----Signature-----

APPROVAL OF THE ADVISOR

Name of the first Advisor: Seid Mussa

Date----- Signature-----

APPROVAL OF THE EXAMINER

Name of the examiner: Awel Jemal

Date----- Signature-----



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Jimma University: College of Health sciences, Department of pharmacy, MSc in Pharmaceutical supply chain management.

Questionnaire (instrument) developed to assess several determining factors of agility in SCM for manufacturing firms:

a. Verbal Consent

Hello, my name is _____. I am working as data collector for a study conducted by Jimma university PSCM post graduate student on a study of factors determining agility of SCM in local pharmaceutical industries in Ethiopia. I want you to respond to the questionnaire which is about your willingness and perception towards the study points in order to collect information necessary for understanding the factors determining agility of SCM in local pharmaceutical industries/healthcare industries for redeveloping appropriate strategies and interventions in this area. To attain this purpose, your honest and genuine participation is very important. I expect the interview may take about 20-30 minutes. You do not need to provide your name. Please be assured that all the information gathered will be kept strictly confidential. You can prefer not to respond to all or some of the questions and you can stop the interview at any time.

Are you willing to participate in our study?

Thank you for your cooperation!!!

Name of college _____

Date of interview _____

Questionnaire code _____

Name of data collector _____

Supervisor name _____

Sign _____

Sign _____

Part 1: Quantitative Survey personal interview guide

Hi, I am conducting a short survey on agility of SCM in local pharmaceutical industries in Ethiopia. Thus, I would just take some insights from you on factors determining/influencing agility (quickness, and effectiveness) of supply chain operations. There are no rights or wrong answers, since you are involved in SCM decisions, your opinion is really important for understanding on the determining factors of agility of supply chain.

A1.Q1. Tell me something about yourselves! what do you do-as in occupation! your hobbies! your interest? How do you describe yourself as a person? Do you generally plan! decision maker!

A1.Q2. If I was to ask you to list determining/influencing factors of agility in your pharmaceutical industries; they would be:

A2q3. How the following supply chain issues which drive change may impact your business?

- Regulatory compliance,
- Supply chain cost management/reduction
- Visibility!
- Development chain/product architecture, early supplier involvement, strategic partnership. .../
- Technology
- HR and inadequate infrastructure/
- Others, specify !

A2q4 How the following cost management related supply chain issues may impact your business?

- Logistics and distribution partnership
- It investment
- Outsourced transportation management
- Timely and cost-effective access to key inputs, especially active pharmaceutical ingredients

A3q5- what Successful strategies are used for being agile in the unstable pharmaceutical market!

- Collaboration, vs Industry fragmentation!

Thank you for your cooperation.

1.	<p>Length of implementation/years/</p> <ol style="list-style-type: none"> 1. 1-5 2. 5-10 3. 10-15 4. 15-20 5. 20-25 6. >25 	
2.	<p>Production/formulation system:</p> <ol style="list-style-type: none"> 1. Engineer to order 2. Make to order 3. Assemble to order 4. Make to stock 5. Make to order and make to stock 	
3.	<p>No of employees:</p> <ol style="list-style-type: none"> 1. 1-50 2. 51-100 3. 101-150 4. 151-250 5. 251-500 6. 501-1000 7. >1000 	
4.	<p>Annual sales in million birr:</p> <ol style="list-style-type: none"> 1. Under5 2. 5-10 3. 10 to <25 4. 25 to<50 5. 50 to<100 6. >100 	

	<ul style="list-style-type: none"> a. CEO/president b. Vis president c. Director d. Manager e. Senior officer 	
6	<p>Job functions:</p> <ul style="list-style-type: none"> a. Company executive b. Marketing and sales c. Manufacturing /production d. In bound logistic e. Quality control f. Quality assurance g. Finance h. Research and Development <p>Others _____</p>	
7.	Years worked at the organization: _____	

Study Questioners

Part III. Factors determining/influencing agility (swiftness, quickness, responsiveness, and effectiveness) of supply chain management from some key SCM operation factors.

	Questions for factors determining agility	Responses				
No		strongly disagree	Disagree	no opinion	agree	strongly agree
A	Planning and reorder segmentation					
1	Market research and monitoring					
2	Forecast of alternatives Suppliers					
3	Focus on collaborative forecasting					
B	Assessment and prioritizing of suppliers for purchasing					

		ion					
		one					
	crit	erion in selecting suppliers					
5	cost	standards for supplier selection					
6	Maintaining	list of prequalified suppliers					
C	Utilizing of IT tools (UIT)						
7	E-commerce						
8	Electronic	biding/EDI /					
9	RFID(Radio	frequency identification)					
D	Information sharing						
10	We inform	trading partners in advance of changing needs, this influence agility in the SCM					
11	our trading	partners share proprietary information with us, this influence agility					
12	we and our	trading partners exchanges information that helps establishment of business planning, this influence agility in the SCM					
13	we and our	trading partners keep each other informed about events or changes that may affect the other partners, this influence agility in SCM					
E	Suppliers empowerment						
14	Operational	information sharing/ our partners share Operational information with us. this influence agility					
15	Flexible	contract					
16	Partnership	with suppliers					

	our suppliers, this influence agility in SCM					
18	we have helped our suppliers to improve their product quality, this influence agility in the SCM					
19	we have continuous improvement programs that include our key suppliers, this influence agility in the SCM					
20	we include our key suppliers in our planning and goal-setting activities					
G	Material quantity adjustment (for different orders)					
21	Order consolidation					
22	Variety of suppliers					
H	Process integration & performance management					
23	Co-managed inventory					
24	Collaborative product design & development					
25	Synchronous supply					
I	Cost reduction(CR)					
26a,	-Sourcing cost influence cost reduction/ CR;/ so this influence agility in the SCM					
26b	-Our company has high sourcing cost					
27a,	-Inventory cost influence CR; so this influence agility in the SCM					
27b	-our company has high Inventory cost:					

	influence agility				
28b	-we deliver customer order on time				
29a	-Reliability delivery, influence DS this				
	influence agility				
29b	-we provide dependable delivery				
29c	-We have Flexibility in operation and delivery				
K	Trust development (TD)				
30	Trust-based relations with suppliers				
31	Minimizing uncertainty (MU)				
L	Environmental pressure				
32a	-Political factors, there are political supports/not.				
32b	-Specifyí				
33a	-Economic factors ,there are Economic factors influencing agility in SCM				
33b	-Specify...				
34a	-Social factors, there are Social factors influencing agility				
34b	-Specifyí				
M	Customer Relationship				
35	We frequently interact with customers to set reliability, responsiveness, and other standards for us. this influence agility in SCM				
36	We frequently measure and evaluate customer satisfaction. this influence agility in the SCM				



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	e					
	agility in the SCM					
38	We periodically evaluate the importance of our relationship with our customers. This influence agility in the SCM.					

Thank You for your cooperation.

Manufacturing Companies

No	Name of the factory	Production Type
1.	Addis pharmaceutical factory S.C	Human Pharmaceutical
2	Asmi Private Limited Company	Surgical dressing and antiseptic disinfectants
3	Cadila Pharmaceuticals(Ethiopia) PLC	Human Pharmaceutical
4	Dana trading Private Limited Company	Medical Supply/Absorbent cotton/
5	East Africa Pharmaceuticals /British Sudanese Joint Venture	Human & Veterinary pharmaceuticals PLC
6	Ethiopia Pharmaceuticals and (EPHARM)Public Pharmaceutical Industry	Manufacturing Pharmaceuticals ,medical supplies Enterprise
7	Fawes Private Limited Company	Pharmaceutical liquid manufacturing/Oral liquid/
8	National Veterinary*/(GOV) Public Enterprise	Veterinary Medicine /vaccines/
9	Pharmacure Private Limited Company	Large volume intravenous /IV /fluids
10	Rx Africa Ethio-American Joint Venture	Human Pharmaceutical
11	Sino Ethiop Associate(Africa) Ethio Chinese Joint Venture	Pharmaceutical Raw Material /hard empty gelatin capsules/
12	Moab Private Limited Company	Medical Supplier/Sanitary towels ,napkins & cosmetics/
13	Desta Private Limited Company	Medical Supplier /first aid bandages/plasters/
14	Bethlehem Pharmaceuticals **Private Limited Company	Human Pharmaceutical
15	Etab Private Limited Company	Syringe Manufacturing Medical Supply/Syringes/
16	Biosol** Private Limited Company	Human Pharmaceutical
17	Life line/APF-IV	Large volume intravenous /IV /fluids
18	Julphar pharmaceutical manufacturing plc	Human Pharmaceutical
19	Fanosmediteck	Medical Supplies/syringe/

* Company producing veterinary medicines not human medicines.

** Companies currently not operational. Out of these eighteen factories only fourteen factories are currently operational.

ation of all the variables.

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		Agility in the supply chain operations	PRS	APS	UIT	IS	SE	SSP	MQA	PIPM	COR	DS	TD	EP	CR		
Spearman's rho	Agility in the supply chain operations	Correlation Coefficient	1.000	.596**	.462**	.100	.158	-.273**	.714**	.314**	-.221*	.540**	.242*	.503**	.384**	.299**	
		Sig. (2-tailed)	.	.000	.000	.344	.134	.009	.000	.002	.035	.000	.021	.000	.000	.004	
		N	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	PRS	Correlation Coefficient	.596**	1.000	.438**	.018	.069	-.292**	.538**	.243*	-.150	.426**	.246*	.343**	.362**	.195	
		Sig. (2-tailed)	.000	.	.000	.864	.516	.005	.000	.020	.155	.000	.019	.001	.000	.064	
		N	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	APS	Correlation Coefficient	.462**	.438**	1.000	.053	.250*	-.379**	.451**	.245*	-.223*	.254*	.223*	.335**	.295**	.250*	
		Sig. (2-tailed)	.000	.000	.	.621	.017	.000	.000	.020	.033	.015	.033	.001	.005	.017	
		N	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	UIT	Correlation Coefficient	.100	.018	.053	1.000	-.062	.036	.048	.099	-.015	.008	-.122	-.020	-.085	-.010	
		Sig. (2-tailed)	.344	.864	.621	.	.560	.732	.653	.349	.886	.939	.251	.848	.425	.922	
		N	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	IS	Correlation Coefficient	.158	.069	.250*	-.062	1.000	-.005	.203	.337**	-.094	.102	.199	.283**	.305**	.486**	
		Sig. (2-tailed)	.134	.516	.017	.560	.	.965	.053	.001	.373	.337	.058	.006	.003	.000	

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		91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	-.273**	-.292**	-.379**	.036	-.005	1.000	-.161	-.183	.094	-.244*	-.117	-.143	-.206	-.063
SE	Sig. (2-tailed)	.009	.005	.000	.732	.965	.	.128	.083	.377	.020	.268	.175	.050	.550
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.714**	.538**	.451**	.048	.203	-.161	1.000	.318**	-.299**	.406**	.199	.418**	.224*	.255*
SSP	Sig. (2-tailed)	.000	.000	.000	.653	.053	.128	.	.002	.004	.000	.058	.000	.033	.015
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.314**	.243*	.245*	.099	.337**	-.183	.318**	1.000	.053	.372**	.194	.353**	.250*	.341**
MQA	Sig. (2-tailed)	.002	.020	.020	.349	.001	.083	.002	.	.615	.000	.065	.001	.017	.001
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	-.221*	-.150	-.223*	-.015	-.094	.094	-.299**	.053	1.000	-.089	-.074	.004	.064	-.086
PIPM	Sig. (2-tailed)	.035	.155	.033	.886	.373	.377	.004	.615	.	.403	.483	.969	.546	.417
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.540**	.426**	.254*	.008	.102	-.244*	.406**	.372**	-.089	1.000	.299**	.481**	.349**	.095
COR	Sig. (2-tailed)	.000	.000	.015	.939	.337	.020	.000	.000	.403	.	.004	.000	.001	.368
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91

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	Correlation Coefficient	.242*	.246*	.223*	-.122	.199	-.117	.199	.194	-.074	.299**	1.000	.295**	.383**	.008
DS	Sig. (2-tailed)	.021	.019	.033	.251	.058	.268	.058	.065	.483	.004	.	.004	.000	.937
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.503**	.343**	.335**	-.020	.283**	-.143	.418**	.353**	.004	.481**	.295**	1.000	.375**	.250*
TD	Sig. (2-tailed)	.000	.001	.001	.848	.006	.175	.000	.001	.969	.000	.004	.	.000	.017
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.384**	.362**	.295**	-.085	.305**	-.206	.224*	.250*	.064	.349**	.383**	.375**	1.000	.262*
EP	Sig. (2-tailed)	.000	.000	.005	.425	.003	.050	.033	.017	.546	.001	.000	.000	.	.012
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91
	Correlation Coefficient	.299**	.195	.250*	-.010	.486**	-.063	.255*	.341**	-.086	.095	.008	.250*	.262*	1.000
CR	Sig. (2-tailed)	.004	.064	.017	.922	.000	.550	.015	.001	.417	.368	.937	.017	.012	.
	N	91	91	91	91	91	91	91	91	91	91	91	91	91	91

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).